COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1959/133

GEOLOGICAL OBSERVATIONS IN THE LOUISIADE ARCHIPELAGO.

by

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ABSTRACT

The history of the Louisiade Goldfield is traced in some detail from compilation of old reports and maps.

The Louisiade Archipelago is largely composed of metamorphosed sediments of schistose character. Gneisses are found on western Misima Island. Tertiary volcanic sediments occur on Misima, and basic igneous rocks, probably of volcanic origin, on the Deboyne Islands. Quaternary raised coral reefs are common.

Misima has yielded approximately 240,000 ozs. of fine gold, approximately 100,000 ozs. from alluvial deposits, and 140,000 ozs fromthe oxidised part of the Umuna Lode. The downward extension of the Umuna Lode is sulphide-bearing and has not been tested. Auriferous reefs occur at Quartz Mounta

Sudest Island has yielded approximately 10,000 ozs. of alluvial and eluvial gold. The other islands of the Calvados Chain are of similar lithology to Sudest and may yield eluvial gold.

INTRODUCTION

The Louisiade Archipelago is a group of hilly islands, elongated on an east-south-easterly axis, situated east of the Papuan mainland between longitudes 152°10'E and 154°25'E and latitudes 10°35'S and 11°45'S. The archipelago consists of Misima and Rossel Islands, the Deboyne Islands and the islands of the Calvados Chain, including Sudest (Tagula). It is included in the Misima sub-district of the Milne Bay administrative district.

Most of the thirty or so Europeans in the area live at Bwagaoia, the sub-district headquarters on Misima. Gold mining has been the main industry of the islands: about a quarter of a million fine ounces have been produced; but copra, pearl and trochus shell and copal gum are now the main products. One European is at present engaged in lode mining on Misima and several natives are winning small amounts of alluvial gold on Misima and Sudest.

Small ships ply between Samarai and Misima about every three weeks, and may be chartered. Less frequently the other islands are visited by the small ships of traders, missions or the Administration. A twice-weekly air service connects Samarai and Port Moresby. Nivani Lagoon in the Deboyne Islands had been used as a seaplane base.

The fifteen or so miles of road on Misima connect the mining areas with Bwagaoia. None of the other islands have vehicular roads, although the remnants of an old waggon road are still to be seen near the Mt.Adelaide Mine on Sudest.

The object of this report is twofold; firstly to make readily available historical, mining and geological data concerning the Louisiade Archipelago, and secondly to record geological observations made by the author during a brief visit to the islands. New observations have been made in the islands of the Calvados Chain and the Deboyne Group, and a new interpretation is placed on the geology of western Misima. Little is added to previous knowledge of the geology of eastern Misima.

The writer visited the mining areas on Misima Island in August 1958 with Mr.A.G. Palmer of Oceanic Minerals Development, and later visited some of the Renard, Deboyne and Calvados Chain Islands in the company of Mr.E.D. Ryan, trader, on the M.V. "Titan". Mr.Ryan's local knowledge was of great assistance.

A geological map of the archipelago (Plate 2) is based on the Admiralty Chart of the area. New information and amendments have been added to E.R. Stanley's (1915) geological map of Misima Island (Plate 3) and a company assay plan of the Quartz Mountain leases (Plate 5). Gladstone's Double Chance Mine was surveyed by A.G. Palmer and the writer using compass and chain (Plate 6). Traverses across Sudest Island were mapped by pace-and-compass method and later adjusted to a plan drawn from trimetrogon aerial photographs (Plate 4). Probable inaccuracies in this plan arise from the poor reproduction at the edges of the vertical photographs, and from using oblique photographs. A little photo-interpretation was possible in the Madawa Point area.

Observations of earlier writers have been included in the text but the reader should bear in mind that several of these men, for example Sir William MacGregor and Mines Inspector Mr.C.E.H. Rich were not trained geologists.

PHYSIOGRAPHY

Topography:

The islands are hilly and generally elongate parallel to the trend of the archipelago. Most have the general feature of a drowned coastline, though some cliffs and benches indicate recent uplift.

Misima has the most rugged topography, particularly west of Mt.Oiatau, where the island rises steeply from sea-level to a narrow razor-back ridge over 3,000 feet high. Sudest is the largest island in the archipelago being about forty miles long and seven miles wide. Mt.Rattlesnake or Riu in the centre of Sudest is 2,645 feet high. Mt.Rossel on Rossel Island reaches 2,750 feet.

Coral reefs surround the archipelago except for Misima Island and enclose an area 135 miles long and up to 30 miles wide around the Calvados Chain, in which the sea is not more than 250 feet deep. (Fig.1, p.12). Beyond this coral barrier the ocean floor drops away steeply, depths of more than 5,000 feet having been recorded between Misima and the Deboyne Group, between Misima, the Renard Islands, the Manuga Reefs and Sudest and between the Manuga Reefs and the Tawa Tawa Mal Reef.

Climate:

The monsoonal seasons are well marked and have some influence on rainfall. The north-west monsoonal season, from December to March is the wetter. The average monthly figures

for Misima, derived from ten years of records, indicate a slightly drier period during the south-east monsoonal season from May to October. The annual average rainfall is 123 inches (National Development, 1951). The more southerly islands are probably drier. The area is subject to occasional cyclones usually in the north-west season.

Vegetation:

For the most part the islands are covered by rain-forest with a visibility limit of about sixty feet. However, much of the lower country of the Calvados Islands and eastern Misima is grassed.

HISTORY

Stanley (1915) compiled the following data on the early history of the Louisiade Archipelago:-

"Louis Vaez de Torres is credited with being the discoverer of the Louisiade Archipelago in August 1606 (Annual Reports for British New Guinea, 1891-7)."

"Dampier made geological observations in the Northern Islands and the North-east Coast in 1609, but apparently did not reach the Louisiade. (Wallace, p.4)."

"The French navigators visited the Archipelago, exploring some of the islands in the years 1766-69, and later in 1793, Bruny-D'Entrecasteaux passed through these waters and the northern group received his name accordingly (La Bondeuce et La Flute L'Etoile, 1766-69, and Voyage de Bruny-D'Entrecasteaux 1793)".

"Accounts of the islands date back as far as 1512 - the first Europeans being the Spanish sailor Alvaro do Sacedra or Saavedra, and a Portugese (Way Elkington, p.5)."

MINING HISTORY

The first systematic prospecting in Papua was done by a party of Queensland miners in 1878. They investigated a number of discoveries by Dr.Lawes and Mr.Goldie around Port Moresby, but found nothing worthwhile (Annual Report 1906-07); the first successful gold field was, however, not on the mainland but in the islands of the Louisiade Archipelago.

(a) Sudest Island

On September 4th, 1888, Papua's sovereignty was declared and at about the same time came word of gold on Sudest. The first finds were probably made by those associated with the repatriation of native labourers from the Queensland cane-fields Within a month there were 200 miners in the Griffin Point area, within a year 400 (Ann.Rept.1888-9). Only 38 men were employed in mining on the Sudest field by 1890 and the field was practically cleared by 1896.

Caledonian Reef

At the western end of the island Messrs McLean and Samuelson found the first auriferous reef, the Caledonian, and worked it on a small scale. In July 1891 A.Gibb Maitland of the Queensland Geological Survey visited Misima Island and the Caledonian Claim on Sudest. In 1893 the Caledonian Claim was abandoned but towards the end of that year a Mr.McCord discovered the Mt.Adelaide lode on the divide south-east of Griffin Point.

Mt.Adelaide

By 1897, four miles of waggon road to the Mt.Adelaide prospect from Hula on the south coast has been constructed and a ten-head stamp battery started crushing in September, 1897. In April 1899, after gale damage, the mine was closed, having yielded a "large quantity" of auriferous quartz for unknown returns. British New Guinea Gold Pty.Ltd., under the management of a Mr.Hancock, was formed for this venture. The area, still known to the natives as "Hancock's", is near Mt.Wawe (probably Mt.Adelaide) and was visited by the writer. The battery is in surprisingly good condition.

Alluvial mining on Sudest had practically ceased in 1896, the diggers moving on to Woodlark Island and the Mambare field on the mainland. Alluvial mining has continued until today, mostly by natives, though there were several Europeans working in the middle thirties. The finding of the Cornucopia reefs in 1937 raised the hopes of these men but values were too erratic and the leases were abandoned in 1938. Recorded production to June 1893, is 6,000 ozs. gold. There are few definite figures for the subsequent years but it is unlikely that total production was greater than 10,000 ozs.

(b) Rossel Island

In October, 1888 William (Later Sir William) MacGregor visited Griffin Point on H.M.S. "Swinger". Recognising that more miners had gathered than could hope for a livelihood he took a party of twenty-one miners to Rossel Island where he noted that the country was "schistose, similar to Sudest" and that there were "traces of gold in places". The miners found nothing worthwhile and returned to Sudest.

In 1893 a party of six miners visited Rossel Island but again found nothing worthwhile.

(c) Pana Tinani Island.

After visiting Rossel Island McGregor took miners to Pana Tinani (Joannet) where he noted that this island also was schistose with only "doubtful traces of gold".

(d) Misima Island

MacGregor and his party moved on to Misima arriving on the 20th October, 1888. The miners did not examine the western end owing to the lack of alluvium. The prospecting miners found gold in three different places on the east end but not in payable quqntity. (Ann.Rept. 1888-9). Apparently the diggers were not communicative at the time as, describing the same visit six months later, MacGregor reported that "Rough colours of gold were found at several places and shortly afterwards some of the prospectors returned to the island and opened up a goldfield on which there have been as many as 400 miners employed at one time". However, "generally speaking it seems to be very hard work to make 2 dwts. a day on what is considered to be the best ground". (Ann.Rept. 1888-9).

Stanley (1915) records that the first find on Misima was made by two prospectors called "Frenchy" and "Jimmy" on Gincsia Creek.

The number of miners on Misima dropped to forty by 1891 and continued to decrease until, in 1901, there were only nine. In 1890, application was made for the first lease over a reef but no work was done on it. Copper mineralisation at Mt. Sisa was known but not worked. (Ann.Rept.1900-01). A dredging claim at Tauhik was granted in 1900 but not worked.

Umuna: In 1904, the Umuna lode was discovered by Robert Boyd and in the following six years he won 1050 ozs.from it (Pacific Islands Monthly, 15th February, 1940). He called his lease "the Massive". In 1906 a battery was erected. Boyd was also the first to take up leases in the Quartz Mountain area in 1904.

In September 1911, the Misima Gold Mining Syndicate erected a Huntingdon mill at the head of Cooktown Creek (probably on the Massive lease). In 1913, the Mt.Sisa Gold Mining Company installed a mill "of unique construction" on Ingubinaina Creek. The mill, which can be seen today, was a failure owing to serious defects in its fundamental design.

The Government Geologist, Evan R. Stanley, visited the field in 1915. He reported on the geology of "The Massive Lode" being mined by the St.Aignan Mining Company (W.Griffiths, Manager) and mentions the Misima Gold Mining Company, (C.H.J. Clayton, Manager), formerly New Guinea Option Syndicate, which became prominent ten years later. The only lodes not in the Umuna - Mt.Isa area were Grant's Claim and the Quartz Mountain leases. Alluvial gold was at that time still being won from Ara (St.Patrick's) Creek.

Block 10: In late 1914, the Broken Hill Pty. subsidiary, Block 10 Co.Ltd., moved into the field. It commenced production on the 14th. May 1917 and closed on the 22nd September, 1922 owing to the "collapse or dangerous condition of some of the tunnels containing payable ore". (Ann.Rept.1923). The Company had built ten miles of railway track, opened up a considerable length of the Umuna lode and in all produced 40,700 ozs. gold (King, 1949).

Misima Gold Mining Co. In 1923 a local syndicate took over some of the Block 10 leases and proceeded to treat the ore by cyaniding without crushing; they obtained a 66% recovery. On the 15th October, 1927, they closed "owing to the necessity for new methods of treatment, which entailed the expenditure of a considerable sum of money for machinery etc.". However, in 1928 the company was re-floated as the New Misima Gold Mining Co.Ltd. Total production from Misima Gold Mining Co.Ltd., was 13,000 ozs.(various Annual Reports).

New Misima Gold Mining Co.Ltd. This company was responsible for almost the entire production from Misima from 1928 until August 1935 when Cuthbert's Misima Gold Mining Co. Ltd., took over. Total production was 20,900 ozs. (King, 1949).

Cuthbert's Misima Gold Mining Co.Ltd. This company produced from August 1935 until January 1942, when they were ordered to close on account of the war. Production to that date was 52,346 ozs. gold and 153,314 ozs. silver. Peak production of 9,771 ozs. gold was reached in the last full year's operations.

Much of the workings collapsed during the war and a storm in late 1943 seriously damaged surface installations. Full-scale rehabilitation began in 1946. In 1949, a diamond drilling programme designed to test the lode at depth, failed because of poor core recovery. The first ore was milled in April 1949 but "due to high costs, shipping difficulties, shortage of experienced staff and exhaustion of financial reserves, the company went into voluntary liquidation in April, 1950". (Ann.Rept.1949-50). Post-war production amounted to 351 ozs. gold.

Other Mines: Other companies operating in the immediate pre-war period were Quartz Mountain (Papua) Ltd., (Manager, C.H. Donaldson), Misima Reefs Ltd., at Kulamalia (Manager, Mr.Gordon), Misima United N.L. in and around Ara Creek, and Gold Mines of Papua which had begun operations in 1934.

Gold Mines of Papua commenced production at Mararoa in May, 1938, and closed on the 19th August 1939, having produced 8,500 ozs. gold and 24,000 ozs. silver.

In October 1938, a lode reported to assay 44 ozs. gold per ton was found by A.Alexander on leases abandoned by Gold Mines of Papua. Garrett and Davidson are reported to have confirmed an assay of 5 ozs. of gold per ton. However, this apparent bonanza is not mentioned in subsequent reports, and it is believed that the above assays were not representative. (Warden's reports).

Post-war production: Only two companies other than Cuthbert's Misima went into production in the post-war years. In 1947-48 Mararoa Goldmines Ltd. produced 149.5 ozs. gold from a small pilot plant. Quartz Investments Ltd. at Quartz Mountain produced for a few months in 1951 but cyclone damage caused the closure of the mine. The total production for Misima, calculated from Annual Reports and the figures quoted by King (1949) is between 236,000 and 239,000 ozs. of gold; the major producers were -

Block 10	40,700 ozs.
Misima Gold Mining	13,000 "
New Guinea Gold Mines ..	20,900 "
Cuthbert's Misima Gold Mines	52,697 "
Gold Mines of Papua ..	8,500 "

Cuthbert's and Gold Mines of Papua produced three ozes of silver for every ounce of gold. The fineness of gold samples from Quartz Mountain, as noted in mine records, was 772 with silver 200.

The total production for the Louisiade field, i.e. Misima and Sudest, is about 250,000 ozs. gold. This figure is conservative as much of the early gold production was not recorded, being disposed of by various means. Some was entered with the Customs Office at Samarai, some at the Cooktown Customs Office, some with the Samarai storekeepers, and some taken out privately and disposed of in Australia.

GEOLOGY

PREVIOUS WORK

Stanley (1915) states that the geology of the island was first described by MacGillivray in "The Voyage of H.M.S. Rattlesnake" (1852). McGillivray recorded that "Such of the Islands as was examined consisted of mica-slate, the direction of the beds of which is nearly the same as that of the archipelago itself".

Thomson ("British New Guinea") visited Misima in the early eighteen-nineties and noted "Limestone and great masses of conglomerate with a mixture of schistose slate and quartz". Gibb Maitland, 1892). His remarks on Sudest together with those of C.E.H. Rich (1936-1938) and Firth Smith (1938) are incorporated elsewhere in this report.

Evan R.Stanley's Report on the Geology of Misima (1915) is the result of painstaking work under difficult conditions, and is the main contribution to knowledge of the geology of the area.

GENERAL GEOLOGY

Metamorphosed sediments, generally schistose, are the most common rock-type in the archipelago, and are loosely grouped under the term Schist pending their definition by more detailed work. A complex of higher grade metamorphics includ gneisses of probably both igneous and sedimentary origin occur on Western Misima and is, for the present, referred to as the Gneiss.

A narrow belt of Tertiary volcanics and volcanic sediments forms part of the northern coastline of Misima. Basic igneous rocks of probably volcanic origin occur in the Deboyne Islands together with unmetamorphosed deep-water sediments.

Raised coralline limestone of Quaternary age is common to many of the islands.

Dolerite dykes and quartz veins are common to all exposures of the two groups of metamorphics. Only on Misima an intermediate porphyry forms irregular bodies within the Calvados Schist and appears to be associated with mineralization. Gneissic granite and gabbro are a part of the Western Misima Gneiss.

STRATIGRAPHY

The sedimentary sequence is represented by:-

1. Quaternary sediments.
   - (a) Unconsolidated
   - (b) Coralline limestone
   - (c) Sediments of Eastern Sudest.
2. Tertiary volcanics and sediments.
3. Palaeozoic and/or Mesozoic Metamorphics.
   - (a) Schist
   - (b) Gneiss.

1. Quaternary Sediments.

(a) Unconsolidated: - The hilly nature of the islands generally precludes the formation of alluvial deposits There are minor deposits on eastern Misima, Sudest and probably on Rossel Islands. Beaches are small owing to the steep offshore slopes and the growth of coral. A cemented Quaternary beach sand is exposed on the southern beach of Oreia Islet in the Renard Group. The dip of the beds, which may be deposition ranges between five and ten degrees to the south. Islets of coral sand occur along the present-day coral reefs.

(b) Coralline limestone - Six or seven narrow benches of coralline limestone at the western end of Misima indicate recent uplift. The highest is at about 800 feet. Benches are conspicuous along the southern coast though the degree of uplift appears to decrease towards the east. At Bwagaoia the only terrace is about fifteen feet above the present day reef. Raised reefs are absent between Rokia Point and Ewena on the northern coast. A number of islands in the

archipelago are composed in part or entirely of raised coralline limestone. Examples are the Renard Islands (other than Kimuta I.), Sabari Island in the Calvados Chain (elevation 180 feet), the eastern part of Panaeate Island in the Deboyne group (elevation 200 feet approximately) and low-lying Torless Islands west of the Deboyne group.

(c) Sediments of Eastern Sudest: Quaternary or Tertiary sediments probably cover the eastern part of Sudest Island. Air photographs indicate flat-lying country, elevatio about 500 feet, with an intricate drainage pattern. The Mt. Arumbi hills in the north of the area differ in morphology fr the hills in the schistose country to the west and it is sugg ed that they are composed of the younger sediments. Rich traversed the western edge of this country and recorded a "coarse conglomerate with fossil remains" east of Baumuna Cre (Rich 1.4.36).

2. Volcanics and Sediments.

Volcanics and sediments extend along the northern coast of Misima from Rokia Point to Liak in a belt about a mil wide. Beds exposed at Siagara are exclusively volcanic, comprising interbedded tuff, agglomerate with boulders of andesi lava and small flows of fine-grained lava.

Farther west the beds are predominantly marine sediments with a minor amount of fine volcanic material. Interbedded tuffaceous calcarenite and minor grey shale crop out near Liak. The calcarenite is largely composed of Miocene larger foraminifera. It is well lithified and shows strong current-bedding and ripple-marking. The grey shale contains planktonic Miocene foraminifera.

These sediments are overlain by conglomerate containing boulders of gneiss, schist, quartz and dolerite with no obvious volcanic component. Stanley (1915) recorded an appar unconformity between conglomerate and the underlying sediments in the easternmost stream draining into Liak, but this has not been confirmed by later work.

Basic rocks of probable volcanic origin also occur i the Deboyne Islands associated with fine-grained deep-water sediments. Both types occur as boulders on the west coast of Panapompom Island but only the igneous types were seen on Nivani Island. Dark fine-grained siliceous lenses in a creamy chert comprise the Panapompom sediments.

MacGregor (Ann.Rep. 1890-91) observed "lava" on Panaeate Island also; presumably this forms the high country near the west coast.

The age of the Deboyne rocks is unknown.

3. Palaeozoic and/or Mesozoic Metamorphics.

A Palaeozoic and/or Mesozoic age is ascribed to the metamorphics on the following grounds:

(i) they appear to be a continuation of the south-easter trending Owen Stanley Metamorphics, which are expose on the Papuan mainland; these are considered to be Palaeozoic:

(ii) they are overlain by unmetamorphosed Tertiary sediments.

(a) Schist:

The rocks described under this heading include metamorphosed sediments varying in grade from phyllite to mica schist and andalusite-mica schist. They occur in the islands of the Calvados Chain, on eastern Misima. Kimuta Island (Renard Group) and probably Rossel Island.

The original sediments varied in grain-size from mudstone to conglomerate with mudstone and greywacke predominating. Quartzite, limestone and chert, are relatively minor.

Misima Island Greywacke mica schist and mica schist with minor graphite schist, quartzite and a mafic gneiss with small basic augen comprise the Calvados Schist at Umuna. King (1949) suggests that the original sediment here was water-lain volcanic material. Bedding is preserved in places by alternating pure mica schist and feldspathic or sandy schist. Elsewhere it is obscured by schistosity and apparently the development of feldspar along closely spaced planes of schistosity.

Recrystallised limestone containing minor amounts of galena forms an easterly trending cliff north of Mt. Sisa. Limestone and quartzite, commonly silicified and shattered, crop out at Quartz Mountain. These beds contain galena and sphalerite as vug linings. Minor limestone also occurs in Ingubinaima Creek about a half mile downstream from the Double Chance Mine.

The Renard Islands lie ten miles east-south-east of Misima. Mica schist and schistose conglomerate are exposed on Kimuta Island. The conglomerate is composed of probably volcanic porphyritic acid boulders, diameter approximately 2", in a matrix of schistose arkose and mica schist. The bedding of the matrix is distorted around the boulders.

The other islands of the group, and the Manuga Reefs which lie ten miles farther east-south-east, probably represent submarine ridges of schist.

The Deboyne Islands; MacGregor (Ann.Rep.1890-91) noted that the rocks of Panapompom Island were "schistose". This was not confirmed by the writer's visit to the west coast of the island.

The Calvados Chain islands are almost entirely composed of the Calvados Schist formation, but there is some variation in the degree of metamorphism. Sericite and mica schist comprises the Griffin Point area of Sudest Island but several miles to the south are greywacke and mudstone of phyllite grade. In places the mudstone is interbedded with chert. Phyllite with chert lenses also occurs on Pana Numara Island.

Schistose greywacke with minor fine black mudstone crops out on Taifaur and Nigahau Islands, schistose quartz greywacke crops out on western Pana Tinani Island and mica schist and micaceous greywacke schist occur on Minoa Island. Elongate crystals, probably of andalusite, occur in the Minoa schist exposures.

Rossel Island is described by MacGregor (Ann.Rep. 1890-91) as "schistose, similar to Sudest".

(b) Gneiss

Included under this heading is a complex of para- and ortho-gneiss varying in composition from acidic to ult- basic. This appears to form the greater part of western Misima, and was seen by the author at Buogaboga, Ebora, ar various points on the northern coast including Liak, Laram and Ewena.

At Liak gneissic granite intrudes and absorbes a basic gneiss of probable sedimentary origin. Garnet amphi and well-bedded garnetiferous gneiss with alternating basi acidic layers occur farther west at Larama. Similar bedded garnetiferous gneiss and boulders of garnet amphibolite wer also seen at Ewena.

Exposures on the south coast are similar. At Buogaboga a gneissic gabbro appears to intrude paragneiss an schist. Acidic to basic banded gneiss crops out near Ebora.

Stanley (1915) noted the intrusive gneissic gabbro Buogaboga and on the divide between Buogaboga and Liak, and observed the exposures on the northern coast. He suggested linear intrusion of gabbro or gabbroic gneiss cropping out along the divide and concealed by metamorphics on both sou and northern flanks. This hypothesis has not been support field evidence.

He suggested too that the metamorphic formations o western Misima are entirely of igneous origin. The well-defined banding of thin acidic and basic beds in the garne ous gneiss of the northern coast, and the mica schists at Buogaboga are here proposed as evidence for sedimentary or

The question of the relationship between gneiss a schist should be answered by the fieldwork of the Bureau o Mineral Resources 1959 Regional Party. The occurrence of within the gneiss at Buogaboga, and of gneiss within the s at Umuna, suggest that gneiss and schist may derive from th sedimentary sequence.

Alternatively the Western Misima Gneiss and the Calvados Schist may be products of separate orogenic cycles now separated by erosional unconformity or faulting. A poss parallel is reported on Fergusson Island in the D'Entrecast Group where phyllites and quartz schist rest unconformably o higher metamorphic series of granite gneisses (National Development, 1951).

The Western Misima Gneiss was not seen on the oth islands of the Louisiade Archipelago. Rich (10.7.36) repor that the greater part of Pana Tinani Island is composed of igneous gneiss but in a brief visit to the island the write saw only typical Calvados Schist.

INTRUSIVE ROCKS

The intrusive rocks noted by the writer are listed in suspected chronological order, youngest to oldest:-

1. Dolerite dykes.
2. Quartz veins.
3. Intermediate porphyry, fine-grained felsite, and minor granite.
4. Gneissic granite and gabbro.

All of the above types intrude the metamorphics of Misima but the gneissic granite and gabbro are restricted to the Western Misima Gneiss. Quartz veining is common to all exposures of the Calvados Schist throughout the archipelago and dolerite was seen on Sudest Island.

The quartz occurs typically as narrow stringers which either transgress or conform to the bedding, in places conforming even where the beds are isoclinally folded. The quartz is broken and vuggy with iron and manganese staining in the vugs and fractures. The stringers are probably the source of eluvial gold on Sudest.

Quartz also occurs as fracture fillings as in the lodes at Umuna and the Quartz Mountain "Open cut" on Misima and at Mt.Adelaide on Sudest. These veins often include portions of the country rock. Those at Quartz Mountain are vuggy with quartz crystals, galena, sphalerite and rarely copper minerals lining the vugs.

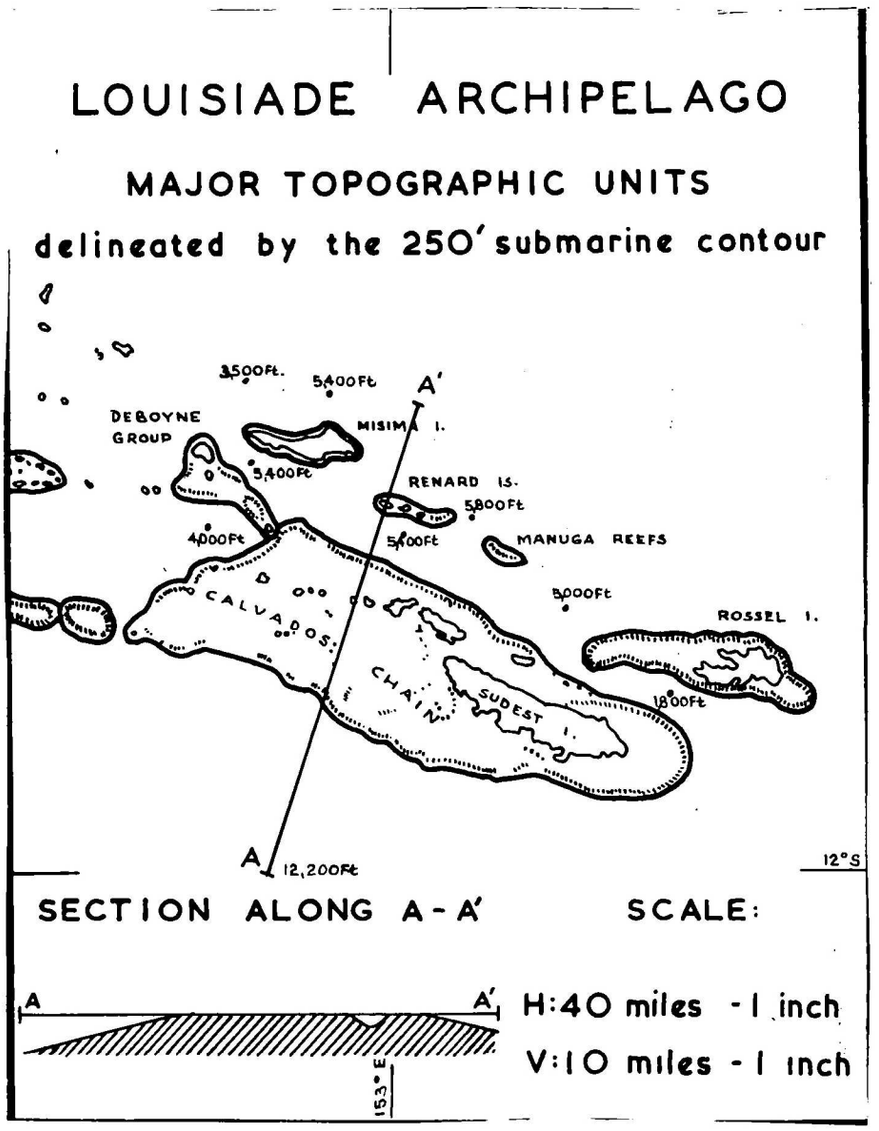
The intermediate porphyry has been seen only on Misima where it intrudes both metamorphic formations. It forms irregular bodies and may have interfingered with surrounding country rock. The fine-grained felsite occurs as thin dykes and may be a chilled phase of the porphyry. Small bodies of granite in the Umuna area may be differentiates of the porphyry The gold mineralisation of Misima is attributed by Stanley (1915) to the porphyry.

STRUCTURE

The east-south-easterly trend of the archipelago conforms with that of the eastern Papuan mainland and the metamorphics are tentatively correlated with those of the mainland.

Ocean soundings reveal an interesting configuration of the sea floor into broad shallow shelves and narrow deep troughs (see Fig.). It may well be that the shelves represent tectonic blocks and that their well-defined margins are due to faulting. The deep separating Misima, the Renard Islands, and Rossel Island from the Deboyne and Calvados groups may be a fault trough.

Drowned coastlines on most of the islands indicate a general subsidence of the archipelago; raised coral benches in places indicate subsequent emergence.



Faulting

Major quartz veins and brecciation of country rock indicate faulting at Mt.Adelaide and in the Griffin Point area on Sudest and at Umuna on Misima.

The trend of the Mt.Adelaide Fault was not apparent to the writer but from old reports it is believed to be approximately east-west. The Griffin Point fault is represented by a two-mile long line of low ridges covered in quartz rubble, running parallel to the coast and about a mile from it. Mt. Lola Diwago may be a reflection of this fault as it lies along strike to the east.

The Umuna Fault is the major mineralised zone on Misima and has yielded most of Misima's gold. Stanley (1915) reported that "The general direction of the lode is shown on the surface by large boulders of white saccharoidal quartz containing many veins of glassy crystalline quartz, together with laminated crystalline and saccharoidal quartz". He also recorded (Stanley, 1915a) that "There are two apparent walls (which)....dip at a high angle to the south-west, striking approximately north-west and south-west". King (1949) found evidence that faulting occurred both before and after the intrusion of the porphyry.

On eastern Misima competent beds within the Calvados Schist Formation have been fractured and faulted on a small scale, providing channels for subsequent mineralisation.

Folding

The Tertiary volcanics and sediments of Misima are gently folded with dips of up to 40 degrees.

The Calvados Schist Formation is folded into steep-flanked anticlines and synclines with near horizontal pitch; the axis of folding at the Double Chance Mine strikes 60 degrees. Drag-folding exposed on the Kulamalia Road Pitches gently to the east-north-east. Minor isoclinal folding was observed in lower Ara Creek.

On Sudest south of Griffin Point, the Schist dips consistently to the north-north-east; the dips are generally shallower on the southern coast. Gibb Maitland (1892) and Rich (15.4.36) recorded similar dips at the western end of the island and in Rambuso Creek to the east.

Overturned isoclinal folding on a small scale is exposed at the head of the Billabong Creek estuary near Griffin Point. The writer suggests that the consistent north-north-easterly dips across the island indicate overturned isoclinal folding on a major scale (see section, Plate 4). This may be due to compression from the north-north-east.

The minor folds observed on Sudest plunge gently to the west-north-west.

On the smaller islands of the Calvados Chain no isoclinal folding was seen. Probable b - lineation on Nigahau plunges at 20 degrees to the east-south-east but folding on Nimoa plunges to the west-north-west.

The Western Misima Gneiss exhibits steep dips and tight drag-folds in places. However, on the whole, the beds are remarkably undisturbed. Excellent exposures from Liak westwards show only gentle folding in places where the beds have not been disturbed by intrusion.

GEOMORPHOLOGY

The archipelago represents a submerged mountain chain of predominantly schistose rock. The schists are folded into structures which commonly strike east-south-east parallel to the long axis of the archipelago.

The most rugged mountains are those of western Misima which are composed of crystalline gneiss. Some other mountains are known to reflect quartz impregnation of major fault zones, as at Umuna - Mt.Sisa on Misima and Wawe (Mt.Adelaide) and probably Lula Diwago on Sudest.

The deep troughs which separate the island groups may be due to faulting.

The area south and west of Griffin Point (Sudest Island) between the main range and the coast is one of low generally northerly trending ridges and intricate drainage such as would hardly be produced by normal erosion on schists of consistent east-west strike. Perhaps the anomalous drainage originated in a cover of unconsolidated sediments and has been superimposed upon the schists; however, good exposures in the eluvial gold workings reveal no trace of this hypothetical cover.

On eastern Sudest a relatively flat area with intricate drainage suggests an existing cover of young sediments.

ECONOMIC GEOLOGY

(a) Misima

Lode mining on Misima has been confined to two areas: the line of the Umuna Lode, and the Quartz Mountain leases.

Umuna: The first reef gold was won from the Massive Lease, situated where Cooktown Creek cuts the Umuna Lode. The greater part of subsequent gold production has come from leases within half a mile of the Massive Lease which have been worked successively by the Block 10, Misima, New Misima and Cuthbert's groups.

Lode material is mostly confined to the Umuna Fault Zone, which is marked on the surface by quartz boulders on a sharp ridge. King (1949) traced this, the Umuna lode, from Mt.Sisa to Kulamalia where it bifurcates and disappears, hidden, he suggested, by a cover of younger volcanics.

Stanley (1915) attributed the Umuna mineralization to quartz veins associated with intermediate porphyry. These, he reported, "not only penetrated the porphyry, but a large proportion of the schistose and gneissic country as well, in (the) immediate neighbourhood of the main axis of disturbance." He described the lode as having "two apparent walls which, in reality, represent two reversed faults, highly brecciated, carrying good gold values".

Firth Smith (1937) noted that "The quartz increases towards the hanging wall, the whole lode being up to 30 feet wide; it is loose and soft and is mined entirely by pick".

Of the mineralisation Stanley (Ibid) wrote that "The richest portions of the lode are to be found on the foot-wall side in the brecciated porphyry portions, in which much well crystalline pyromorphite is found occurring in vughs with a little chromate of lead. In nearly every case where this particular breccia occurs, good (gold) values are obtained".

Near Umuna there are other small lodes described by Stanley as "more or less independent and of a different character, sometimes carrying fair (gold) values. They consist essentially of a fine gritty black mass containing oxide of iron, broken quartz and sometimes manganese. They have no consistent direction throughout and vary considerably in thickness and habit". Such lodes occur on the No.2 North Massive lease, and at Quartz Mountain (see later).

The Umuna Lode appears to be vertically zoned as follows (King, 1949) :-

(i) Upper 100-250 feet:- No sulphides and insufficient gold to warrant mining.

(ii) Middle, from below the upper zone down to the 600 foot level:- High gold values, negligible sulphides.

(iii) Lower, below 600 feet:- Gold and base-metal sulphides, grade unknown.

It appears that a primary ore-body of gold and sulphide has been subject to leaching of sulphides and downward migration of gold. A parallel is seen in the old Edie Creek Mine where downward migration of gold has resulted in the impoverishment of the upper portions of ore shoots (Noakes,1941). It might be noted however, that two authorities (Bateman, 1942, p.278, and McKinstry, 1948, p.245) state that gold will not migrate except in arid conditions and in the absence of carbonates.

An alternative hypothesis is that the zoning at Umuna is primary; this would be difficult to prove. Whichever is the case it would not be wise to assume that all gold prospects on Misima will improve in grade at depth.

Any future investigation of the Umuna Lode should be directed at the deep zone of primary mineralisations. The zone might prove to be (a) gold ore, (b) base-metal ore or (c) base-metal and gold ore. Cuthberts failed to test the zone as their plant could not treat sulphide-bearing ore and their 1949 drilling programme gave inconclusive results. This was due to poor core recovery and caving. It is understood that the holes were of small diameter and that little casing was used. In any future diamond drilling, bits of larger diameter and stationary split inner-tube cross-barrels should be used. Percussion drilling has not been tested on this field.

In 1951 Messrs W.J. Bloomfield and G.P. Buchanan hand-picked 52 tons of material from the Cuthbert's No.7 level (600 feet below surface); this assayed 20.2% Pb, 36.1% Zn. 18.5 dwts. Au per ton and 3 ozs. Ag. per ton.

Gold Mines of Papua developed a lode along strike north-north-west of Umuna, and another calcite-bearing lode to the west of this on which King (1949) commented thus: "apart from the high proportion of calcite, the lode material otherwise resembles Cuthbert's Misima ore and the country rocks are the same flat-lying schists and intrusive porphyry". About 40,000 tons of ore from this lode yielded approximately 8,500 ozs. gold and 24,000 ozs. of silver.

Gordon's Misima was ready to commence production at Kulamalia at the southern end of the Umuna Lode when evacuation was ordered in 1942. After the war Mr.H.Gladstone milled about 150 tons of the better ore from this area but production failed to confirm the reported assays and he abandoned the project.

Of the Mararoa Gold Mines workings, a mile north-north-west of Umuna, King (Ibid) reported that "none of the workings are accessible but some high grade ore is said to have been found. The country rocks are porphyry and schist".

Ara Creek Area: An area to the north-west of Mt.Sisa, about 1½ miles long was held under lease by Misima North Gold Mines (pre-war). King described it as a northern extension of the Umuna lode and recorded that C.H. Donaldson estimated a reserve of 75,000 tons of 6 dwt.ore. There was no production.

Scottish Queen Mine, Mararoa: After draining a small lake at Mararoa, H. Gladstone won approximately 1,000 fine ozs. of apparently reef gold in nineteen months. The area is now largely overgrown. The gold was in a shallow-dipping band of grey pug probably representing a fault zone in schist and porphyry.

Double Chance Mine: This is the only mine in operation at present. It is situated on a hillside above Ingubinai Creek, east of the main Umuna lode. The ore is taken from an open cut about twelve feet wide and at present (August,1958) 120 feet long, trending 60 degrees. The country rock is schist and phyllite striking 60 degrees and dipping steeply.

North-west of the open-cut are well-bedded schists dipping to the north-west. A vertical shear which forms the north-western wall of the cut separated the bedded schist from a feldspathic iron-stained schist, or possibly sheared porphyry which is being mined. Another vertical shear forms the south-eastern wall of the cut and separates the feldspathic schist from a roughly banded mica-feldspar schist. The banding dips vertically and may have originated from the intrusion of porphy along closely-spaced planes of schistosity.

Gold occurs in a system of steep fractures within the feldspathic schist; the fractures are coated with manganese and iron oxides and trend at approximately 340 degrees. These fractures occasionally contain visible gold in wire form.

An irregular band of porphyry, three to six feet wide, and a dolerite dyke, four feet wide are exposed above the well-bedded schist of the north-western wall. The dolerite strikes parallel to the schist but has a steeper dip and transgresses a narrow dyke of felsite which strikes 340 degrees.

Exploration to the east-north-east along the strike of the schist revealed a sharp decrease in the number of fractur trending 340 degrees, and a probable decline in gold mineralisa tion. The well-bedded schist and phyllite of the north-western wall is exposed in a deep costean about 200 feet further along strike suggesting that it the favourable zone continues along strike, it will be found to the south-east of this costean. The author considers that mineralisation is associated with the quartz-filled fault, striking 315 degrees which is exposed at the mouth of the open cut. Movement along the plane of the fault has probably caused the fractures striking 340 degrees and the gold in the fractures may be genetically related to th quartz in the fault-plane. The feldspathic schist may have bee preferentially mineralized and exploration along the strike of the fault might reveal other favourable beds.

Production from the Double Chance Mine over a fifteen month period in 1957-58 was 226 fine ounces of gold from an estimated 3,000 tons of ore, i.e. approximately 1.5 dwts. per ton if the producer's ore estimate is correct. The fineness varied from 709 to 789 and averaged 744.5.

The Quartz Mountain lodes, situated about a mile sout west of Umuna, are similar in type to those of Umuna. The main differences are -

(i) that the lodes here strike between 250 and 310 degree

and (ii) that metallic sulphides are present in the surface outcrop. This is probably due to the rapid erosion of the hill-side and the high degree of silicificatio which seals some of the vugs.

Stanley (1915a) recorded "black gritty material" probably manganese oxides, limestone and quartzite with crystal- ine quartz, and pyrites, zinc blende and galena.

Firth Smith (1937) recorded that the quartz is "vuggy, banded, typically epithermal in type and is associated with much earthy manganese material which yields colours of free gold in the dish. The sulphides also contain gold". The writer washed several samples of similar grit without success.

The writer was unable to ascertain the full history of the area. The first leases were taken out by Robert Boyd in 1904. At the time of Stanley's visit in 1915 the St.Aignan Gold Mining Syndicate was developing the lodes. In 1931 Misima Options Ltd., W.H. Gordon, Manager, had taken over the prospect which was later transferred to Quartz Mountain (Papua) Ltd.

C.H. Donaldson, Manager for Quartz Mountain (Papua) Ltd., reported surface enrichment thus, "the very fine gold being caught in the cracks, vugs etc. of the (surface) boulders and further enrichment immediately subsurface where percolating surface water has carried the fine gold down into fissures or fault zones. He believed that "All lodes throughout the series are genetically associated with the porphyry intrusive". (Donaldson, 1928).

Development during the pre-war years indicated low values in most of the lodes. Post-war production came from a surface accumulation of vuggy quartz boulders set in clay above the 500 foot contour. This area was known as the Open Cut and is probably the surface indication of a quartz-filled shear. Sampling of the boulders showed an average assay of 5.2 dwts. gold per ton over a length of 300 feet. The clay matrix averages about 1 dwt. gold per ton. This information is from mine records in the possession of Mr.A.M. Thomson, resident of Misima Island.

Three hundred feet to the south-west of the Open Cut, workings off the No.2 N.E. cross-cut passed through 19 feet of ore assaying 12.6 dwt. gold per ton. These workings collapsed during the war and an attempt to re-open them was not complete. Further west a low cliff of vuggy quartz extends for about 60 feet and bears 310 degrees. The north-western forty feet of this cliff are reported to have averaged 15.6 dwts/ton. The writer took check samples from the cliff, which indicate an average of 8.0 dwts. per ton. This lode is about six feet wide and dips steeply to the north-east. A little costeaning would clarify its dimensions. The vugs here and in the minor lodes exposed in Inhabit Creek are lined with sphalerite, galena and quartz and in a few places show a little copper staining. Several lodes are exposed lower on the hill where considerable exploration has revealed generally low grades (see Plate 5). It was not possible during the short visit to discern any pattern in the lode system. Mineralization is commonly associated with competent beds such as quartzite and limestone. Fracturing and brecciation of these beds has opened the way for mineralising solutions.

Alluvial Mining: Until about 1904, all Misima's gold production came from alluvial workings and a little alluvial gold is still being won today, mostly by natives. Total production of alluvial gold is between 80,000 and 100,000 ozs.

The chief known deposit is on Tauhik Creek where the three streams draining the Quartz Mountain area have contributed alluvium. In 1939 a programme of bulk testing, drilling and surface sampling indicated a reserve of one and a half million cubic yards of wash carrying 10.5 grains per cubic yard (Donaldson, 1939). In 1958 Mr.A.M. Thomson was ground-sluicing when the water supply permitted.

(b) Sudest

There has been no successful lode-mining on Sudest though three attempts, one on quite a large scale, have been made. The absence of the porphyry associated with gold mineralization on Misima may explain this.

The Caledonian Claim on western Sudest was worked on a small scale by Messrs Maclean and Samuelson (or Samuels) from 1890 to 1893. Gibb Maitland (1892) describes a series of milky vuggy quartz veins between three and twelve inches thick containing pyrite, "limonite, haematite, psilomelane and manganese staining". These veins all trend between 280 and 300 degrees and dip to the north, apparently (though Gibb Maitland does not say so) conforming to the bedding. Three tons of ore treated in Sydney in 1890, under the direction of Mr.S.S. Vale yielded 4 ozs.18 dwts. of gold and 1 oz. 21 grains of silver.

The Mt. Adelaide lode was discovered in late 1893, and was producing in 1897 and 1898 after the installation of a ten-head battery. The writer visited the area and noted phyllite country rock and a breccia of sericite schist in fragments in impure quartz. It is not known whether this was the main lode. The lode was reported to be a vertical quartz reef, two to four feet wide, extending for several hundred yards along the divide and carrying visible fine gold in places. The lack of wear on the battery is evidence of very little production.

The Cornucopia leases (see Plate 7) are situated on the western slopes of the main dividing range, altitude about 450 feet and distant 1¼ hours' walk from Jolanden (Joe's Landing) on the north coast.

Administration mining engineer C.E.H. Rich reported (Rich 21.5.1938) that mineralization occurs in quartz stringers and veins up to eighteen inches in width, the wider veins commonly showing banded structure. Some veins transgress the bedding of the country rock while others conform even where the bedding is folded. The country rock is schist with an east-west strike. Two of Rich's samples assayed 5 oz. gold per ton but others showed values around 1 dwt. Little gold was won from the workings and the area was abandoned in 1938, only a year after the leases had been taken out. Failure was probably due to the necessity for selective mining of the narrow quartz veins and to the inconsistency of values within those veins.

The full text of Rich's report is appended to this report.

Alluvial mining was the source of almost all of Sudest's gold production, the main area being inland from Griffin Point. This includes the Fourmile, Billabong and Brown Gully Creek areas. In the five years to 1893, 6,000 ozs. were won from this area, but returns since then are not accurately known. The quantity of this gold won from eluvial deposits is not known but the observations of the writer suggest that it was a large proportion. Many of the low grassy ridges in the area have been, in places, denuded of soil. (See under Geomorphology) There is no evidence of earlier sedimentary cover apart from the suggestive topography so it must be assumed that the gold concentrations were formed by eluvial means, i.e., rock decay and subsequent removal by erosion of the lighter elements in the soil.

The source of this gold is probably the fine quartz stringers, such as those described by Gibb Maitland and Rich, which persist throughout the schists in the Griffin Point area.

Rich (10.6.36) may have been referring to eluvial deposits when he recorded that "With the exception of the working in Salmon Creek, all ground from which alluvial gold is being won at the present time exhibits the same characteristics, it is more in the nature of over-burden carrying a fairly large quantity of quartz fragments which are themselves barren of gold."

The first definite record of eluvial mining is in 1941 when H. Pierce and T. Craig installed pumps at Griffin Point to lift water to the ridge tops. However, in the Fourmile Creek area, the writer saw old eluvial workings which, according to native reports, were operated by Messrs Perrin and Kenny about fifty years ago. Other workings east of Billabong Creek appeared to be even older.

After the war, Pierce continued to work eluvial gold near the Griffin Point rest-house and alluvial gold from old wash on the banks of Fourmile Creek. The Griffin Point workings consist of a number of pits up to six feet deep formed by the sluicing away of soil to expose the weathered rock. The water was directed into a channel in which slate boulders acted as a riffle. Periodically the boulders were removed and the floor of the channel cleaned, the resulting wash being panned for gold. Samples from the pit-walls were washed by the writer. Those from near quartz veins consistently showed a colour, but several other samples were barren.

The other eluvial workings showed commonly only one to two feet of soil developed over the weathered rock.

The writer saw alluvial gold in Mataututu Creek near Pierce's workings and in a tributary of Fourmile Creek and was shown T.Craig's workings on Headwater Creek. Alluvial gold has also been won on the southern fall. H.Morley worked in Hula Creek and G.Burfitt worked in Baumuna and Salmon Creeks (Rich, 15.4.36 and 10.1.36).

In 1936, a company, Louisiade Gold N.L., began work in the Griffin Point area but accomplished little. Recommendations made by Rich (7.7.36) were apparently not heeded. These remain as good advice for any party interested in re-opening the area. He recommended the blasting of a number of rock-bars in Fourmile and Billabong Creeks, exposing gravels of the river bed which could never before have been worked. The bar at the head of the estuary of Billabong Creek he regarded as the most attractive proposition.

He further advised that the prospector should try to locate old beds of alluvium left by the creeks when changing course. A good example of such a deposit is Pierce's old workings on Fourmile Creek.

ECONOMIC PROSPECTS

Misima

The gold and base-metal potential of the lower part of the Umuna lode remains untested. Drilling and exploratory mining may well reveal that either or both are present at ore-grade. The obvious point for initial testing is the Cuthbert's mine which is in the area of greatest secondary enrichment but there may prove to be ore-bodies at any point along the four miles of known mineralization.

The Quartz Mountain lodes merit further examination.

The western part of Misima appears to have been neglected, probably due to the general lack of alluvium. Although the country rock is of a different nature, the intermediate porphyry which is associated with the eastern mineralisation has been observed there. A close examination of the excellent creek exposures there might be rewarding.

Sudest

The search for lodes on this island has probably not been very intensive. It is apparent that much of the alluvial and eluvial gold has come from small rich patches of mineralised quartz and from fine gold disseminations in quartz veins. However, the possibility of major quartz veins with payable gold remains.

Further alluvial and eluvial gold might be won, especially if the recommendations of Rich are considered.

The other Islands.

All of the islands of the Calvados Chain are of similar lithology to Sudest. Although few are large enough for alluvial deposits to have formed, eluvial gold such as at Sudest might occur. However, early prospecting on Rossell and Pana Tinani Islands was not successful.

ACKNOWLEDGEMENTS

The assistance of the Bwagaoia Sub-District Office, Mr. E.D. Ryan, Mr.H.Gladstone and Mr.A.M. Thomson, and the hospitality of Mr. & Mrs.P.K. Moloney, Mr.A.Munt and Mr. W. Callanan were greatly appreciated.

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APPENDIX.

The Director of Mines,
PORT MORESBY

Griffin Point,
21st. May, 1938.

CORNUCOPIA SYNDICATE - SUDEST ISLAND

Acting on your instructions I proceeded to Sudest Island for the purpose of examining the areas held by members of the Cornucopia Syndicate.

The area is situated on Sudest, an island which is about seventy miles from Misima Island and comprises Cornucopia No.1 East lease of 50 acres and Cornucopia No.2 of 14 acres. Adjoining these leases to the west is a prospecting area held by Mr.Morley, a member of the syndicate and for the purpose of this report is included in the area discussed. The leases are situated on and near the main dividing range and are at an approximate altitude of 800 feet above sea level. The area may be reached by bush track from either the Northern or Southern shore, the track to the northern shore being the shortest about one and a half hours walk from a good anchorage for small boats and known as Joe's Landing. There would be no great difficulty in constructing a road from the landing to the leases.

GENERAL GEOLOGY

The whole area is comprised of schist, striking east and west and with a vertical dip. In several places the schist has been folded and at the south-western corner of the prospecting area, occupying a more or less level junction of two creeks there is a dolerite pipe, about 200 feet in diameter which appears to have had little affect on the adjoining schist and which does not appear to be connected with the ore occurrence. There is evidence of earth movements sufficiently heavy to cause extensive faulting.

ORE BODIES

These are essentially quartz veins, varying in width from a thread to eighteen inches which, in the wider veins, often show a banded or ribbon structure. The oxidised zone is shallow and extends to about twenty feet below the surface in the two places where it is opened up. An increase of mineralisation is usually accompanied by an increase in gold content. In no case so far tested does the gold content of the schist encasing the quartz veins exceed one pennyweight.

The quartz veins may be placed in three classes.

(1) Veins which occur in schist where no definite fault apparent.

(2) Veins which occur in a definite fault zone.

(3) Veins which occur in the folded schist and conform to the folding.

Under the first heading come the numerous quartz veins, some of which carry gold, which are seen in nearly all the creeks of the area. No.2 workings come under this heading and comprise an open cut which exposed a three inch vein carrying free gold striking 115 degrees and dipping to the north-east at 65 degrees. An underlay shaft sunk to 12 feet, samples of

schist and quartz stringers over widths of 3 and 5 feet in the eastern end gave an assay result of 12 Grs. per ton. A drive was put in for 39 feet following stone showing free gold. In the face of this drive a sample which included ten inches of schist with an eight inch quartz vein gave an assay result of 3 dwts. 12 grs. gold per ton, 3'6" of adjoining schist assayed 1 dwt. 5 grs. A one and one fifth ton parcel of ore from this open cut and drive sent to Port Kembla assayed 1 oz. 7 dwts. 5 grs. gold per ton and 7 dwts. silver, no copper. This cannot be taken as being representative of ore which can be mined in bulk. It is a sample of ore from selective mining.

The No.3 or Main Lode which is now being driven on is representative of the second and probably the most important class of vein. This is a fault zone (or zone of earth movement) along which a drive has been put in for 58 feet from the present portal. This zone varies in width from 5 to 9 feet and is easily distinguishable from the adjoining country and no difficulty is being experienced in following it. Within this zone occur the quartz veins from one to four inches in width which carry gold values which in one of my samples reached 4 ozs. 17 dwts. per ton. They are not confined to any particular section of the zone, the result above was obtained on the foot-wall at 55 feet. The assay results of my sampling of the drive, tabulated on the accompanying plan, indicate that to 58 feet the fault zone material or lode, taken in bulk would not pay to work, selective mining being the only possible method.

I would point out that in my sampling of this drive, from portal to45 feet the heavy timbering prevented me from investigating, from the narrow rich vein point of view that part of the fault zone. It is reasonable to assume and; Mr.Morley tells me, that there are gold bearing veins in that length which were not shown up in my sampling. A one and a half ton parcel of ore from near the portal sent to Port Kembla for treatment assayed 4 dwts. of gold and 7dwts of silver per ton. This again is not a sample of material representative of a full face in the drive but of selective mining.

No.1 Workings are representative of the third class of vein, and comprise an open cut in the face of a hill where a quartz vein five inches in width is exposed. This vein has an apparent width of two feet which is due to overfolding at about three feet from the floor of the cut. An average sample of the vein at this point over a width of four feet gave a result of 4 dwts. gold per ton, and a grab sample of the best looking stone gave 3 ozs. 12 dwts. gold per ton. This sample was of the more heavily mineralised, banded quartz, the mineral being iron pyrites and probably galena. When time permits it would be worth while to drive on this vein, it will probably cut-out within a few feet but at a short distance a second and third make may be exposed.

BATTERY POSSIBILITIES.

In ore deposits of this nature, short, narrow, rich veins in almost valueless wall rock there is always a difficulty in arriving at the tonnage and value of ore reserves. In the true sense of the term there is no "Proved Ore" on the property other than that mined and stacked on the surface and a few tons exposed in the face, a total of probably five tons. Under these conditions any battery larger than a one or two head is out of the question. In considering the installation of a small battery there are two courses available. The first is that selective mining can be carried out and the payable ore stacked until such time as sufficient ore has been mined to ensure the return of capital expenditure on plan. The alternative is the

immediate erection of a small battery and owing to the absence of proved ore no definite assurance can be given as to whether the erection of a battery would pay or not, its installation at this stage therefore would be a gamble with the chances in favour of success.

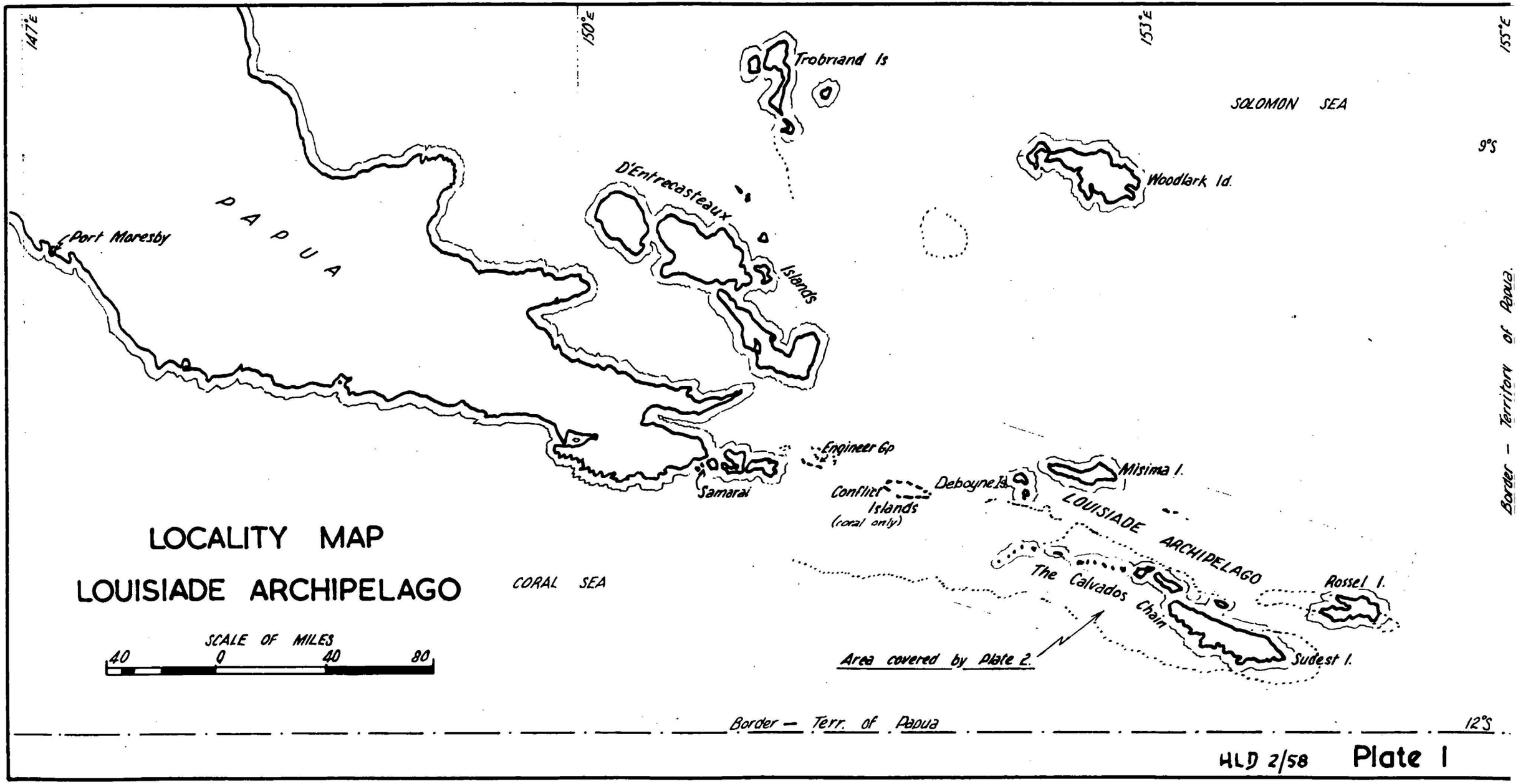
Owing to the amount of mineral in the ore away from the immediate surface it is very desirable that in any plant erected the product of from the battery should be run over corduroy strakes where most of the mineral and coarse gold will be caught.

FUTURE POLICY

I would recommend, that the present policy, which is essentially one of prospecting, be extended to embrace the extraction of rich veins as they are met with in the mine workings.

That the erection of a small battery be held over until such time as a reasonable amount of rich vein ore has been mined and stacked ready for crushing.

Field Engineer.
21/5/38.

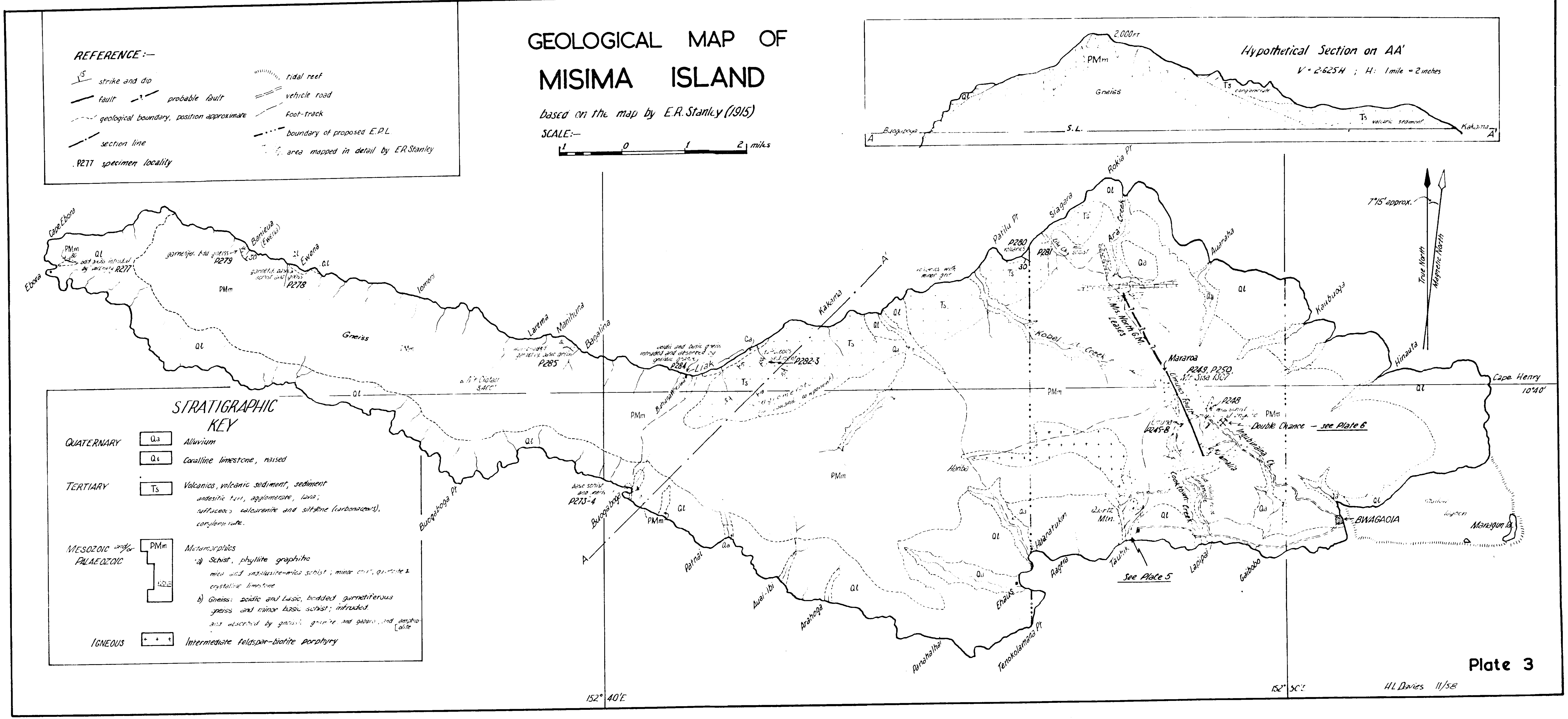


LOCALITY MAP
LOUISIADE ARCHIPELAGO

SCALE OF MILES
40 0 40 80

HLD 2/58 **Plate 1**

Geological observations in the
LOUISIADE ARCHIPELAGO
SCALE OF MILES
5 0 5 10 15
1 : 300,000
STRATIGRAPHIC KEY
Ql Quaternary – coralline sand and raised limestone
Ts Tertiary – volcanics, volcanic sediments and sediments – andesitic agglomerate, tuff and lava; tuffaceous siltstone and calcarenite; conglomerate.
P/Mc Mesozoic and/or Palaeozoic – Schist: mica- and andalusite-mica schist, schistose greywacke and conglomerate, phyllite, quartzite, limestone, chert; with quartz veins, felsite dykes and intermediate porphyry.
P/Mw Palaeozoic and/or Mesozoic – Gneiss:– acidic to basic bedded garnetiferous gneiss and minor basic schist, intruded and absorbed by gneissic granite and gabbro, quartz, dolerite and amphibolite.
REFERENCE:
Strike and dip.
Direction and dip of lineation.
Overturned anticline showing pitch of folding.
Fault.
Probable fault.
Strike and dip of quartz vein.
P294 Specimen locality.
Line of coral reef
Section line
Geological boundary, position approximate
Probable geol bdry. "
MISIMA ISLAND
raised coralline limestone
DEBOYNE ISLANDS
PANAETE I.
PANAPOMPOM I.
NIVANI I.
TORLESSE IS.
raised coral
RENARD ISLANDS
KIMUTA I.
TAWA TAWA MAL REEF
PANA-WINA
PANA TINANI
NIMOA
CALVADOS CHAIN
THE
MOTORINA I.
BAGAMAN I.
PANA NUMARA I.
Panasia I.
DUCHATEAU
The Sunken Barrier
Jomard Passage
YEINA I.
ROSSEL ISLAND
Mt. Rossel 2150'
SUDEST (TAGULA) ISLAND
Griffin Point
Caledonian Mine approx posn (Au)
Mt. Riu or Rattlesnake 2645'
Mt. Arumbi 1150'
Tertiary or Quaternary sediments
Cape Siri or Sudest
Madama Point
Pantava Pt.
Burfitt's
"coarse conglomerate with fossil remains"
For detailed plan see Plate 4
7°30' approx
True North
Magnetic North
11°S
11°30'S
10°30'S
152°E
152°30'E
153°E
153°30'E
154°E
Plate 2
4LD 2/59


GEOLOGICAL MAP OF
MISIMA ISLAND
based on the map by E.R. Stanley (1915)
SCALE:-
1 0 1 2 miles
REFERENCE:-
strike and dip
fault
probable fault
geological boundary, position approximate
section line
P277 specimen locality
tidal reef
vehicle road
foot-track
boundary of proposed E.P.L
area mapped in detail by E.R. Stanley
Hypothetical Section on AA'
V = 2·625H ; H: 1 mile = 2 inches
2,000 FT
PMm
Gneiss
Ts conglomerate
Ts volcanic sediment
S.L.
Kakama
A
A'
STRATIGRAPHIC KEY
QUATERNARY
Qa Alluvium
Ql Coralline limestone, raised
TERTIARY
Ts Volcanics, volcanic sediment, sediment
andesitic tuff, agglomerate, lava;
tuffaceous calcarenite and siltstone (carbonaceous),
conglomerate.
MESOZOIC and/or PALAEOZOIC
PMm Metamorphics
a) Schist, phyllite graphitic
b) Gneiss: acidic and basic, bedded garnetiferous gneiss and minor basic schist; intruded and absorbed by gneissic granite and gabbro, and amphibolite
IGNEOUS
Intermediate felspar-biotite porphyry
Cape Ebora
Ebora
Banieua (Ewena)
Ewena
Iomonu
Larema
Manihuna
Bagalina
Gneiss
P277
P278
P279
P285
P284
Liak
P282-3
Kakama
Patilu Pt
Siagara
Rokia Pt
Ara Creek
Auaraha
P280
P281
Kobel Creek
Mis. North G.M. Leases
Mararoa
P249, P250
Mt. Sisa 1307'
Umuna Fault
P248
P245-8
Double Chance - see Plate 6
Ingubinaina Ck
Kaubuoga
Hinauta
Cape Henry
10°40'
Horibe
Quartz Mtn.
Cooktown Creek
See Plate 5
Tauhik
Ragera
Lapipai
Gaibobo
BWAGAOIA
Managun Is.
Ugaratukin
Ehaus
Tenokolamana Pt
Panahalhai
Arahoga
Auai-ibi
Patnai
Buogaboga
Buogaboga Pt
P273-4
7°15' approx.
True North
Magnetic North
152° 40'E
152° 50'E
Plate 3
H.L. Davies 11/58

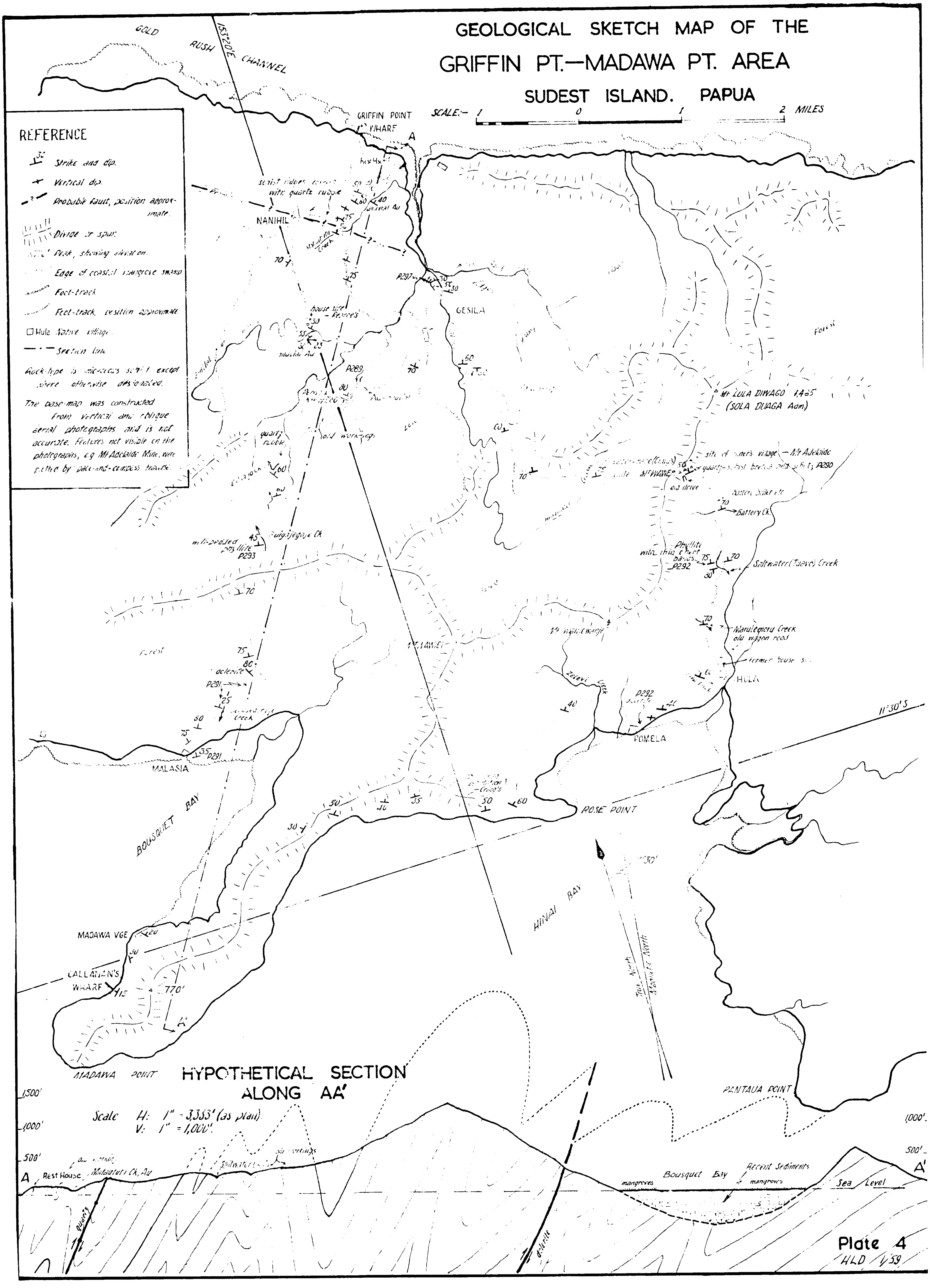
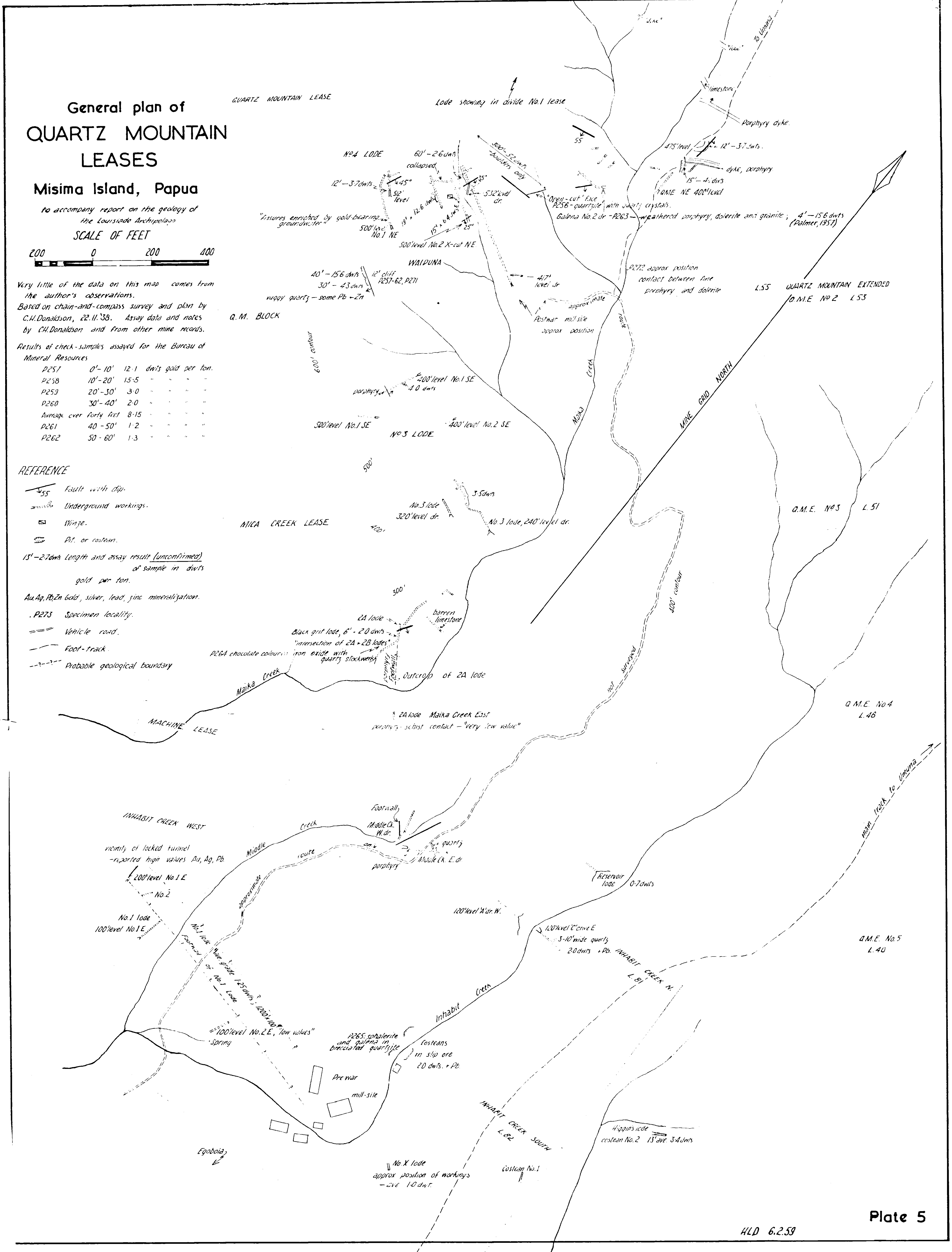


Plate 4

HLD 1/59

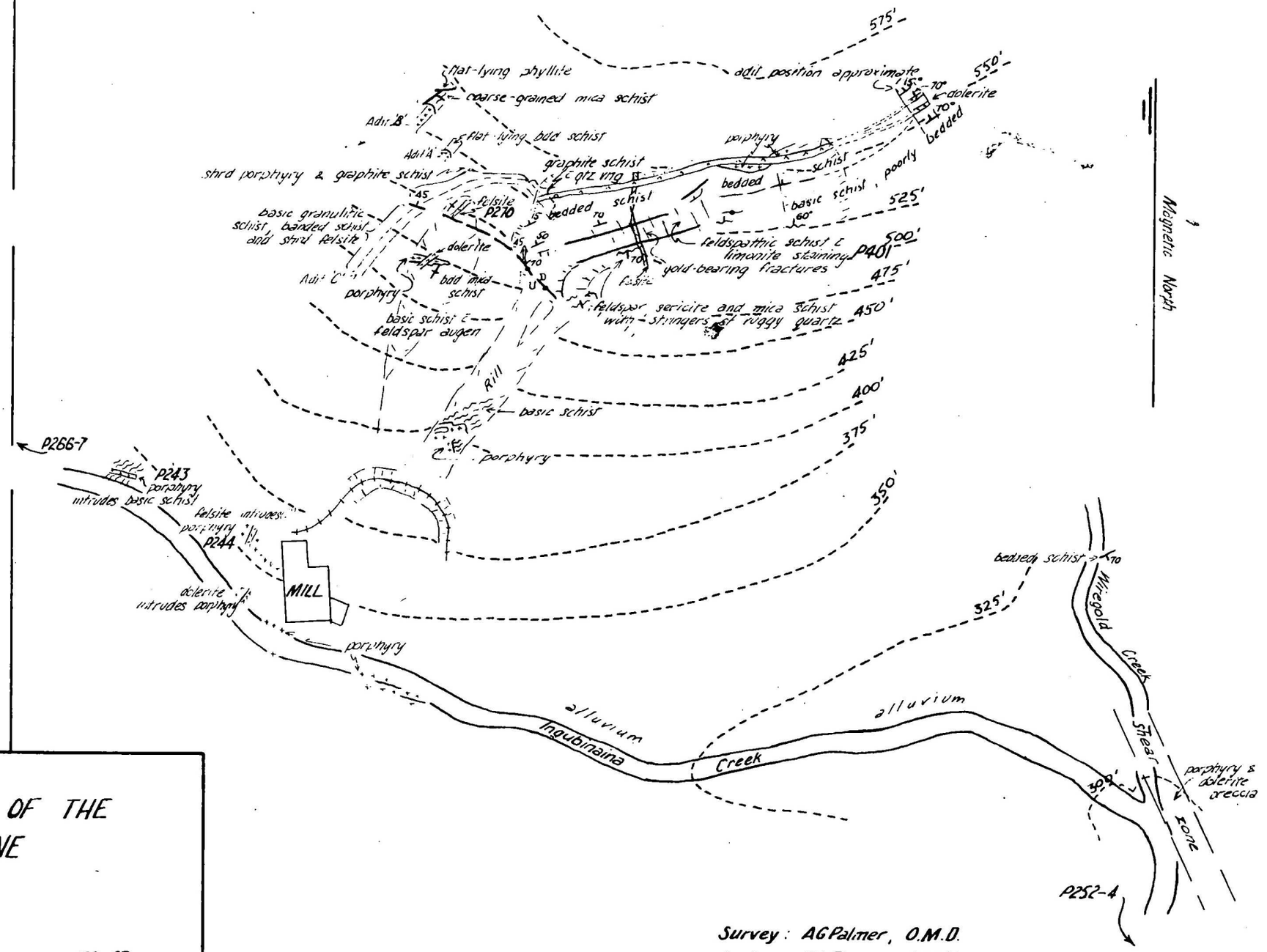

General plan of
QUARTZ MOUNTAIN LEASES
Misima Island, Papua
to accompany report on the geology of the Louisiade Archipelago
SCALE OF FEET
200 0 200 400
Very little of the data on this map comes from the author's observations.
Based on chain-and-compass survey and plan by C.H.Donaldson, 22.11.'38. Assay data and notes by C.H.Donaldson and from other mine records.
Results of check-samples assayed for the Bureau of Mineral Resources
P257 0'-10' 12·1 dwts gold per ton.
P258 10'-20' 15·5 " " " "
P259 20'-30' 3·0 " " " "
P260 30'-40' 2·0 " " " "
Average over forty feet 8·15 " " " "
P261 40-50' 1·2 " " " "
P262 50-60' 1·3 " " " "
REFERENCE
55 Fault with dip.
Underground workings.
Winze.
Pit or costean.
13'—2·7dwts Length and assay result (unconfirmed) of sample in dwts gold per ton.
Au, Ag, Pb, Zn. Gold, silver, lead, zinc mineralization.
.P273 Specimen locality.
Vehicle road.
Foot-track.
--?--?-- Probable geological boundary
QUARTZ MOUNTAIN LEASE
Lode showing in divide No.1 lease
To Umuna
limestone
Porphyry dyke.
475' level
12'—3·7 dwts.
dyke, porphyry
15'—4·1 dwts
QME NE 400' level
No4 LODE
60'—2·6 dwts
collapsed
12'—3·7dwts
45°
512' level
35°
532' level dr.
300'—5·2 dwts —boulders only
55
"Open-cut" face
P256 - quartzite with quartz crystals.
Galena No.2 dr - P263 — weathered porphyry, dolerite and granite ; 4'—15·6 dwts (Palmer, 1957)
"Fissures enriched by gold-bearing groundwater"
500' level No.1 NE
19' x 12·6 dwts
15' x 6·4 dwts
25°
500' level No.2 X-cut NE
WAIDUNA
417' level dr
40'—15·6 dwts
30'—4·3 dwts
12' cliff
P257-62, P271
vuggy quartz — some Pb + Zn
P272 approx position contact between fine porphyry and dolerite
L.55 QUARTZ MOUNTAIN EXTENDED
Q.M.E No2 L53
approximate
route
Postwar mill-site approx position
Q.M. BLOCK
600' contour
400' level No.1 SE
4·0 dwts
porphyry
Maika Creek
MINE GRID NORTH
500' level No.1 SE
400' level No.2 SE
No3 LODE
500'
3·5dwts
No.3 lode 320' level dr.
No.3 lode, 240' level dr.
MICA CREEK LEASE
400'
Q.M.E. No3 L.51
400' contour
300'
barren limestone
2A lode
Black grit lode, 6' · 2·0 dwts
"intersection of 2A + 2B lodes"
P264 chocolate coloured iron oxide with quartz stockwerks
porphyry
Footwall
Outcrop of 2A lode
Maika Creek
MACHINE LEASE
2A lode Maika Creek East
porphyry - schist contact — "very low value"
not surveyed
Q.M.E. No.4 L.46
main track to Umuna
INHABIT CREEK WEST
Footwall
Middle Ck. W.dr.
Middle Creek
route
quartz
porphyry
Middle Ck. E.dr
vicinity of locked tunnel —reported high values Au, Ag, Pb.
200' level No.1 E
No.2
No.1 lode
100' level No.1 E
approximate
No.1 lode ave. grade 1·25 dwts ; 1200' x 100'
Footwall of No.1 Lode
Reservoir lode
0·7dwts
120' level 'A' dr. W.
120' level 'C' drive E
3-10' wide quartz 2·0 dwts + Pb.
INHABIT CREEK N. L.81
Q.M.E. No.5 L.40
Inhabit Creek
100' level No.2 E, "low values"
Spring
P265: sphalerite and galena in brecciated quartzite
Costeans in slip ore 2·0 dwts. + Pb.
Pre-war mill-site
Egoboia
INHABIT CREEK SOUTH L.82
Higgins lode
costean No.2 13' ave. 3·4 dwts
No.X lode approx position of workings — ave 1·0 dwt.
Costean No.1
Plate 5
HLD 6.2.59

REFERENCE

- schist, showing trend
- intermediate porphyry
- felsite
- dolerite
- fault showing dip and lineation
- fault, position approximate
- fractures
- geological boundary
- " " , position approximate
- dip of bedding
- dip of schistosity
- underground workings
- broken ground
- railway
- .P252 specimen locality
- approx. contour

GEOLOGICAL SKETCH MAP OF THE DOUBLE CHANCE MINE MISIMA Ip, PAPUA

SCALE: 80 0 80 160 FT



Survey: AG Palmer, O.M.D.
Geology: HL Davies, B.M.R.

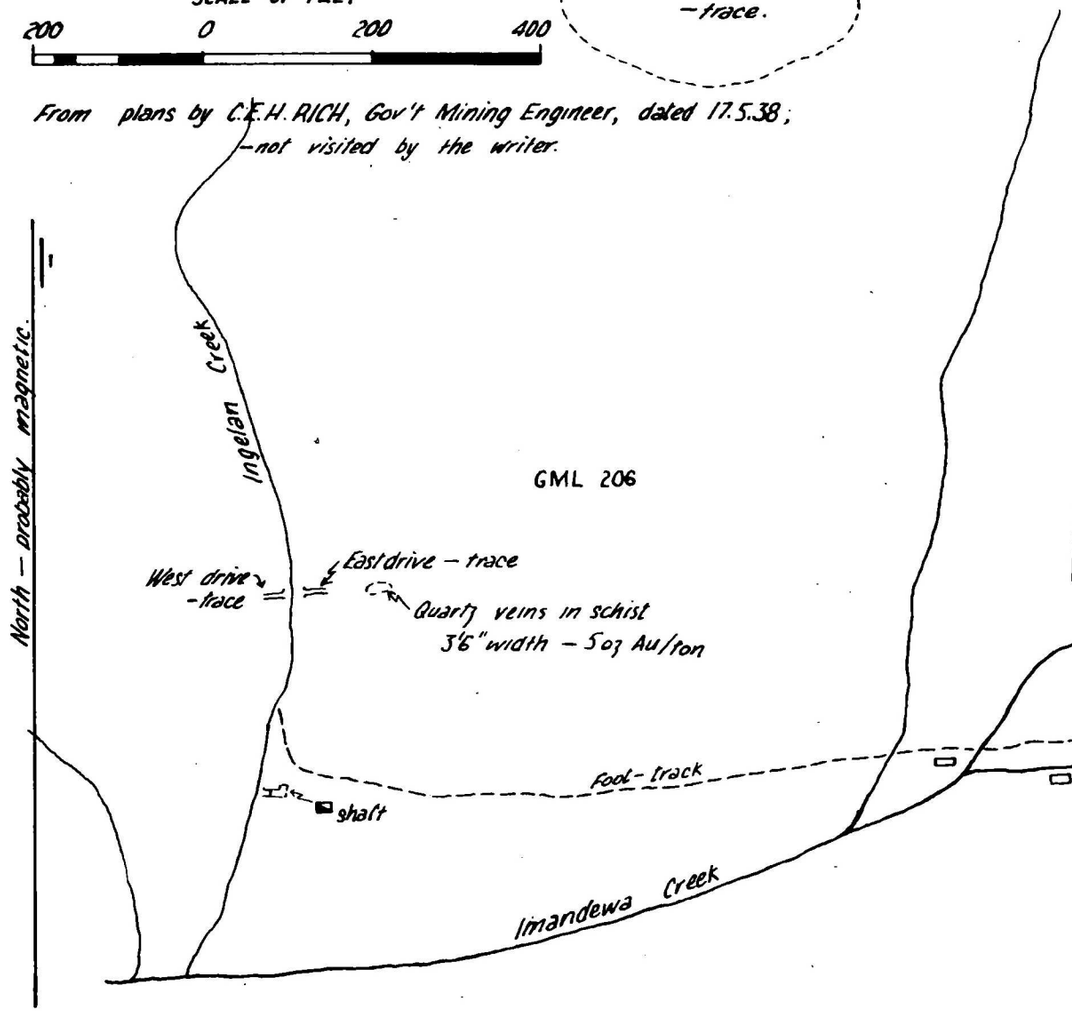
Plate 6.
HLD 1/58

CORNUCOPIA LEASES, SUDEST
ASSAY PLAN

SCALE OF FEET
200 0 200 400

Quartz boulders – trace.

From plans by C.E.H. RICH, Gov't Mining Engineer, dated 17.5.38; – not visited by the writer.



Nº 3 (MAIN) DRIVE

Distance from portal:		Width:	Gold per ton:
—	5' from surface, above portal	5'	1 dwt
30'	Floor sample	5'	12 gr.
55'	Footwall (Southern) Section	4'	12 gr.
55'	Quartz vein on footwall	4"	4 oz 17 dwts
55'	4' below other samples	8'	1 dwt
57'	Foot of drive	3'	6 dwts 19 gr.

Seven other samples, three from the end of the drive (58') assayed only trace quantities of gold.

Nº 2 DRIVE

39'	Face of drive, includes 8" qtz vein	18"	3 dwts 12 gr.
39'	" " " , schist	3'6"	1 dwt
	Open-cut above No. 2 Drive, on hanging-wall of quartz vein	4'	1 dwt 5 gr.

CORNUCOPIA
Nº 1 EAST

HLD 2/59

Plate 7
to accompany Louisiade Report