COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Report No. 9

THE MINERAL DEPOSITS AND MINING INDUSTRY OF PAPUA-NEW GUINEA

By

P. B. NYE and N. H. FISHER

Issued Under The Authority Of Senator the Hon. W. H. Spooner, M.M.,
Minister For National Development

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LIST OF REPORTS

1. Preliminary Report on the Geophysical Survey of the Collie Coal Basin-N.G. Chamberlain, 1948.
2. Observations on the Stratigraphy and Palaeontology of Devonian, Western Portion of Kimberley Division, Western Australia-Curt Teichert, 1949.
3. Preliminary Report on Geology and Coal Resources of Oaklands-Coorabin Coalfield, New South Wales-E. K. Sturmfels, 1950
4. Geology of the Nerrima Dome, Kimberley Division, Western Australia-D. J. Guppy, J. O. Cuthbert and A. W. Lindner, 1950
5. Observations of Terrestrial Magnetism at Heard, Kerguelen and Macquarie Island, 1947-1948. (Carried out in co-operation with the Australian National Research Expedition, 1947-1948). N. G. Chamberlain, 1952.
6. Geology of New Occidental, New Cobar and Chesney Mines, Cobar, New South Wales -C. J. Sullivan, 1951.
7. Mount Chalmers Copper and Gold Mine, Queensland-N. H. Fisher and H. B. Owen, 1952.
8. Geological and Geophysical Surveys, Ashford Coal Field, New South Wales-H. B. Owen and L. W. Williams,
9. The Mineral Deposits and Mining Industry of Papua and New Guinea-P. B. Nye and N. H. Fisher
10. Geological Reconnaissance, South-Western portion of Northern Territory-G. F. Joklik,

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Department Of National Development

Minister - Senator the Hon. W. H. Spooner, M.M.

Secretary - H. G. Raggatt

Bureau Of Mineral Resources, Geology And Geophysics

P. B. NYE *Director*

J. M. RAYNER - *Deputy Director*

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N. H. FISHER - *Chief Geologist*

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SUMMARY

Mineral deposits in Papua include those of gold, copper, and manganese,and from these gold, silver, copper, copper matte and copper ore, manganese ore, osmiridium, and platinum have been produced. The gold has been obtained from alluvial deposits and lodes and from the copper deposits. Silver has been obtained along with the gold, but no separate record of it has been kept. The osmiridium and platinum have been won during the mining of the alluvial gold deposits.

A fairly intensive search has been and is being made for petroleum, but there has not been any commercial production up to the present.

The total value of the mineral production to 30th June 1951 is estimated at £4,062,662, the detailed production being as follows:-

			£A	£A
Gold	Bullion & Native Gold	869,574 oz.	3,510,818	3,530,662
	Ore	240 tons	19,844	
Copper	Ore	11,066 tons	128,416	488,765
	Matte / Blister Copper	15,453 tons	360,349	
Osmiridium	Native	971 oz.	24,395	24,395
Manganese	Ore	1,999 tons	16,980	16,980
Platinum	Native	218.75 oz.	1,860	1,860
			Total	4,062,662

G O L D

Gold was the first mineral mined in Papua and has been mined continuously, except for the war years 1943-1945 inclusive, since 1888. The total production to June 30th 1951 has been 869,574 bullion oz., estimated to contain 612,026 fine oz. of gold and 256,675 fine oz. of silver, (and 240 tons of ore estimated to contain 2,607 fine oz. of gold). The value of the gold is £A3,530,662 which is 87 per cent. of the total value of mineral production. Most of the gold deposits have been alluvial, and they have been worked by individuals and parties by hydraulic and ground sluicing methods, etc. Since no large areas of alluvial ground have been found there has not been any hydraulic sluicing on a large scale or dredging, except small scale attempts in the Yodda and Lakekamu fields. Only a few lodes have been worked, of which the principal ones are those on Misima and Woodlark (or Murua) Islands.

E.R. Stanley (1924) reported that "the occurrence of reef gold was intimately associated with decomposed porphyrites and diorites impregnated and traversed by quartz veins, themselves carrying gold. Secondary replacement, both lateral and vertical, has changed the country schists and slates into a soft formation in certain localities, carrying a workable percentage of gold. Fissure veins, associated with auriferous quartz, are also common in the Woodlark, Gira and Yodda goldfields".

The following are the proclaimed goldfields:-

Louisiade - In the South-eastern Division and including the islands of Misima, Rossel, and Sudest. Proclaimed 1889.

Murua - In the South-eastern Division and including the island of Murua or Woodlark. Proclaimed 1898.

Gira - In the Northern Division. Proclaimed 1898.

Milne Bay - In the Eastern Division. Proclaimed 1899.

Yodda - In the Northern Division. Proclaimed 1900.

Keveri - In the Eastern Division. Proclaimed 1904.

Lakekamu - In the Central Division. Proclaimed 1909.

Astrolabe - In the Central Division. Proclaimed 1906.

1. The Louisiade (Stanley, 1915) field includes Misima and other islands in the Louisiade Archipelago east of the eastern end of the island of New Guinea. The greater part of the mining has been carried out on Misima Island and most, if not all, of the production has been from that island. Other islands which have been prospected or perhaps worked include Tagula (or Sudest) Island.

Gold was discovered on Misima in 1888 and the field was proclaimed in 1889 and became the first of the Papuan fields. The original discovery was an alluvial deposit and 400 men were working in the year of its discovery. The creek and its tributaries were worked, but no reefs were found.

The history of the earlier period of the field is not known, but mining was probably confined to alluvial workings until 1912 or 1914. The production in 1911-12 was 600 oz. and the total production of the field till 30th June, 1909 and 1912 respectively, was:-

	Oz.	£
To 30th June, 1909	19,497	68,961
" " " 1912	20,497	72,461

Although alluvial gold continued to be won in relatively small amounts, lode mining became predominant in the later history of the field. The total production to later periods was:-

	Oz.	£
To 30th June, 1919	42,575	119,030
" " " 1926	138,049.5	253,557
" " " 1931	152,003	295,530

The Block 10 Misima Gold Mines, N.L., began to operate in 1914 and ceased work in 1922. It worked the Massive lode at Umana and the mine became known as the Umana. The lode was apparently the oxidised portion of a large sulphide lode. It was partly due to the proposed treatment of the sulphide ore that the Company ceased operations in 1922. The production by the Company is not known, but judging by the statistics above it possibly produced about 100,000 oz. of gold bullion.

The Umana mine was subsequently taken over by the Misima Gold Mining Company which operated until 1927-28, its production from 1925-26 being:-

	Ore Treated	Bullion	Value
1925-26	11,111 tons	4,351 oz.	£13,705
1926-27	12,571 "	Not recorded	14,217
1927-28	3,977 "	1,038 oz.	2,829

The Company was refloated as New Misima Gold Mines Limited and continued operations until 1935, production being as follows:-

	Ore Treated Tons	Bullion Oz.	Value £
1928-29	-	1,029	2,882
1929-30	-	2,283	6,584
1930-31	10,879	4,699	14,398.9
1931-32	-	7,135	25,293.7
1932-33	15,038	12,594	28,992
1933-34	-	15,630	31,820
1934-35	14,762	16,712	37,521.6
		60,082	147,492.2

The Company's operations were exceedingly profitable during, at least, 1934 and 1935, and paid 90 per cent. per annum. In 1935 the mine was sold to Cuthbert's Misima Goldmine Limited and the annual amount of ore treated was increased from 15,000 to 40,000 tons. Operations were continuous until the last available record in 1940-41. The production is given below:-

	Ore Treated Tons	Bullion Oz.	Value £
1936-37	22,456	27,133	55,264
1937-38	-	30,697	72,031
1938-39	34,552	31,859	72,768
1939-40	-	38,631	77,625
1940-41	-	39,658	89,041
		167,978	366,729

Operations were profitable until the mine closed early in 1942 because of the war. Efforts to re-open the mine after the war were unsuccessful and the company was in liquidation in 1951.

Other companies did testing and developmental work from 1929 onwards and particularly again from 1934. Of these, Gold Mines of Papua Limited was the most important. It was formed in 1933 and carried out considerable developmental work and, according to reports, disclosed a large body of payable ore. At 30th June, 1937, reserves were 400,000 tons including 25,000 tons of oxidised ore with a value of 46/- (Aust.) per ton with gold at £6/18/- (sterling) per fine oz. The deposits worked included the lodes on the western fall of Mount Sisa. Production began early in 1938, and was as follows:-

	Ore Treated Tons	Bullion Oz.	Value £
1937-38		4,689	3,538
1938-39	30,326	26,691	30,755

Production ceased owing to a decrease in grade and the unprofitable results. It is reported that although prospecting was carried on until February 1940 it did not disclose any quantity of profitable ore.

In 1940-41, it was reported that the Gordon's Misima Company was getting plant and also that sluicing was being conducted on Sudest Island.

Active operations were, therefore, in progress in this field until affected by the proximity of war. It is understood that other prospecting operations were giving favourable results, but no important developments have taken place since the war.

2. The Murua field (Stanley, 1912) includes Murua or Woodlark Island 200 miles north-east from the eastern extremity of the island of New Guinea.

Gold was discovered in 1895, a small rich area of alluvial ground yielding 500 oz., and the field was proclaimed in the same year. Reefs were subsequently discovered and production from this source commenced in 1901-02. About 60,000 oz. of alluvial gold were obtained before reef mining began.

In 1905-06, there were three mining centres - Kulamadau, Basai and Karavakum. Five companies were working in that year and produced 8,919 oz. from crushing and cyaniding. In addition, 1,608 oz. of alluvial gold were obtained.

Total production up to different periods is given below:-

	Oz.	£
To 30th June, 1909 -	122,148	425,048
" " " 1912 -	150,008	523,251
" " " 1919 -	189,818	676,449
" " " 1926 -	200,348	693,105
" " " 1931 -	206,805	712,956

This table shows a decreasing average annual production from approximately 9,000 to 1,300 oz.

The most important company was the Kulamadau Gold Mining Company which worked from 1903 till 1922, but complete records of production are not available. The Woodlark Queen Proprietary Company worked from 1901 to 1907. Several other smaller companies also operated from 1904.

Many companies, syndicates, and parties worked after 1923, but it appears that all were short-lived and production was small. The Woodlark King Gold Mining Company Limited was apparently one of the most successful and operated from 1904 until 1928-29.

During 1934-35 and 1935-6, a search was made for dredging areas, but without result.

From 1933-34 to 1938-39, the sand and slimes dumps from previous battery operations, not already cyanided, were investigated and cyanided for their gold content. The only production figures are 1,279 oz. from 8,254 tons from the Woodlark King Dumps and 317 oz. from 13,619 tons from Busai dumps.

No production has been recorded since 1938-39. It would appear that the alluvial deposits have been worked out and that the profitable parts of the known lodes and reefs have been extracted.

3. The Gira goldfield is situated on the headwaters of the Gira River which flows north-easterly into the Pacific Ocean, 20 miles south-east from Morobe. The upper part of the field was known as the Aikora. All the gold obtained was from alluvial deposits, but no detailed information is available.

The total production to 30th June, 1931, was 67,690 oz. valued at £255,113. Except for 191 oz. in 1931-32, there has been no later recorded production. The greater part of the above production was obtained before June, 1909, to which date it was 60,622 oz. From its proclamation in 1898, the average annual rate of production was approximately 6,000 oz; this agrees with the only available figure prior to 1909, viz., 6,000 oz. in 1905-06.

The earlier history is not available, but after 1925-26 the field was worked by a few individuals. Two companies - The Gira River Sluicing Company in 1926-27 and the Aikora Gold Sluicing Syndicate in 1929-31 - attempted hydraulic sluicing operations, but with little success. Dredging claims were taken up in 1925-26, 1929-30, and 1931-32. The Gira River was tested by scout drilling in 1932-33 with unpromising results, but the plant could not reach the bedrock and the results are, therefore, not conclusive. Further testing for dredging was done in 1938-39, but progress results did not disclose any important values.

Judging by production figures, the alluvial ground for working by individuals appears to be more or less thoroughly depleted. During recent years only one or two men appear to have been working. Some testing was conducted in the search for dredging areas, but the results were not encouraging.

4. The Milne Bay field is situated around the head of Milne Bay and Mullen's Harbour at the eastern end of the Island of New Guinea.

Its early history is not available, but production for 1905-06 was stated to have been 1,000 oz., and in 1907 it was reported to be declining. Its total estimated production up to 1908-09 was 13,612 oz. and to 1925-26 was 14,230 oz., so that little pro-

duction took place during that period. There was no production between 1925-26 and 1930-31. Apparently the gold was obtained from alluvial deposits.

A slight revival occurred in 1930-31 and later years, and attempts were made to work reefs, dredging, and alluvial areas. A treatment plant was erected on one lease by 1932-33 and it was reported that crushing was about to begin. However, in 1934-35, the Samarai Gold Development Company, N.L., transferred its leases, but the operations were not sufficiently successful. In 1937-38, the Juno and Louise mines were operating and the treatment plant on the latter at Oura Oura was re-organised. Three mines were operating on a small scale in 1938-39, but there is no later record of working. The only recorded production during the above period was for 1938-39.

	Ore Treated Tons	Bullion Oz.	Value £
Rough Ridge Mine	1,301	771	6,268
Juno and Jumbo Mine	320	110	552

During the same period, alluvial mining was continued, particularly by natives, but the production was not recorded.

It appears that the alluvial deposits have been more or less depleted and that the reefs tested have not been found to contain sufficient ore to make successful mines.

5. The Yodda goldfield is situated on the Yodda River to the north-east of Port Moresby. The proclaimed field includes a large tract of country between the Owen Stanley Ranges and the north-east coast.

The field was worked for its alluvial deposits and the greater part of the production was obtained in the earlier years. The detailed history is not known, but up to 1908-09 the production was 68,240 oz. with a value of £255,450. The production for 1905-06 was given as 6,000 oz. Until 30th June, 1931, the total production was 76,832 oz., valued at £287,128. The rate of production had, therefore, been considerably reduced and it would appear that

the easily worked deposits were becoming exhausted. From 1925-26 until 1934-35 the field was almost deserted and the production negligible.

In 1932-33, boring operations were carried out on possible dredging areas, and in 1934 the Yodda Goldfields Company Limited was formed to work ground on the Upper Mambare River. The plant was transported to the field by air and production began in 1934-35. The Company apparently worked continuously till 1940-41. Complete records of production are not available, but the following indicate the scope of operations:-

	Gold oz.	Value £
1937-38	-	7,480
1938-39	1,297	10,047
1939-40	1,498	12,053
1940-41	865	6,925

A dividend was paid in 1938-39. The Company bored the ground (probably in 1938) with the following results:-

Amount	Value per C. Yd.	Total Value
76,100 c. yds.	4/-	£15,220
135,000 " "	2/-	£13,500
20,000 " "	2/6	£2,500
133,000 " "	4/-	£26,600
364,100 c. yds.		£57,820

During 1938-39, the amount treated was 34,766 cubic yards, so that the above reserves represented 10 years of working. However, in 1940-41 the Manager reported "that, although values won during the year were fair there are indications that the gold is petering out" and "if no further payable ground is found, the prospect for 1941-42 is anything but bright".

It is reported that a second company - the Yodda Prospecting Syndicate - was working in 1940-41. Its production was 425 oz. valued at £3,600.

6. The Keveri field is situated near Mount Suckling on the main range and about 100 miles east from Port Moresby. Access was gained from Cloudy Bay on the south coast.

The field was proclaimed in 1904 and by 1908-09 the production was 3,770 oz., and by 1925-26 was 4,770 oz. There has not been any recorded production since 1926. A small amount of prospecting and mining was possibly carried out after 1930-31, and in 1934-35 a possible dredging area was tested, but the results are not known.

It would appear that the alluvial deposits were of small extent and quickly worked out.

7. The Lakekamu field is situated in the upper reaches of the Lakekamu River and its tributaries, near the border of Papua and about 130 miles north-north-west of Port Moresby. It was proclaimed in 1909 and its area extended in 1931.

As in other fields, the greater part of the production came from the first few years' working. In 1911-12, 6,500 oz. were produced and the total to that period was 17,500 oz. The totals to later periods were:-

	Oz.	£
To 1918-19	34,892	130,952
1925-26	37,170	138,822
1930-31	37,425	139,834

Although there was only a small production after 1925-26, prospecting and testing operations were actively conducted. Several reefs were discovered in 1930-31, but any development work must have given unfavourable results. An almost continuous search for dredging ground was conducted. Interested companies included Tinar Gold Mining Company Limited, Papua Gold Syndicate, and Tiveri Gold Dredging Company Limited. The latter appears to have been the only one to reach the production stage. It operated a small bucket dredge for at least two years (1933-34 and 1934-35) and expected to reach the dividend stage, but no information is available. By 1935-36, the activity decreased, as testing did not appear to give sufficiently encouraging results. It is doubtful, however, whether the testing was adequate.

C O P P E R

Production to 30th June, 1951, has been 11,066 tons of ore and 15,453 tons of matte and blister copper, with a value of £488,765. This value places it second on the list of mineral production.

Two mineral fields have been worked almost entirely for copper - the Sideia and the Astrolabe fields.

1. The Sideia field includes Sideia or Basilisk Island, a small island situated immediately east of the south-eastern end of the Island of New Guinea. It was proclaimed in 1915, but after a short period of prospecting with unsatisfactory results was abandoned.

2. The Astrolabe field is situated on the southern side of the Laloki River, 15 to 17 miles to the east of Port Moresby by the Port Moresby-Rouna Falls Road. Copper ore was discovered some years prior to 1905, but prospecting began and the field was proclaimed in that year. The export of copper ore began in 1906 and continued until 1922. Some 11,066 tons were exported in that period, the greatest annual export being 2,700 tons in 1921-22. Most of this ore probably came from the Dubuna mine.

A company - New Guinea Copper Mines Limited - acquired most of the properties in 1922, erected a smelter at Bootless Inlet and continued operations until 1925-26. The Dubuna mine was connected with the smelter by 5½ miles of 3'6" railway and the Laloki Mine with the railway by 3½ miles of aerial ropeway. The company produced 9,040 tons of matte and also 261.5 tons of blister copper. Fires in the mines, difficulties regarding plant, and the low price of copper contributed to the cessation of operations.

There was only a very small output of copper ore from 1927-28 to 1938-39.

Mandated Alluvials, N.L., later acquired the properties, and smelting began in April, 1938. Up to and including 1940-41, some 1,200 tons of matte were exported. The total of the 1939-40

and 1940-41 production was 925 tons and it contained 235.21 tons of copper, 4,436 oz. of gold, and 16,521 oz. of silver, with an estimated total value of £62,080. Ore treated up to the end of 1940 consisted of 14,178 tons from the Sapphire-Moresby King and 4,394 tons from the Laloki mine.

During 1941, the possibility of increasing production was considered by the Commonwealth Copper and Bauxite Committee. However, the Pacific war position prevented the taking of any action and there has been no mining and smelting since 1941.

The ore deposits are lenticular bodies of dense pyritic ore (pyrite, pyrrhotite and marcasite), with chalcopyrite as the primary copper mineral, and small amounts of galena and sphalerite. The Laloki body is the largest. Its maximum dimensions at the adit level are 450 feet long and 90 feet wide, and the body is explored over a vertical depth of 160 feet. Other bodies are the Sapphire-Moresby King, Dubuna, Sapphire King, and Federal Flag.

Ore reserves are given (Fisher, 1941) as follows:-

		Amount tons	Copper Content %	Gold Content Dwt. per ton	
Laloki Mine		265,000	4.57	4.13	Sulphide Ore
Sapphire-Moresby King Mines	probable	9,000	1.7	10	Oxidized Ore

MANGANESE

Manganese ore has been known to occur for many years, but mining did not commence until 1937-38, and export of the ore began in 1938-39. Production increased steadily until 1940-41, in which year 402 tons were exported. The advent of war with Japan affected operations for a short period, but mining was conducted throughout the war years, although production decreased after 1942 to a minimum of 44 tons in 1946. From 1944 to 1951 annual production averaged 50 tons.

The deposit being mined is in the Rigo area, 40 miles south-east from Port Moresby. In this area and within a radius of 10 miles of the anchorage of Kapa Kapa, at least six deposits are known. This product has been shipped to Australia and used in the manufacture of dry batteries, for which use it has been shown to be highly satisfactory.

Mining has been carried out at three localities within a radius of $1\frac{1}{2}$ miles. These are known as Gomai-Golo (Pandora Mine), Doavagi, and Kemaia. All the exported ore has come from the Pandora Mine.

All these occurrences are situated in a roof pendant of sedimentary rocks on a gabbro intrusive. In part the sedimentary rocks are limestones of Upper Cretaceous age, but they include also massive brown cherts and thin-bedded siliceous argillites similar to the lower Eocene rocks of the Port Moresby district. The manganese occurs in these siliceous rocks, but because of absence of bedding and abundant minor faulting it is difficult to determine the relationship of the manganese bodies to the sediments. The manganese ore appears to occur in two lenticular beds a few feet apart. The largest lens has a minimum length along the strike of about 80 feet, maximum thickness of about 4 feet, and has been followed down the dip for 70 feet.

The ore exported is pyrolusite, and the grade is brought up by hand-picking to 86 percent. MnO_2. It has been established as an excellent battery-grade manganese ore and is one of the few sources of ore of that grade in Australia and its Territories.

In view of the reported nature of the deposits and the lack of extensive testing and development, known reserves must necessarily be small. It is probable, however, that production at past rates might continue for a few years.

OSMIRIDIUM

Osmiridium is a native alloy of osmium, iridium, and other metals of the platinum group and has been found in small quantities in almost every alluvial goldfield in Papua. At first, little notice was taken of it and it was not marketed until about 1919.

Of this production the greater part (about 730 oz.) was produced between 1920 and 1925; since 1931-32 the greatest annual production has been 8.5 oz. in 1934-35.

The available official reports do not indicate where the osmiridium was obtained, but it was probably mainly from the Gira and Yodda goldfields to the east-north-east and north-east of Port Moresby. Some was produced from the Lakokamu field, shed from the serpentine and peridotites occurring in the Owen Stanley Ranges in those regions. These rocks are present in the headwaters of the Waria River and at intervals to the south-east, in the headwaters of the Gira, Yodda and Kumusi Rivers, on Mungoni River and at Milne Bay.

It is impossible to give any idea of reserves of osmiridium in any unworked goldfields, but judging by past production they would be small.

No deposits of osmiridium in the serpentine rock, or alluvial deposits with sufficient osmiridium to work solely for that mineral, have been discovered.

PLATINUM

Small quantities of native platinum have been exported since 1933-34 and the total recorded exports are 218.75 oz. with a value of £1,860. The greater part of this was exported in 1933-34 and 1934-35 and the most recently recorded production was 5 oz. in 1940-41.

Available publications do not give the fields from which the platinum was obtained. However, the production followed a reported platinum boom near Milne Bay in 1932-33 and has probably

come from the gold deposits in that field.

The platinum would almost certainly be shed from the peridotites and serpentines occurring on the southern side of Milne Bay. It is impossible to give any idea of reserves in the above type of deposit, but judging by past production they would be very small. No deposits of platinum in the parent rock, or alluvial deposits with sufficient platinum to work for that metal alone, have been discovered.

PETROLEUM

Surface indications of the occurrence of oil are common in many parts of New Guinea, and small quantities of oil have been recovered by boring at Upois (Vailala River) in Papua and at Matapau in the Mandated Territory.

In point of time, prospecting operations for petroleum in New Guinea fall into four divisions which overlap each other to some extent:-

1. By Commonwealth Government prior to the transfer of control to Anglo-Persian Oil Co., Ltd., 1912-1920. Expenditure - £131,035.

2. By Anglo-Persian Oil Co., Ltd., as agents for Commonwealth Government, 1920-1925. Expenditure - £227,256.

3. Second expedition as under (2), 1927-1929.

4. By private companies from July, 1923 onwards. Amount expended is unknown, but very great. In 1936 the conditions under which prospecting for petroleum could be done in Papua and New Guinea were made more liberal. As a result prospecting activities greatly increased. The principal companies engaged have been the Australasian Petroleum Company, Island Exploration Company, and Papua Oil Development Limited. Smaller companies include Oil Search Ltd. (interests later taken over by Australasian Petroleum Co.), Oriomo Oil Company, and Papuan Apinaipi Petroleum Company Limited.

The Australasian Petroleum Company, the Island Exploration Company and the Papua Oil Development Limited (especially the first) have made very extensive detailed geological surveys, based on air photographs. They have also done geophysical work and scout drilling in Papua. Several of the concessions held by these companies have been abandoned after geological examination.

As a result of its investigations the Australasian Petroleum Company selected its first site for a deep test at Kariava on the Vailala River. Drilling operations were suspended on 10th January, 1942, because of the entry of the Japanese into the war, when this well had reached a depth of 5,117 feet. Drilling was resumed in March, 1946, and the hole was finally abandoned in April, 1948, at a depth of 12,621 feet. Some small gas showings were obtained in this well, but the results generally were disappointing.

A second deep test was started on 11th September, 1948, on the Oroi anticline, near Yule Island. It was drilled through lower Miocene sediments to a depth of 5,516 feet and abandoned on 29th October, 1949. Small shows of gas were obtained but no signs of oil.

The third test was drilled on the Upoia structure, near the mouth of the Vailala River, beginning on 22nd January, 1949. It was abandoned at 5,356 feet, without any signs of oil having been obtained.

On 21st March, 1949, a deep test was spudded in on the Hohoro anticline, also near the mouth of the Vailala River. It started in Pliocene beds and was abandoned in July 1950, in upper Miocene mudstone at a depth of 4,721 feet, owing to difficulties in drilling through the soft "heaving mudstone". Another test was begun further down the flank. This was completed at 10,642 feet on March 8th, 1952, without finding any indications of oil.

A fifth test was begun at Wana in the Delta region on 6th April, 1950. It was abandoned at a depth of 9,866 feet after passing through a complete Tertiary section from Pliocene to Eocene. The presence of porous beds, suitable for reservoir rocks, was proved

but no oil was found.

Estimated expenditure by this Company in the search for oil in Papua up to June 30th, 1951, is nearly £8,000,000.

The Island Exploration Company began a deep test on the Omati Anticline in the Delta area on February 22nd, 1950. On 30th June, 1951, it had reached a depth of 8,962 feet.

Three wells designed as tests have been drilled at Oiapu by the Papuan Apinaipi Petroleum Company. The first had reached a depth of 2,769 feet when drilling was suspended. The second was located at the southern end of the structure and was abandoned in volcanic rocks at a depth of 2,086 feet. The third test was located on a local closure on an anticline axis at the north end of the structure. When operations ceased at Oiapu on the 31st December, 1942, this well had reached a depth of 1,844 feet and was in volcanics. It is still not known whether these volcanics are intrusives or interbedded extrusives. Future policy with regard to drilling on this structure largely depends on the solution of this problem.

It has, so far, not been demonstrated that there is an oilfield anywhere in Papua or the Territory of New Guinea, although commercial fields have been proved at the west end of Dutch New Guinea. A considerable amount of field work and drilling has been done, but operations are still in the prospecting stage.

C O A L

The coal seams of Papua are described by E.R. Stanley (1924) as follows:-

"Seams of coal occur in the Tertiary Formations of the Gulf, Delta, and North-Eastern Divisions. They are lignitic in character, are associated with the Petroleum beds, and contain up to 24 per cent. of moisture. Many of the seams attain a reasonable thickness, but are situated in the remote hinterland, thus rendering it impossible to be even considered a commercially workable brown coal. Large blocks of hard, glistening coal have been reported from the Upper Kikori, which may be Mesozoic, as rocks of that age are

known to exist in the area."

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TABLE I.

MINERAL PRODUCTION - TERRITORY OF PAPUA

Year Ending 30th June	Gold				Gold Ore			Platinum		Osmiridium		Copper			Manganese Ore	
	Bullion & Native Gold oz.	Estimated Gold content fine oz.	Estimated Silver content fine oz.	Value £A	Tons	Estimated Gold content fine oz.	Value £	Oz.	£	Oz.	£	Ore tons	Matte tons	Value £	Tons	£
1889	✓ 3,850	3,387	460	14,387	-	-	-	-	-	-	-	-	-	-	-	-
1890	3,470	2,929	540	12,440	-	-	-	-	-	-	-	-	-	-	-	-
1891	2,426	1,971	450	8,371	-	-	-	-	-	-	-	-	-	-	-	-
1892	1,235	1,017	210	4,322	-	-	-	-	-	-	-	-	-	-	-	-
1893	1,200	1,059	140	4,500	-	-	-	-	-	-	-	-	-	-	-	-
1894	1,128	920	200	3,906	-	-	-	-	-	-	-	-	-	-	-	-
1895	728	640	120	2,565	-	-	-	-	-	-	-	-	-	-	-	-
1896	12,840	10,593	2,240	45,000	-	-	-	-	-	-	-	-	-	-	-	-
1897	20,860	17,206	3,650	73,085	-	-	-	-	-	-	-	-	-	-	-	-
1898	15,822	13,344	2,470	56,682	-	-	-	-	-	-	-	-	-	-	-	-
1899	17,550	15,167	2,380	64,425	-	-	-	-	-	-	-	-	-	-	-	-
1900	24,450	20,970	3,480	89,075	-	-	-	-	-	-	-	-	-	-	-	-
1901	21,703	18,612	3,090	79,060	-	-	-	-	-	-	-	-	-	-	-	-
1902	20,873	17,903	3,070	76,047	-	-	-	-	-	-	-	-	-	-	-	-
1903	24,048	20,609	3,430	87,545	-	-	-	-	-	-	-	-	-	-	-	-
1904	23,380	19,994	3,580	84,930	-	-	-	-	-	-	-	-	-	-	-	-
1905	22,729	19,478	3,250	82,736	-	-	-	-	-	-	-	-	-	-	-	-
1906	24,227	20,686	3,540	87,869	-	-	-	-	-	-	-	-	-	-	-	-
1907	16,103	13,863	2,240	58,886	-	-	-	-	-	-	-	137	-	4,098	-	-
1908	14,557	12,012	2,540	51,024	-	-	-	-	-	-	-	176	-	2,479	-	-
1909	14,710	12,032	2,670	51,108	-	-	-	-	-	-	-	67	-	1,340	-	-
1910	15,151	14,168	1,980	60,181	-	-	-	-	-	-	-	72	-	1,439	-	-
1911	18,497	16,197	2,300	68,803	-	-	-	-	-	-	-	403	-	12,386	-	-
1912	17,047	14,273	2,770	60,628	-	-	-	-	-	-	-	594	-	9,681	-	-
1913	18,247	15,094	3,150	64,115	-	-	-	-	-	-	-	1,285	-	18,997	-	-
1914	14,666	11,797	2,860	50,110	-	-	-	-	-	-	-	1,150	-	19,733	-	-
1915	15,290	12,058	3,230	51,221	-	-	-	-	-	-	-	695	-	5,606	-	-
1916	10,930	10,181	740	43,248	-	-	-	-	-	-	-	864	-	9,971	-	-
1917	9,678	8,943	730	37,986	-	-	-	-	-	-	-	1,322	-	14,050	-	-
1918	12,168	7,889	4,270	33,512	-	-	-	-	-	-	-	1,112	-	11,572	-	-
1919	11,769	6,272	5,490	26,641	-	-	-	-	-	-	-	224	-	1,613	-	-
1920	11,751	5,122	6,620	21,757	-	-	-	-	-	88.50	2,930	10	-	107	-	-
1921	13,232	4,350	8,880	18,478	-	-	-	-	-	208.00	6,245	255	-	1,830	-	-
1922	52,704	13,799	38,900	58,615	-	-	-	-	-	56.00	959	2,700	-	13,514	-	-
1923	17,033	5,295	11,700	22,494	-	-	-	-	-	145.00	2,790	-	1	14	-	-
1924	2,166	1,578	580	6,702	3.00	7	30	-	-	119.00	3,533	-	8	120	-	-
1925	4,947	4,153	790	17,642	1.00	47	200	-	-	116.00	3,630	-	2,089	41,674	-	-
1926	7,746	6,388	1,350	27,134	4.45	136	580	-	-	50.00	1,500	-	11,466	201,732	-	-
1927	8,140	6,150	1,990	26,124	6.00	202	856	-	-	26.00	430	-	582	35,799	-	-
1928	2,408	1,704	700	7,240	6.00	193	820	-	-	36.50	550	-	16	208	-	-
1929	2,287	1,625	660	6,901	3.00	32	137	-	-	28.75	375	-	-	-	-	-
1930	3,634	2,358	1,260	10,059	1.75	143	606	-	-	28.75	500	-	8	194	-	-
1931	6,923	5,283	1,640	26,097	1.25	25	146	-	-	46.75	700	-	-	-	-	-
1932	8,574	8,014	560	54,241	4.75	65	475	-	-	0.75	12	-	2	60	-	-
1933	15,268	9,387	5,800	70,337	3.00	131	1,008	-	-	-	-	-	-	-	-	-
1934	19,496	10,814	8,600	87,893	7.25	131	1,111	96	794	-	-	-	2	74	-	-
1935	21,732	16,136	5,500	140,692	4.25	127	1,108	46	318	8.50	112	-	-	-	-	-
1936	26,199	19,254	6,900	167,173	1.00	86	751	21	171	-	-	-	2	10	-	-
1937	33,586	21,605	11,900	187,781	28.25	551	4,772	8	94	5.00	59	-	-	-	-	-
1938	41,308	25,835	15,400	223,160	52.00	184	1,597	41.25	413	3.50*	40	-	44	2,300	-	-
1939	64,622	35,808	28,800	325,116	67.50	196	1,905	1.50	15	4.00	30	-	308	34,655	54	314
1940	46,239	30,422	15,800	316,203	46.25	351	3,742	-	-	-	-	-	518	37,510	195	1,380
1941	-	-	-	-	-	-	-	5.00	55	-	-	-	407	5,999	402	3,244
1942	ø 23,893	14,056	9,600	133,341	-	-	-	-	-	-	-	-	-	-	346	2,474
1943	-	-	-	-	-	-	-	-	-	-	-	-	-	-	359	2,567
1944	-	-	-	-	-	-	-	-	-	-	-	-	-	-	173	1,237
1945	-	-	-	-	-	-	-	-	-	-	-	-	-	-	171	1,217
1946	-	-	-	-	-	-	-	-	-	-	-	-	-	-	44	311
1947	446	379	63	4,077	-	-	-	-	-	-	-	-	-	-	58	415
1948	283	213	66	2,296	-	-	-	-	-	-	-	-	-	-	28	479
1949	27	24	3	264	-	-	-	-	-	-	-	-	-	-	68	1,017
1950	ø 2,018	788	1,210	10,875	-	-	-	-	-	-	-	-	-	-	59	1,480
1951	ø 587	248	333	3,716	-	-	-	-	-	-	-	-	-	-	42	845
TOTAL	869,574	612,026	256,675	3,510,818	240.70	2,607	19,884	218.75	1,860	971.00	24,395	11,066	15,453	488.756	1,999	16,980

xv

Ж Based on export figures from 1928.

✓ Quantity and value as shown in statement of exports.

ø Estimated.

PART II TERRITORY OF NEW GUINEA by N.H. Fisher

SUMMARY

Gold and silver are the only minerals that have been produced in the Territory of New Guinea (former Mandated Territory). The total value of the gold production of the Territory up to 30th June, 1951, is £2,648,151. More than 90 per cent. of the gold has been obtained from alluvial workings, and about 60 per cent. of the total has been won by the dredges of Bulolo Gold Dredging Ltd., along the Bulolo and Watut rivers in the Morobe Goldfield. Gold reefs of epithermal type and late Tertiary age have been worked at Edie Creek and Golden Ridges near Wau. Outside the Bulolo and Watut River valleys and the adjacent areas, gold has been produced from the Sepik district, the Upper Ramu River, and Mt. Hagen, and small amounts from the Upper Purari River, from Tabar Island, and from Bougainville.

GOLD

Historical

Mining in the Territory of New Guinea has, up to the present, been almost entirely confined to the winning of gold, mostly from alluvial deposits. Prior to the 1914-1918 war Australian prospectors crossed the border, without the knowledge of the German authorities, and worked some of the richer patches along the Waria and Ono Rivers, near the Papuan Border. This production has, no doubt, been included in the records of the nearby Gira Goldfields in Papua. The history of gold-mining proper in the Territory of New Guinea dates from 1922 when William (Shark-eye) Park penetrated the Bulolo Valley and found payable gold at the mouth of Koranga Creek, three miles north-north-west of the present site of Wau. Owing mainly to difficulties of transport, the progress of the field was slow for several years and only a few miners were getting profitable returns until 1926, when Royal and Glasson made their way up the side of the Edie Creek gorge and discovered the phenomenally rich alluvials in the comparatively flat bed of the creek above the gorge. A rush followed, aerodromes were built and air transport superseded the long arduous haul by

native carriers from the coast, and the dredging areas of the Bulolo and Watut Rivers were pegged. Prospectors went farther afield and opened up claims along both rivers and their tributaries over a distance of fifty miles or more, from the head of the Watut almost to Maralinan, when the river opens out onto wide flats prior to joining the Markham. Capital was invested, the Bulolo Valley alluvials were bored, more aerodromes cleared and air transport developed sufficiently to enable all the necessary parts for the construction of large dredges to be flown in. The first two dredges of the Bulolo Gold Dredging Company began operations in 1932 and the fleet was gradually increased until by 1940 eight dredges, operated by three hydro-electric powerhouses, were in operation. Concurrently with the development of the placer ground the smaller alluvial properties turned more and more to the use of large-scale sluicing methods, water races were built and hydraulic sluicing, supplemented where necessary by the use of elevators, was widely employed, particularly by New Guinea Goldfields Limited, Koranga Gold Sluicing Limited, and many other companies and private claim and lease-holders. Outside the Bulolo and Watut Valleys, payable gold was found just over the coastal divide in Black Cat Creek and the Bitoi River, near Salamaua at Kela, in tributaries of the Wampit and Waim Rivers, in the headwaters of Ramu and Purari rivers, and near Mount Hagen. In 1935 the Sepik goldfield, embracing a large area south-west of Wewak, was opened up. In practically every case, transport was entirely by aeroplane with costs ranging from £10 per ton to about £100 per ton for inland areas such as Mount Hagen, and the consequent high cost of supplies offset to some extent the advantages of cheap native labour.

Since the war, although the use of a road, which was built during the war from Labu on the coast near Lae to the Bulolo-Wau area, has lowered transport costs, other costs, particularly those of native labour, have risen so high that it has been possible to re-open only the richer properties.

The goldfields proclaimed in the Territory of New Guinea are as follows:-

Morobe goldfield. Proclaimed February, 1923, boundaries amended 1930 and 1933; now comprises practically all the area south of the Markham River and includes the headwaters of the Ramu River.

Kieta goldfield. Proclaimed October, 1924; a roughly triangular area including the township of Kieta and extending along the coast from latitude 6°S to 6°21'S and inland to longitude 155°20'E.

Sepik goldfield. Proclaimed May, 1937; includes nearly all of the area between the Sepik River and the sea, except a small area of uncontrolled territory in the south-west corner.

The following provisional goldfields, each of 1 square mile, have also been declared:-

Upper Ramu. Proclaimed January, 1930, revoked March, 1933 and included in the Morobe goldfield.

Upper Purari. Proclaimed January, 1933.

Talele, New Britain. Near Cape Lambert; proclaimed June, 1933.

Tugi Tugi, Tatau Island, Tabar Group, off the east coast of New Ireland; proclaimed June, 1934.

The gold mining operations are conveniently divided into three classes:- Dredging (Bulolo Gold Dredging Limited); Alluvial workings other than dredging; Lode mining. The following table shows how the production up to the end of June, 1941, was distributed between the three classes. Corresponding figures for recent years are not at present available, but most of the post-war production has been obtained by dredging.

TABLE II

GOLD PRODUCTION: MOROBE DISTRICT
TERRITORY OF NEW GUINEA

Year	Alluvial Fine Oz.	Dredging Fine Oz.	Lode Fine Oz.	Total Fine Oz.	Value £A
Prior to 30/6/30	197,896			197,896	843,308
1930-31	29,824		34	29,858	158,046
1931-32	48,518		2,600	63,485	434,352
1932-33	46,236	62,635	13,042	121,913	925,899
1933-34	46,969	91,653	25,653	164,381	1,345,801
1934-35	41,185	124,681	29,736	195,602	1,730,644
1935-36	42,828	123,715	22,984	189,527	1,657,979
1936-37	49,077	136,867	30,152	216,096	1,901,989
1937-38	49,279	133,553	19,963	212,795	1,855,684
1938-39	48,216	159,769	21,288	229,213	2,116,117
1939-40	63,268	180,857	27,450	271,575	2,878,353
1940-41	63,329	173,833	18,873	256,035	2,733,880
TOTAL	739,628	1,196,930	211,821	2,148,376	18,578,052

	Alluvial	Dredging	Lode
% of Total 1939-40	23.3	66.6	10.1
% of Total 1940-41	24.8	67.8	7.4
% of Total to 30/6/41	34.5	55.7	9.8

Dredging.

Three separate areas have been worked by Bulolo Gold Dredging Limited. The principal one, covering the largest area and containing the deepest ground (up to 225 feet), extends from the

bottom end of the Bulolo gorge, near the site of the former Bulolo powerhouse, down to 3 miles below Bulolo township, a total length of approximately ten miles. The dredging area is nearly 2.5 miles wide at the widest portion. At the lower end of this main area another small gorge limits dredge operations and the next area extends from the lower end of this gorge downstream for four miles to the Watut River junction, up the Watut for two miles and below the junction through the rich Bulwa flats for 5.5 miles to below the mouth of the Baiune Creek. The third area is higher up the Bulolo Valley, near Wau, from the mouth of Koranga Creek back up the river to the mouths of Sandy and Wau Creeks, and includes the lower reaches of Wau Creek.

During 1941 the Company was in full production at the rate of 180,000 fine ounces per year and it was considered that the reserves were sufficient to last 10-15 years, though it might not be possible to keep all eight dredges working for the full period. The total amount yet to be recovered is perhaps 1,500,000 fine ounces of gold. Average value of the ground worked during 1939-40 was a little over 2/- per cubic yard.

Alluvial Mining other than Dredging.

Alluvial mining apart from dredging has been carried on along the Bulolo and Watut Rivers and their numerous tributaries, including Kodiak Creek, Quombo Creek, Crystal Creek, Binatang Creek, Little Wau Creek, Flat Creek, Koranga and Namie Creeks, Edie, Merri, and Slate Creeks, Webiak Creek, Sandy Creek, Poverty Creek, and Kulolo Creek, flowing into the Bulolo; Hidden Valley Creek, Kapoul Creek, Nauti Creek, Iroa Creek, Surprise Creek, Roaring Creek, Reedy's Creek, Subroar Creek, and Bitap Creek, flowing into the Watut; in the Black Cat Creek and the Bitoi River; in the Waim River; in Wongonbungor Creek, flowing into the Wampit River; at Kela near Salamaua; on the Waria and Ono Rivers; near Kaispit, Upper Markham River; in Yonki Creek, Biakira Creek, Efontera, Ornapinka, and Barola Creeks, all tributaries of the Upper Ramu River; on the Upper Dunantina River, between Kainantu and Bena-bena; and on Ewunga and Kunimo Creeks near Mount Hagen.

In the Sepik Goldfield the principal streams were the Screw and the Parchee Rivers, and the headwaters of the Atob and Anumb Rivers, but gold has been won from many other streams flowing from either side of the central divide which separates the streams flowing to the sea from those flowing into the Sepik River.

A small quantity of alluvial gold has been won on the Tugi Tugi field, Tatau Island, in the Tabar Group east of New Ireland, and a very small quantity from the Kupei area, west of Kieta, on Bougainville Island.

The principal source of the gold of the Morobe district is the area at the head of Edie Creek, where it occurs as small rich stringers throughout an area of hydrothermally-altered schist - known as "mudstone" - adjacent to intrusives of quartz porphyry, also hydrothermally altered and also carrying gold. These porphyries are of late Tertiary age and the gold associated with them is only 500-600 fine, but several other earlier porphyries of similar composition also introduced gold of different but slightly higher fineness, apparently mainly in small stringers like the later occurrences. Away from the Wau-Edie Creek area most of the gold is derived from mineralization associated with the extensive Morobe granodiorite batholith or related intrusives. All this granitic gold is of higher fineness, generally 850-900 parts per thousand.

The gold of the Sepik district is derived mainly from reconcentration of the gold contained in conglomerates of the Mio-Pliocene sedimentary series, but undoubtedly in the first place came from reefs and leaders in the eroded basement rocks, which outcrop along the Torricelli ranges, especially in the deeper valleys.

The dredging claims and leases are far too numerous to list here, but the following are some of the principal pre-war producers from alluvial mining.

Name	Situation of Property
New Guinea Goldfields Ltd.	Edie Creek, Koranga Creek, Bulolo River
Koranga Gold Sluicing Ltd.	Koranga.
H.T. Allan	Anderson's and Bourke's Creek, Golden Ridges (tribute from N.G.G. Ltd.)
Sandy Creek Gold Sluicing Ltd.	Sandy and Poverty Creeks
Leahy Bros.	Upper Watut River
Gold and Power Limited	" " "
E.J. Thomas	Mouth of Edie Creek
Mrs. D.R. Booth	Bulolo River, below Edie Creek
Bulolo Gold Dredging Ltd.	Bulolo River near Powerhouse, sluicing operations
T. Zoffman	Bulolo River, four miles below Bulolo township
A.J. Peadon	Yonki Creek, Upper Ramu
J. Thurston	Parchee River, Sepik District

Lode Mining

The only workable lodes so far found are near the head of the Edie Creek and at Golden Ridges, 2 miles north-west of Wau. The main veins at Edie Creek occupy a series of steeply dipping fissures aligned in a north-westerly direction, and comprising, from the south-east end, Day Dawn South, Surman's Vein, Edie Lodes Nos. 4, 1, 5, 2, and 3, Karuka, and Enterprise Lodes. Of these, Edie No. 1 lies just within the southern edge of the Upper Edie porphyry, and all the others are in mudstone, schist, or volcanic agglomerate, not far from the porphyry intrusive. The Day Dawn lode lies partly along the schist-porphyry contact and partly in a fissure zone in the schist on the north side of the main Edie porphyry body. One or two other veins have been found up Merri Creek. The outcrops of all these lodes consisted of soft manganiferous material with some quartz, and at deeper levels the lode material consisted of quartz and/or calcite with some rhodocrosite, and a small proportion

of sulphides. Values decreased generally from the surface downwards, particularly below the zone of oxidation.

At Golden Ridges 150,000 tons of manganiferous ore averaging over 1 oz. of gold per ton was found lying flat, almost on the surface, and higher up the hillside, at Upper Ridges, the outcrop of a similar flat-lying but rather lower-grade body was found. This ore turned to calcite, rhodocrosite, and quartz at shallow depth and dipped south-west at about 30° into the mountain. Country rock of these lodes is later Tertiary volcanic breccia. A similar, but steeply dipping, lode was found half a mile to the east, at the head of Anderson's Creek. The Golden Peaks lode is a low-grade manganiferous formation just below Golden Ridges. Another lode which has been worked on a small scale is the Mount Kaindi lode near the top of the mountain of that name. Of these lodes, Golden Ridges and Day Dawn South have been worked out. Most of the gold of the Day Dawn mine has also been extracted, but various shoots of ore are still being worked on a small scale.

Production at the Edie Creek Mine, which was owned and operated by New Guinea Goldfields Limited, ceased on March 17th, 1941, on account of a strike, and the lower levels were flooded. The mine, which includes workings on Edie Nos. 1, 2, and 5, and on Karuka lode, was still closed when the company ceased operations because of the war. Reserves of ore are estimated at:-

	Tons	Recoverable Grade
Main Mine	17,844	8 dwt. Au per ton
Karuka Mine	12,339	5.4 " " " "
TOTAL	30,183	7.0

The Enterprise Company had opened up some 60,000 tons of possibly 6 dwt. ore, but had not commenced production and had no milling plant.

All the buildings and plant at Golden Ridges were destroyed after the entry of the Japanese into the War. Ore was being obtained from Upper Ridges and Anderson's Creeks lodes, and since the

war a new orebody has been developed at Upper Ridges and a new mill built. Up-to-date figures on ore reserves are not available to the writer.

A small reef formation carrying up to 10 dwt. of gold per ton has been found on the Talele goldfield, near Cape Lambert, New Britain (Fisher and Noakes, 1942, p.57),and a little alluvial gold has been recovered from adjacent streams, but the area holds no promise of future production. Ten miles south-west of Kieta, on Bougainville Island, a small company was engaged for several years in working a low-grade cupriferous lode, consisting of a stockwork of quartz veins in porphyry. Some attention was also given to some narrow reefs at Pumkuna a few miles farther inland, which contain moderate gold values, but operations returned little, if any, profit and total production was small.

A description of the ore geology of the Day Dawn Mine and a paper on Metasomatism associated with Tertiary mineralization in New Guinea have appeared in Economic Geology (Fisher, 1939a and b). These papers give a brief outline of the geology of the Wau-Edie Creek area and of the lode occurrences, and considerably more detail on gold occurrence in the Territory of New Guinea is given in a paper entitled "The Fineness of Gold", also published in Economic Geology (Fisher, 1945). At the end of this Report a list is given of geological reports that have been prepared on the different mines and mining areas.

S I L V E R

Silver production from the Territory has been only incidental to gold-mining operations. The alluvial gold from Edie and Merri Creeks contained 40 to 50 per cent. of silver, and this proportion decreased downstream, owing mainly to the addition of higher-grade gold from other sources. Bullion obtained by cyanidation from Day Dawn South, Daw Dawn, and New Guinea Goldfields Limited's Mines at Edie Creek was very rich in silver, and some of it contained only a small percentage of gold. The production of gold and silver from the Territory up to the present is shown in Table III. Each district is listed separately.

PLATINUM AND OSMIRIDIUM

These minerals occur in serpentinous rocks in the Waria Valley and also in similar material in the basement rocks which are exposed in the core of the ranges in the Sepik district. Small quantities have been included in parcels of alluvial gold forwarded from the Waria and Ono Rivers and from the Sepik goldfield but the total production amounts to only a few ounces.

MERCURY

Cinnabar has been found in alluvial gravels of the Upper Edie Creek and can be seen associated with pyrite in the Enterprise lode on the lower levels of the mine, but there is little possibility of its being extracted on a commercial scale.

MANGANESE

All the gold lodes contain a certain proportion of manganese, and their outcrops consisted of black soft earthy manganiferous material. Pyrolusite, psilomelane, and manganite have been identified and rhodocrosite is plentiful in the Upper Ridges lode and the No. 1 lode at Edie Creek. Most of the oxidized manganese ore has been mined and has passed down the creeks as tailings. In any case little, if any, would have been suitable for industrial use even if the cost of transport had not been prohibitive.

COPPER

Copper minerals have been reported from various parts of the Territory, e.g., Waria Valley, Central Nakanai in New Britain, and Bougainville, but have not been found in sufficient quantity to be of commercial interest.

LEAD AND ZINC

Samples containing galena, sphalerite and other minerals have been obtained from various localities in the Morobe district and elsewhere, usually from near the contact of intrusive porphyries,

but no defined lodes of any size have been found.

IRON

Small bodies of fairly high-grade and one or two larger bodies of low-grade iron ore outcrop on and adjacent to Rangarere Plantation, near Cape Lambert, North Baining, New Britain. (Fisher and Noakes 1942, p. 50). The ore consists of hematite and magnetite, and partly replaced sedimentary rocks, and carries some pyrite. It was examined by Dr. R.L. Jack and Mr. K. Church of Broken Hill Pty., Ltd., but was considered by them not to have any promise as an iron ore producer.

Boulders of solid magnetic iron ore carrying gold have been found in Yonki Creek and Barola Creek in the Upper Ramu area, but the source of these boulders has not been discovered.

SULPHUR

Sulphur occurs as the native element, which has been deposited by solfataric action around the craters of active and extinct volcanoes along the northern coast of New Britain and New Guinea. The principal deposits are at Mount Pago, 4,000 tons, and Mount Garbuna, 1,700 tons, with lesser amounts at Lolobau Island, the South Son, Talasea, Langila, Rabaul, and Kairiru. Details of these deposits have been published in Geological Bulletin No. 3 of the Territory of New Guinea, in two papers. (Fisher and Noakes 1942, pp. 40 and 46).

LIMESTONE

Unlimited quantities of limestone of various types are found both on the islands and on the mainland. The degree of compaction varies in a general way with age. The crushed material known as "coronace", which is used successfully in roadmaking in New Ireland, New Britain and elsewhere, is of Pleistocene to Recent age. Eocene to Miocene limestones are plentiful, however, and possibly even earlier limestones are known, as at Rangarere, and at Quombo Creek and the Upper Bulolo River near Wau.

CLAY

Clays suitable for brickwork and rough pottery are abundant in the Tertiary and Recent sedimentary deposits, and these are to be found throughout the Madang and Sepik Districts, in the Bulolo, Watut, Waria, and Upper Ramu Valleys as well as on the Islands of New Britain and New Ireland. No bricks have been manufactured, and the prevalence of earthquakes in many areas in New Guinea would limit the use of bricks in construction work.

BAUXITE

During 1952 samples containing a high percentage of available alumina were found in three places on Manus Island, by J.E. Thompson, Senior Geologist, during a geological investigation specifically directed towards the search for bauxite. Further testing of the deposits will be carried out.

PHOSPHATE ROCK

Deposits of phosphate rock, estimated to contain at least 80,000 tons, occur on the islands of Wuvulu, Aua, and Manu, about 285 miles west of Lorengau on Manus Island, in the Admiralty Group. Also on the Purdy Islands, approximately 95 miles south-west of Lorengau, deposits occur with estimated reserves of 27,000 tons of phosphate rock containing 22 to 26 per cent. tricalcium phosphate.

Bat guano occurs in caves in many parts of New Guinea. It has been estimated that the Kaut caves on the western side of New Ireland contain 5,000 to 10,000 tons of guano.

COAL

Seams of lignitic coal up to two feet thick have been found in upper Miocene strata at Matakan Plantation, west coast of New Ireland, and on the Toriu River, west coast of Gazelle Peninsula, New Britain, south of Pondo. Proximate analyses are given below.

	Fixed Carbon	Volatile Hydro-Carbons	Moisture	Ash	Sulphur	Total
Toriu River	27.06	33.47	20.06	13.39	5.82	100.0
Matakan	27.02	35.94	21.15	12.15	12.50	100.0

PETROLEUM

An outline of the history of the search for oil in New Guinea and Papua has been given in Part I, dealing with the Mineral Deposits and Mining Industry of Papua. For more than ten years before World War II, Oil Search Limited, and later the Australasian Petroleum Company, were engaged on geological mapping, supplemented later by aerial photography, in the Sepik district, between the Sepik River and the sea, and Island Exploration Limited mapped considerable areas in the Madang district between the coast and the Ramu River. A well-defined dome structure was found near Maimai, 42 miles south of Aitape, and several other anticlinal axes were mapped in adjacent areas. Subsequent detailed field work on the Maimai area revealed discouraging features and the search for oil in the Territory of New Guinea was relegated to second place pending the testing by drilling of more favourable structures in Papua. After the war Australasian Petroleum Company carried out further geological mapping of anticlinal areas south-west of Aitape, but the permit areas were abandoned during 1950.

REFERENCES

Fisher, N.H., 1939a - Ore Geology of the Day Dawn Mine: Econ. Geol. 34, 2, p. 173.

_____ , 1939b - Metasomatiam Associated with Tertiary Mineralization in New Guinea: Econ. Geol. 34, 8, p.890.

_____ , 1945 - The Fineness of Gold, with Special Reference to the Morobe Goldfield, New Guinea: Econ. Geol. 40, 7, p. 449.

Fisher, N.H. and Noakes, L.C., 1942 - Geological Reports on New Britain. Geol. Bull. N.Guinea, 3.

The following unpublished reports were prepared by members of the Geological Survey Section of the Department of Lands and Mines, Territory of New Guinea, before 1942. Copies of these reports are held at the Canberra office of the Bureau of Mineral Resources, Geology and Geophysics. Those marked * were duplicated and received a limited distribution at the time of preparation.

By N.H. Fisher - Report on the Day Dawn South Lode
" " " Day Dawn Mine
" " " Enterprise Mine
" " " Mt. Kaindi Lode
" " " Upper Ridges Lode
" " " Andersons Creek Lode
" " " Lower Edie Area
" " " Sandy Creek Area *
" " " Upper Langimar-Kareeba area *
" " " Area between Wau and Garaina, Waria River. *
" " " Gold Discovery at Wongonbungor Creek, Wampit River. *
" " " Benembi Plateau, Mt. Hagen. *
" " " Gold-bearing area of the Wewak district.

REFERENCES (contd.)

By N.H. Fisher - Report on the Talele Goldfield New Britain
" " " Kupei Goldfield, Bougainville

By L.C. Noakes - Report on the Upper Bitoi-Black Cat area, including notes on the area between Wau and Salamaua. ✱

Report on the Upper Watut Area.

Report on the Chimbu-Hagan Area. ✱
Report on the Edie and Karuka Lodes.

TABLE III

ESTIMATED GOLD AND SILVER PRODUCTION

TERRITORY OF NEW GUINEA

All Quantities in Fine Oz.

Year Ending June 30th	MOROBE		GOLDFIELD		CENTRAL HIGHLANDS (Mt. Hagen) x		SEPIK		KIETA		NEW IRELAND		NEW BRITAIN		TOTAL PRODUCTION				Total Value
	Gold		Silver		Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Value £A	Silver	Value	
Prior to Dec. 1926	23,000		11,000												23,000	100,000	11,000	1,500	101,500
Jan. 1927 to June																			
1928	100,365		92,640												100,365	426,552	92,640	10,191	436,743
1929	44,277		34,500												44,277	188,176	34,500	2,587	190,763
1930	30,254		22,800												30,254	128,580	22,800	1,710	130,290
1931	29,858		19,800												29,858	154,046	19,800	1,485	155,531
1932	63,485		36,000												63,485	434,352	36,000	2,710	437,062
1933	121,913		54,150												121,913	925,899	54,150	5,690	931,589
1934	164,381		78,636												164,381	1,345,802	78,636	7,969	1,353,771
1935	195,602		86,876		27	9	710	58	45	2.2	105	17.7	8.65	.7	196,498	1,738,561	86,964	12,742	1,751,303
1936	189,527		94,274				1,056	87	113	5.6	22	3.7	8.65	.7	190,727	1,668,464	94,371	11,930	1,680,394
1937	216,096		123,286				6,097	500	598	29.7	25	4.2	-	-	222,816	1,961,125	123,820	13,572	1,974,697
1938	212,795		171,188		485	159	10,109	829	487	24.2	4	.7	-	-	223,880	1,952,344	172,201	18,040	1,970,384
1939	229,213		147,277		302	99	7,871	645	297	14.8	22	3.7	-	-	237,705	2,193,438	148,040	15,982	2,209,420
1940	271,575		194,585		435	143	6,589	540	217	10.8	124	21	-	-	278,940	2,954,199	195,300	23,306	2,977,505
1941	256,035		183,818		747	245	6,238	512	32	1.6	45	7.6	-	-	263,096	2,808,833	184,584	21,965	2,830,798
1942 ♯	90,192		57,351		66	22	1,541	240	-	-	-	-	-	-	91,799	982,250	57,613	6,079	988,329
1947	18,002		12,457		457	150	-	-	-	-	-	-	-	-	18,459	198,664	12,607	2,921	201,585
1948	81,245		56,222		1,183	388	424	34							82,852	899,444	56,644	13,311	912,755
1949	89,764		62,117		451	148	915	74	166	8					91,296	982,572	62,347	14,392	996,964
1950	83,344		57,674		735	241	753	61	126	6					84,958	1,210,275	57,982	17,938	1,228,213
1951	86,676		59,980		617	202	205	17	95	5					87,593	1,356,962	60,204	22,576	1,379,538
TOTAL	2,597,598		1,656,631		5,506	1,807	42,507	3,597	2,176	108	347	59	17.3	1.4	2,648,151	24,610,539	1,662,203	228,596	24,839,135
TOTAL VALUE EACH DISTRICT																			
	24,116,032		227,754		62,034	386	407,566	432	21,376	16	3,379	8	152	.2					

♯ Production ceased in January 1942 and figures are available only for July - November, 1941.

x Rec orded under District of Madang up to 1942.

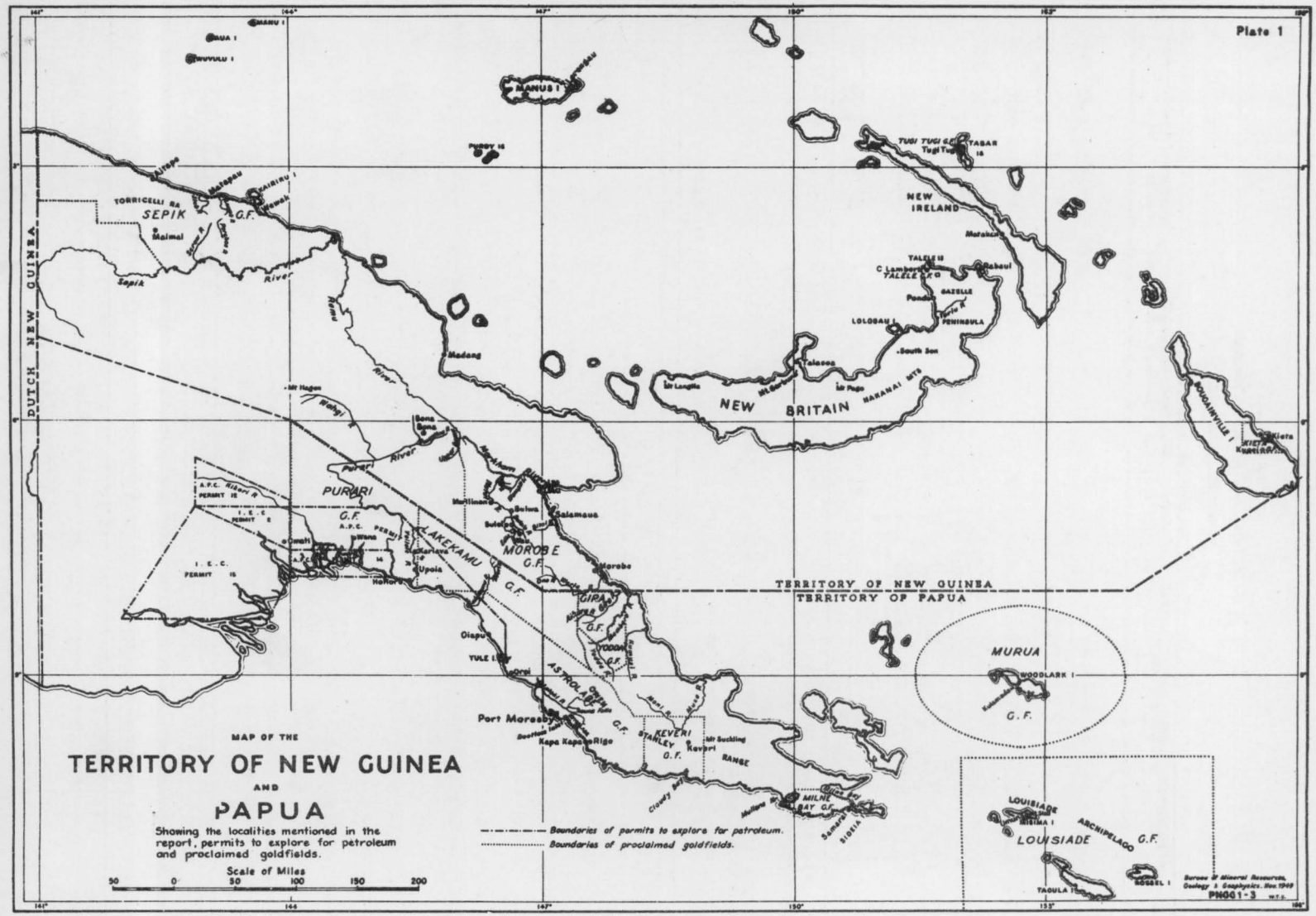
Plate 1
MANUS I
NEW IRELAND
NEW BRITAIN
DUTCH NEW GUINEA
SEPIK
PURARI
MOROBE
GIRA
KEVERI
MURUA
TERRITORY OF NEW GUINEA
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Port Moresby
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Rigo
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Buka I
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Woodlark I
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MAP OF THE
TERRITORY OF NEW GUINEA
AND
PAPUA
Showing the localities mentioned in the report, permits to explore for petroleum and proclaimed goldfields.
Scale of Miles
50 0 50 100 150 200
Boundaries of permits to explore for petroleum.
Boundaries of proclaimed goldfields.
Bureau of Mineral Resources, Geology & Geophysics. Nov. 1949
PNG61-3