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REPORTS OF THE EDIE CREEK AND KARUKA MINES (N. G. G. LTD.)

EDIE CREEK

TERRITORY OF PAPUA - NEW GUINEA

by

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REPORT ON EDIE CREEK MINE

N. G. G. LTD

(Incomplete)

by

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(Written 1941 but part of manuscript destroyed by enemy action 1942)

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1. INTRODUCTION :

The report is intended as a detailed account of the geology and mineralogy of the Edie Creek Mine at Edie Creek in the District of Morobe, and incorporates with the work of the writer geological data obtained from the plans and reports of previous workers.

At the Edie Creek Mine, New Guinea Goldfields Ltd. have developed and mined a lode system comprising four principal lodes occupying parallel shears. Three of these, Nos. 1, 2, and 5 are contiguously exposed in the main workings of the mine, while Karuka lode lies about .4 Kms. (¼ mile) to the north east and may be regarded as a separate mine connected by a long haulage cross-cut with the main mine shaft up which ore from all lodes is hauled to the surface. For the purpose of clarity lodes No. 1, 2 and 5 exposed in the main mine are described in this report and Karuka lode reserved for separate treatment.

The field work and drafting were carried out in conjunction with other Survey duties over a period of six months from August, 1940 to January, 1941, the writer spending about 8 weeks in all at the Edie Creek Mine.

A. Location

The Edie Creek Mine lies at an altitude of approximately 2,100 metres (7,000 ft.) above sea level towards the head of the Edie Valley, about 7 Kms. (4.3 miles) south-south-west of Wau in the District of Morobe.

The milling plant and mine offices are situated on a prominent spur dividing Edie Creek from the headwaters of Slate Creek, a tributary of the Edie system. The property is connected by a steep mountain road about 16 Kms. (10 miles) long with Wau, where cargo flown from the port of Salamaua or Lae is transferred to motor trucks.

B. Climate

The climate is temperate to cold, with high rainfall and frequent wind. Mornings are usually clear and warm, afternoons generally overcast with rain and nights are invariably cold. The average annual rainfall, taken over ten years is 105 inches and falls mainly between November and April with December and March the wettest months and June the driest month in the year.

During the wetter season falls of rain cause considerable damage to roads and mine workings. High winds are frequent, although more prevalent during the wetter season, and usually come from a northerly direction.

C. Transport and Costs

Transport of food and equipment to Edie Creek is costly since it involves both aerial and motor transport. At present freight rates, transport from Salamaua to Edie Creek costs £23. 6. 8d. per ton - £21 per ton by air to Wau and £2. 6. 8d. per ton by road to Edie Creek. New Guinea Goldfields Ltd. have reduced costs over the Wau-Edie section by operating a motor service of their own and estimate the total cost of transport from the coast at £20 per ton.

D. Timber

Timber is readily available in the Upper Edie area but is in general of poor quality for mining purposes and does not last long in normal underground workings. Good timber, such as lemon wood, is comparatively scarce and has been largely cut out in the vicinity of the mines. Mining leases have now been denuded of timber for a radius of about 1 mile from the No.4 shaft.

3. PREVIOUS GEOLOGICAL WORK :

Previous geological records of the Edie Creek Mine were compiled by four separate workers - H.M. Kingsbury, Blanchard, G. Hall and J. McDonald - and have been freely used by the writer in compiling both plans and report.

H.M. Kingsbury, as geologist to New Guinea Goldfields Ltd. from 1930 to 1934 carried out extensive preliminary surveys at Edie Creek and compiled surface and underground plans which have remained the basis for geological work in the Edie Mine and in the Upper Edie area.

In 1931, H.M. Kingsbury sent representative specimens of the rocks and ores exposed in the mine at that time to J.D. Donnay of Stanford University, California, who made a microscopic examination of the specimens and compiled a report on his work. This report was made available by the Company and has formed the basis of petrological work in the area.

In 1934 Roland Blanchard, Chief Geologist at Mount Isa Mines Ltd., Qld., Australia, inspected the Edie Creek Mine and reported on sampling and ore values but carried out no detailed geological work on the property.

In April 1938, G. Hall, a geologist attached to the same mining company, visited the mine for some weeks and compiled a geological report and a set of geologic plans and sections based on a more comprehensive system of block numbering than that previously employed. The earlier work of Kingsbury was fully utilised in this compilation which brought geological work at the mine up to date to April, 1938. Unfortunately the time available was not sufficient for detailed work and the geological atlas was not completed.

In 1938 J. McDonald commenced duty as geologist to New Guinea Goldfields and subsequently carried out further geological mapping at the mine until his transfer to administrative work caused geological mapping to lapse.

The scope of the present work was, then, to complete all geological mapping in the mine, to compile a new and somewhat more detailed mine atlas and collect sufficient data for a detailed report on the property.

4. GENERAL GEOLOGY

The essential geological features of the Edie Creek area are a basement series of phyllites and schists of probable Palaeozoic age and small intrusions of late Tertiary prophyry with which lode mineralisation is associated.

The Edie Creek Mine lies mainly in the metamorphics of the Kaindi series but exposes a body of quartz biotite porphyry in the more easterly workings. The lodes exposed in the mine occupy a series of well defined shears which traverse both metamorphic and igneous rocks.

A. The Kaindi Series

The Kaindi series is essentially composed of dark coloured slates and phyllites and, in the Upper Edie area is represented by biotite phyllite and chloratoid schist. The Series was deposited under geosynclinal conditions, perhaps in late Palaeozoic time, and was subsequently folded and regionally metamorphosed. It was intruded by granodiorite in Pre-Tertiary time and later by a suite of acid hypabyssal rocks injected at intervals over a long period extending from about Miocene time to the end of the Tertiary epoch.

The older granite intrusions are not represented in the Edie Creek area, although the eastern boundary of the Ekuti Ranges batholity lies only 4 Kms. (2½ miles) to the south or west.

The Kaindi Series was originally composed of predominantly fine sediments and usually shows little variation over wide areas. The degree of metamorphism is not high and is almost entirely regional in character, contingent on compression and folding. In the vicinity of the Edie Creek mine the metamorphics show no alteration attributable to the neighbouring granitic intrusion and little more than silicification around the margin of the Late Tertiary biotite porphyry.

A significant and unusual variation in the metamorphics is found in an irregular belt of light coloured chloritoid schist which runs in a north-westerly direction across the head of Edie Creek. The belt has not been mapped in detail, but extends for some 3.5 Kms. (a little over 2 miles) with a very irregular eastern boundary against phyllite and porphyry. Both metamorphic types are exposed in the Edie Creek mine and are regarded as comformable phases of the same series.

(1) Biotite Phyllite.

Biotite phyllites are widely developed in the Upper Edie area and are characteristic of the Kaindi Series as a whole. The rock is usually blue-black in colour, shows slaty cleavage, and in some places marked schistosity, while original bedding is usually obscured. On the surface, the phyllite is always softened to some degree but is usually easily recognised. With complete weathering it passes to a fine clay, usually yellow or reddish in colour from iron staining.

Schistosity shows no fixed relationship to bedding, although the angle between the two planes is usually small, and where the bedding and schistosity are parallel, as on No.5 Level near No.4 shaft, schistosity dips in the same direction but at a lower angle.

In this section, the biotite phyllite shows biotite, quartz and felspar with minor quantities of muscovite, chlorite, magnetite and rutile. The rock shows pronounced directional structures mainly the parallel orientation of elongated biotite and chlorite crystals, and, in places, a degree of foliation, probably consequent on original stratification, in which dark biotite-rich bands alternate with bands composed of colourless quartz and felspar. Large quartz crystals have invariably suffered crushing and recrystallisation, and augen structure is commonly developed. The phyllite has probably been derived from a shale and is a product of regional metamorphism in which the degree of alteration has not been high. Biotite is the only prominent new mineral and the rock has not suffered complete recrystallisation, although much of the quartz and felspar has recrystallised in small grains. The felspars could not be determined although Donnay, in his examination of specimens of the phyllite, found unaltered grains of sodic andesine.

At or near the porphyry contact, no significant change beyond silification has been noted in the phyllite. Detailed petrological work has not been carried out, but one specimen, taken within 1 metre (3 feet) of the porphyry contact on No. 5 Level showed no new features in thin section beyond minute veinlets of quartz and additional silica in the rock.

At the Edie Creek mine, phyllite is not exposed on the surface but appears in the lower workings of the mine, on the 450 level and below. Shattered phyllite is found above this level on the footwall of the No.4 fault but owes its isolated position to faulting and is nowhere known to be thick. On the 450 level, and below. ~~Shattered phyllite is found above this level on the footwall of the No.4 fault but owes its isolated position to faulting and is nowhere known to be thick.~~ On the 450 level, the main drive east of No.4 shaft lies in phyllite for some 180 metres (600 feet) when it passes from phyllite into porphyry. Discernable structure here indicates a south-west to westerly strike and a gentle southerly dip of 10-20.

On the No.5 Level, 27 metres (90 feet) below, phyllites are exposed over 180 metres (600 feet) of the main drive east of No.4 shaft to the porphyry-phyllite contact, and in the long crosscuts running south from the drive. The actual contact of phyllite with porphyry is well exposed at the western end of the exploration drive south of the main drive in block P.Q.30. In these exposures the phyllite strikes from west to a little north of west and dips consistently to the south at angles usually between 10 and 20 degrees and rarely exceeding 30 degrees. In the haulage crosscut running north from No.4 Shaft to the Karuka mine, three blocks of phyllite are exposed, faulted into the chloritoid schist through which the crosscut is mainly driven. The phyllite here strikes consistently west or west by south, and dips south irregularly at angles varying from 5 to 70. No phyllite is exposed in the Karuka workings.

(2) Chloritid Schist

The chloritoid schist, when fresh, is a grey fine grained rock, often with a greenish tinge, and frequently appears massive rather than schistose. The rock is usually well jointed and commonly shows no trace of original structures. Porphyroblasts of white felspar can often be seen with the naked eye, occasionally producing a distinct porphyritic effect. The rock weathers very readily and, once exposed, softens and crumbles in a few months. Consequently, the chloritoid schist outcrops on the surface and extends downwards for 6 metres (20 feet) or more as a fine red clay in which original veinlets of quartz remain insitu. On this account, the rock was first termed a mudstone before its metamorphic origin was appreciated, and has been locally known as 'mudstone' ever since.

The chloritoid schist is exposed in all the upper levels of the main mine, in the haulage crosscut from No.4 Shaft to Karuka and in the Karuka mine itself. Above No.4 Level in the main mine the schist is strongly weathered to a light brown clayey rock, softened and more or less friable and frequently showing prominent weathered felspars. In the haulage crosscut to Karuka, the schist is comparatively fresh and shows more structure than is found in other exposures. The strike is a little south of west, conforming with that of the phyllite, and dips are consistently to the south, varying from 30 to 70 degrees and averaging about 50 degrees. In Karuka mine the chloritoid schist is typically massive and strongly jointed, with structure rarely discernable. On the No.1 Level Karuka however, the schist was observed striking south of west and dipping to the south in conformity with exposures in the haulage crosscut from the main mine.

In the past, the rock has been known technically as a chloritoid schist from the work of Donnay who considered that the rock was originally a normal phyllite and had been altered to chloritoid schist by hydrothermal metamorphism following the intrusion of the porphyries. Donnay had no opportunity to study the field occurrence of the chloritoid schist, and, in any case, exposures in 1931 were very shallow and possibly misleading.

The Kuruka mine and the haulage crosscut running south to No.4 Shaft provide the best exposures of this rock and thin sections were made by the writer from representative specimens from both mine and crosscut. In the light of field occurrence these do not confirm the hydrothermal hypothesis so long accepted but, in the writer's opinion indicate that alteration has been of a regional or dynamothermal character.

In thin section the "mudstone" is seen to consist of felspar, chloritoid and quartz with subsidiary biotite, muscovite and magnetite. The rock shows definite schistosity with a parallel orientation of chloritoid and biotite crystals although this is not so pronounced as in the phyllite, and most sections show no foliation.

Re-crystallisation of the whole rock is well advanced, although the actual grade of metamorphism is again not high. The most prominent secondary mineral is greenish chloritoid forming in acicular crystals, flakes and grains. Albite also appears to be secondary and frequently forms large porphyroblastic crystals around which augen structures have developed. Quartz has been re-crystallised but is present in smaller quantities than in the phyllite. The production of biotite has been delayed and only a little can be found.

The rock is determined as chloritoid schist and a natural product of regional metamorphism. Chloritoid is a typical stress mineral and would readily form under regional metamorphism where the original sediments provided a suitable chemical environment. Furthermore, no minerological features indicative of hydrothermal rather than regional metamorphism were observed in any of the microsections examined.

The field occurrence of the chloritoid schist does not support the theory that it is a hydrothermally altered phase of the normal phyllite. In the first place, phyllite is found at the contact of the biotite porphyry, both in the Edie Creek mine and on the surface in other parts of the Upper Edie area, and shows no change beyond induration - not even the development of low-grade aluminous silicates such as andalusite which frequently occurs in phyllites within the contact aureole of the granite or the Lower Edie porphyry. This restricted contact alteration appears natural with the intrusion of a small igneous body at no great depth beneath the surface and hence a hypothesis involving marked hydrothermal alteration of the phyllites in some places, even extending hundreds of feet from the actual contact, and little or no alteration at other points on the contact itself needs considerable explanation.

In the second place, all the known contacts between the two metamorphic phases are sharp and show faulting, with no gradation from phyllite into chloritoid schist.

The chloritoid schist is therefore regarded as developing with the phyllite under the same environment of dynamothermal metamorphism from sediments which differed from those now converted to phyllite and slate. These original sediments were presumably a conformable phase of the Kaindi Series, and, judging by the metamorphic product, may have been acid intermediate or intermediate tuffs.

B. QUARTZ-BIOTITE PORPHYRY

The porphyry intrusion forms a roughly heart-shaped outcrop about 1 km. long (.6 miles) and 1 km. wide in the widest part. The Upper Edie Creek traverses the centre of the intrusion in which it has cut a narrow gorge. Nos. 2, 3, 5, and Karuka Lode lie close to its western margin and No.1 Lode occurs within the intrusion itself.

In the main mine the south-western margin of the porphyry dipping steeply to the south-west, is exposed mainly on No.3, 450 and 5 Levels. No.3 Level main-drive exposes some 335 metres (1100 ft.) of porphyry at the eastern end between the portal and the porphyry schist contact. The main drive on the 450 and 5 Levels both expose about 410 metres (1350') of porphyry at the eastern end of the mine. The northern edge of a small body of porphyry, possibly an isolated lense is exposed on the 450 level in the south wall of the main drive in Blocks M and N, and extends for a little over 60 metres (200') along the drive.

The intrusion is a quartz-biotite porphyry and in hand specimen shows large phenocrysts of quartz, replaced biotite and some felspar in a fine greyish white ground mass. The biotite phenocrysts have been almost completely psuedomorphed by anauxite, a light brown mineral with a silvery sheen identified in thin section by Donnay. Anauxite is a little known aluminous silicates and is, according to Donnay, the product of alteration by late deutric solutions released by the porphyry. Further evidence of deuteric alterations is seen in sericitisation of the felspars and the production of leucoxene from hornblende. The porphyry weathers fairly readily to a fine, usually iron-stained, clay which is difficult to distinguish from weathered chloritoid schist unless residual quartz phenocrysts remain scattered through the clay.

In structure, the intrusion dips steeply, is discordant and is either a stock or a steeply inclined irregular sill. Portion of the south-western margin of the intrusion is exposed in the Edie Creek Mine and dips to the south-west at about 75 degrees.

C. STRUCTURAL GEOLOGY

At least two periods of structural deformation are recorded in the area - an earlier Pre-Tertiary folding epoch and a later period of faulting and uplift in Tertiary time. Structures contingent on Pre-Tertiary diastrophism are limited to the Kaindi series and their influence on mineralisation has been regional rather than local. Tertiary deformation on the other hand has been responsible for a system of fracturing condusive to lode formation.

(1) Folding

During Pre-Tertiary diastrophism, the Kaindi series was not closely folded but developed broad anticlines and synclines with minor cumpling and drag folding on the limbs of folds. These broad structures have been largely obscured in the Upper Edie area, partly by tilting induced by the major granitic intrusions but mainly by continued faulting, shearing and intrusion during Tertiary time. Consequently, it is impossible to reconstruct the pattern of Pre-Tertiary folding with any degree of accuracy.

In the Edie Creek mine, the phyllite and chlorotoid schist, wherever structure is descernable, strike east and west or a little south of west and dip consistently to the south at moderate angles, suggesting the southern limb of a broad westerly trending anticline. Minor folds are shown in the south crosscut from No.4 Shaft on the No.5 Level (See Plan No.5 Level, Block 56) but are only local features. The chlorotoid schist overlies the phyllite in the main mine and was presumably a conformable phase of the folded series, overlying phyllite before major misplacements occurred in Tertiary time.

The relation between the older and the younger structures is obscure, although the trend of Tertiary fracturing conforms fairly closely to that of the older Pre-Tertiary folds and was presumably influenced by them.

(2) Faulting

During Pre-Tertiary diastrophism, faulting in the Kaindi series was apparently limited to small overthrusts developed in the folds and played a minor part in deformation. Tertiary diastrophism, on the other hand, produced little or no folding in the Upper Edie area but was responsible for a fault system to which all the significant fractures belong. The intrusion of small bodies of magna caused tilting and deformation close to their contracts and were doubtless responsible for some shearing and fracturing as well, although there is clear evidence particularly in the Edie Creek mine, that the major fractures in which ore-bodies have subsequently formed belong to a system of shears induced by regional stresses subsequent to the latest Tertiary intrusion, which in the Upper Edie area appears to have taken place about the end of Tertiary time,

The major fractures lie in a belt or zone trending roughly north-westerly for some 4 kms. (2½ miles) from the head of Bartlett's Creek in the south-east across the head of Edie Creek to at least the Watut-Bulolo Divide. The zone includes upwards of a dozen significant faults each extending 1000 feet (330 metres) or more which are bunched toward the north-western end of the zone to form a pattern of overlapping fissures. One major fracture, the Edie Fault, has been traced by H.M. Kingsbury for nearly 3½ kms.(2¼ miles) with a possible extension of another 1 km.(1/3 mile) at its south-eastern end. It has been traced from near the head of Bartlett's Creek north-west to Edie Creek and downstream in a north north-westerly direction to the Slate Creek junction. The Edie Fault trends a little north of north-west, so cutting across the general strike of the smaller fractures, and is probably an older more powerful fault.

Along the principle fractures faulting took place at intervals over a considerable period, both before and after lode-formation, and as a result of these recurring movements, the sequence of faulting in the Upper Edie area is difficult to determine. Most of the fissures show clear evidence of displacement on more than one occasion. Many show normal displacement on the hanging-wall side, but evidence of horizontal movement as well, so that the major movements appear to have been shears with horizontal and vertical components. The nature of movements subsequent to the major ones is not known but there is evidence of only small displacements and most of them appear normal in character.

A feature of the faults where they traverse porphyry or chlorotoid schist is the frequent occurrence of sheared phyllite along the fault zone indicative in most cases of considerable downward displacement. This is most noticeable in the case of the Edie Fault where it converges on Edie Creek near the portion of No. 3 Level in Block 57. The Fault can be traced from phyllite into porphyry, with little horizontal displacement of the porphyry contact, and continues through the intrusion as a band of sheared phyllite, bearing numerous small fault planes, up to 6 metres (20 feet) in width.

Similar bands of sheared phyllite are found along sections of No.1 Lode within the body of the porphyry on the 450 and 5 Levels, Blocks 56 and 57. Phyllite is found along No.4 Fault where it traverses chlorotoid schists in Blocks 45 and 56 and fragments of phyllite are found in the Karuka Lode fissure in Block 25.

The general sequence of intrusion, faulting and lode formation in the vicinity of the Edie Creek Mine appears as follows :-

After the intrusion and solidification of the quartz biotite porphyry the powerful Upper Edie Fault was established and followed by the system of smaller fractures in which lodes are now found. A series of movements took place along these fractures and in places disjointed them before mineralisation commenced. Movement continued sporadically after the formation of the lodes but mineralisation apparently marked the end of major fault displacement. Subsequent Faulting produced only small displacements along the main lode channels and a few additional cross fractures.

5. <u>ORE GEOLOGY</u>

A. <u>Mapping</u> :

An atlas of geological plans and sections has been compiled to accompany the report and embraces all known workings up to March, 1941. The improved system of Block Numbering and Lettering as laid down by Graham Hall in 1938 has been adopted as standard reference. In this system (See Title Sheet of Atlas) an area embracing all the known lode outcrops is divided into Blocks measuring 1000 feet by 800 feet (300 x 240 metres) by co-ordinance based on magnetic meridium and measured from an adopted origin. The Blocks, numbered 1 to 130, are divided into 100 ft. (30 metres) square which are lettered horizontally and numbered vertically. All horizontal and vertical lines are treated as co-ordinates north, south, east or west of the adopted origin.

Underground workings in the main Edie mine impinge on five blocks, Nos. 45, 46, 47, 56 and 57, but to reduce the number of plans required Blocks 56 and 57 were originally moved 400 feet to the north to embrace portions of the workings impinging on Blocks 46 and 47, reducing the number of blocks involved to 3, 45, 56 and 57. The plans and cross-sections have been compiled on a scale of 30' to 1" to conform with standard practice at the Edie Creek mine; a plan for each of the three blocks on each main level of the mine, with cross-sections at approximately 100' levels. Separate longitudinal sections for each block have been dispensed with in favour of two longitudinal sections of the whole mine, on the scale of 100' to 1", showing the distribution of gold and silver values in the various lodes. Types of hachuring have been used to denote the various rock types in the mine and are the same for all plans and sections. A system of stippling has also been introduced in plans and sections of the lodes to show the tenor of the ore. Four grades are shown, less than .25 ounces gold per ton (sub-commercial) .25 - .5 ozs. per ton, .5 - 1.0 ozs. per ton and over 1 ounce.

For the purpose of administration records a separate atlas will be made by reducing all plans and cross-sections to the standard metric scale of 1/500 used for underground work. The system of block numbering and lettering will be retained and reduced accordingly.

B. Nature of the Lodes :

(1) No. 1 Lode : No.1 Lode lies entirely within the biotite porphyry and outcrops on the surface on Block 57, striking approximately north-west south-east and dipping steeply to the south. The lode averages about 1.25 metres (4 ft.) in width and is predominately of the quartz-manganese oxide type grading in places into quartz-calcite ore carrying sulphide minerals.

On the surface, No.1 Lode is exposed by costeans and fill-rises for approximately 214 metres (700 ft.) from Block Ae 34 where the lode terminates against No.1 Fault, to Block V 29 where No.4 Fault probably cut off the lode channel. The ore is weathered and composed of soft black pulverulant manganese oxides with quartz in crystals and small stringers. The records of values on the surface are very incomplete but grade appears to have been high, particularly in the vicinity of No.1 Shaft. The lode dips to the south towards the ends of the outcrop but dips steeply to the north in the central portion in a buckle possibly due to pre-lode faulting. In this section the lode becomes vertical in depth and assumes a southerly dip some 13 to 16 metres (40 to 50 ft.) above No.3 Level (See sections 3 and 4 Block 57).

On the eastern end of the No.3 Level in Block 57 No.1 Lode is exposed in the main drive for a distance of 275 metres (900 ft.) in from the portal, dipping south at an average angle of 65 degrees. The ore is composed of partly banded manganese oxide with quartz stringers and quartz lined vughs and an irregular iron oxide content. The ore contains more blocky soliceous material west of No.1 Shaft and passes gradually into iron-stained quartz with little manganese content and finally into quartz-calcite ore about 26 metres (80 ft.) from the western termination of the lode against No.4 Fault. Values in the quartz-manganese ore are high, particularly toward the western end, and some 85 metres (280 feet) of the drive passed through ore averaging over 1 ounce gold per ton. Values in the last 25 metres (80 ft.) of calcite ore are considerably lower and average between five and ten dwts. per ton.

At its eastern extremity the lode terminates against No.1 Fault in ZA 34 and the continuation has been found and explored on both sides of Edie Creek. On the western side of the Creek an adit, now collapsed, revealed 21 metres (70 ft.) of low-grade ore, about 12" wide, cut off on the western end by No.1 Fault. Across the Creek to the west the continuation of No.1 Lode was followed in a Drive for 63 metres (210 ft.) when old stream-gravels were encountered. The ore consisted of quartz and manganese oxide but was only 2 ft. wide and carried poor values averaging less than 5 dwts. gold per ton.

Below No.3 Level, No.1 Lode dips fairly evenly to the 450 Level, pinching out below the 3 Level in Block U29 and disturbed by faulting in T29.On the 450 Level the lode is exposed for 400 metres

(1300 ft.) from P29 in Block 56 where the lode terminates on No.4 Fault to Z34 in Block 57 where No.1 Fault is encountered. The average dip of the lode is 50 to 55 degrees to the south, becoming steeper at the western end and somewhat flatter, 40 to 45 degrees, in the central section just west of No.1 Shaft.

The Lode is calcitic for 122 metres (400 feet) at the western end and grades into iron stained quartzose ore in T.29 Block 56. Manganese content increases to the east, with quartz and iron content decreasing, and the lode is composed of partly banded manganese oxides with quartz stringers east of V.30.

The calcitic ore carries low values and is largely of sub-commercial grade, but good values are found in the siliceous ore in T.29, particularly associated with sugary quartz, but east of V.30 as far as the cross-cut to No.1 Shaft the lode narrows and values decline. East of No.1 Shaft, in soft, partly banded manganese oxide, values are consistently above .5 ozs. gold per ton. The main drive has been driven some 15 metres (50 feet) beyond the end of No.1 Lode along the hanging-wall of No.1 Fault but the continuation of the lode has not been exposed.

On the No.5 Level, No.1 Lode is exposed in three distinct sections for over 330 metres (1000 ft.). The lode lies entirely in porphyry but has two narrow bands of phyllite along the foot-wall toward the western end. At the western end, 122 metres (400 feet) of massive calcite ore dipping 60-65 degrees to the south are exposed in the main drive between O.29 Block 56 and S.30 Block 57. The lode channel then becomes very weak and to the east is unmineralised for about 21 metres (70 ft.). Soft manganese ore appears in T.31 and the lode continues to the west with a dip 50-55 degrees for over 122 metres (400 ft.) until intersected by No.1 Fault in W.33. 33 metres (100 ft.) east of No.1 Fault, the quartz manganese lode material grades into calcitic ore which persists to the fault. The main drive continues beyond the No.1 Fault zone and exposes a little over 66 metres (200 ft.) of quartz manganese ore, dipping steeply south, in the displaced leg of No.1 Lode first encountered in X.33. This section of the Lode was not followed to its eastern limit on account of sub-commercial width and grade.

The best values on the Level lie in the 100 metre (330 ft.) of manganese ore between T.31 and W.32 where the ore is practically all of commercial grade and averages over .5 ozs. per ton for 50-60 metres (over 160 ft.). The small block of calcite ore near the No.1 Fault carries very much lower values and is largely of sub-commercial grade, while the quartz-manganese ore in the continuation east of the fault is quite uncommercial. In the calcite section at the western end of the Lode commercial values are limited to a shoot some 66 metres (200 ft.) long in PQ 30 and outside this the ore carries a lower sulphide content and averages under 5 dwts. per ton. No.1 Lode has not been exposed below No.5 Level by either drill holes or winzes.

The manganese section of the Lode has been completely oxidised, even on the No.5 Level, (see longitudinal section) while the calcitic section of the Lode is mainly in a state of partial oxidation and the only true sulphide ore in the mine is found in this section, particularly on and above No.5 Level in PQR.30, Block 56.

(2) <u>No.1a Lode</u> : 1a Lode has only been exposed on and just below the No.3 Level in RS.29 Blocks 56 & 57 and consists of calcitic ore filling a displaced segment of No.1 Lode fissure.

The lode outcrops for 40 metres (140 ft.) on the No.3 Level, terminating east and west against No.4 Fault, but does not extend far above or below. The lode carries ore averaging between 5 dwts. and 10 dwts. gold per ton and has been partly worked in stopes above the 450 Level.

(3) <u>No.2 Lode</u> : No.2 Lode has been the principle producer in the Edie Creek Mine and has been almost entirely worked out above No.4 Level. The lode consists of quartz manganese ore, varying in width

but averaging 1.5 metres (5 ft.) throughout. The lode strikes east and west, dips steeply to the south and lies almost entirely within the chlorotoid schist. Commercial ore is limited in the west by No.4 Fault and in the east the lode channel dies out after encountering the biotite porphyry. West of No.4 shaft No.2 Lode is limited in depth by No.4 Fault but east of the shaft the lode has not been explored below the 450 Level and may die out before No.4 Fault is encountered below No.5 Level.

On the surface, No.2 Lode can be traced in costeans and rises for approximately 460 metres (1500 ft.) from B.25 in Block 45, where the lode is intersected by No.4 Fault, eastward to O.30 in Block 56 where the lode fissure dies out. The western extension of the lode beyond No.4 Fault has been picked up on the surface and on the No.2 Level west but has not been developed. The lode outcrops strongly in Block 45 and in the western portion of Block 56 but in M.27 the outcrop becomes disjointed and the dip flattened due to Hill-Creep. The outcrop has been traced from M.28 to the south-east as far as O.29 where the lode loses width and strength and either dies out or terminates against a leg of No.4 Fault.

The ore throughout consists of weathered black manganese oxide with a varying quartz content in stringers, lenses or irregular blocks. No records were found of gold values in the surface outcrop but they were not as high as those at No.1 Lode outcrop and probably averaged between 5 and 10 dwts. per ton.

On the No.1 intermediate Level east, an adit driven west and lying about 18 metres (60 ft.) below the surface, No.2 Lode is encountered 66 metres (200 ft.) in from the portal in N.29 in badly faulted country adjacent to No.4 Fault. Limbs of the main fault have intersected the lode in several places with little actual displacement to form disjointed segments, one of which is exposed in a cross-cut a few feet north-east of the main lode where it terminates against a fault.

West of this point, No.2 Lode outcrops continuously for nearly 122 metres (400 ft.) to the end of the main drive in K.28, but only averages about 2 feet in width and twice pinches to a mere stringer over the first 70 metres (230 ft.). At the western end, the lode averages over 4 feet in width and has been stoped above the level. The lode fissure dips steeply to the north where first encountered probably due to pre-lode faulting, becomes vertical after about 24 metres (80 ft.) and thereafter dips to the south at 30-35 degrees.

The ore is completely oxidised and mainly composed of manganese oxide, sometimes partly banded with a varying amount of quartz as crystals lining cavities in the ore, as stringers and in places as large irregular blocks and lenses. A little half ounce ore is found at the eastern end of the lode but most of the ore has been extensively leached, particularly toward the western end of the level and averages less than 5 dwts. gold per ton even where the lode is strong.

The No.1 intermediate level west lies about 6 metres (20 ft.) above the level of the intermediate east and was driven west on the lode for 76 metres (250 ft.) from the outcrop in H.28 Block 45. The lode is strong over the entire length of the drive, averaging a little over 1.5 metres (5 ft.) in width, and dips to the south at a high angle near the portal, becoming flatter to the east. The ore is thoroughly oxidised, and comparable with that exposed in the intermediate east, but carries slightly higher values averaging between 5 and 10 dwts. gold per ton. The two intermediate levels have not been connected and the lode is unexposed over the intervening 27 metres (90 ft.)

The No.1 Level, about 33 metres (100 ft.) below the No.1 intermediate Level, extends for approximately 427 metres (1400 ft.) from E.27 in Block 45 east to Q.30 Block 56 and is connected with No.4 Shaft by a cross-cut to the south in J.29. At the western end, No.2 Lode is first exposed in E.27 where a 21 metre (70 ft.) cross-cut from the west portal enters the main drive and thence to the east is exposed continuously in the main drive for 335 metres (1100 ft.) to P.29 where the lode fissure is intersected by No.4 Fault just west of the porphyry contact. An eastern extension of the Lode on the same side of the Fault is exposed in the main drive for 26 metres (85 ft.) but dies out in the biotite porphyry near the eastern portal of the level.

The lode strikes east and west and dips consistently to the south. West of No.4 Shaft dips average about 65 degrees but to the east the lode flattens to 40 to 45 degrees and steepens to 55 degrees at its eastern extremity. At the western end of the Level No.2 Lode continues for some 122 metres (400 ft.) beyong the end of the main drive and is exposed in a short drive in B.25, 12 metres (40 ft.) lower than No.1 Level, where the lode terminates against No.4 Fault. This drive crosses the fault and follows the continuation of No.2 Lode for 24 metres (80 ft.) where development was abandoned.

No.1 Level is no longer accessible but previous geological plans of the level show that the lode persists strongly to within 33 metres (100 ft.) of its eastern limit at No.4 Fault and averages a little over 1.5 metres (5 ft.) in width. Ore exposed in the main drive is thoroughly oxidised and is all of commercial grade. The best values occur in the central portion of the lode in two shoots averaging over ½ ozs. gold per ton - one to the east and one to the west of No.4 Shaft. Toward the western limit of the lode, beyond the main drive the lode probably carries only low values, except in BC.26, and the displaced section of the lode beyond No.4 Fault is recorded as narrow and sub-commercial.

The ore above No.1 Level has been stoped out almost to the intermediate levels above except at the eastern end of the level where the lode is too narrow and the grade too low.

On No.2 Level, about 24 metres (80 ft.) below No.1 Level, No.2 Lode is exposed continuously in the main drive for over 480 metres (1600 ft.) from B.26 Block 45 eastwards to O.29 in Block 56. At the eastern end of the Level the last 122 metres (400 ft.) of the lode are exposed in the main drive and in a second drive lying 2.5 metres (8 ft.) to the south and 3.5 metres (12 ft.) lower which is connected with the surface by a long cross-cut known as the water-race adit.

At the eastern end in Q.29 the lode dies out at the porphyry contact and in the west is cut off by No.4 Fault in B.26. West of this point the displaced leg of No.2 Lode has been exposed in one place in the cross-cut connecting the main drive to the surface. This section of the lode probably extends eastward for about 33 metres (100 ft.) to No.4 Fault but apparently dies out in the west. The average width of the lode is about 1.5 metres (5 ft.) although it pinches almost to a stringer in several places and breaks into three widely separated tongues of ore in CD.27, Block 45. The lode disps south at 65-70 degrees toward both eastern and western limits but dips less steeply just east of No.4 Shaft.

The ore is completely oxidised throughout and consists of manganese dioxides, generally pulverulant, but in places compact, with a varying percentage of quartz in Blocks and small stringers. The lode shows a crude banding of manganese and quartz in places, notably in F.28 west of No.4 Shaft. The continuation of No.2 Lode on the footwall side of No.4 Fault at the western end of the Level carries a slightly higher percentage of quartz, mainly of the granular variety, with iron and manganese staining and strong manganese oxides in places.

The ore is mostly of commercial grade, except where the lode pinches or divides, and has been stoped through to No.1 Level except for a pillar adjacent to No.4 shaft. West of the shaft, the best values lie between ½ and 1 oz. gold per ton and occur in three narrow shoots. East of the shaft the workings are inaccessible but the assay records show values of over ½ oz. gold per ton occurring at short intervals over 90 metres (300 ft.) of the lode.

On No.3 Level, about 18 metres (60 ft.) below No.2 Level, No.2 Lode is exposed continuously for a little over 480 metres (1600 ft.) from C.26 Block 45 eastward to R.29 Block 56. The lode is limited in the west by No.4 Fault and in the east dies out in the quartz biotite porphyry. The main drive was continued for a short distance across No.4 Fault at the western end of the Level but no extension of the Lode was found. The lode strikes east and west in Block 56 and a little north of west in Block 45 with a steep southerly dip of 70-75 degrees throughout.

The average width of the lode is from 3-4 ft., but east of No.4 Shaft it pinches to a 12" vein in K.30, and in QR.30 for a total distance of 91 metres (300 ft.). Excluding these narrow sections where values are below 5 dwts. gold per ton, the ore averages 5-10 dwts. gold per ton but is lower in grade than ore on the No.1 and 2 Levels. Values of ½ to 1 oz. per ton are found in one large and one small shoot west of No.4 Shaft but all stopable ore east of the shaft assays under ½ oz. gold per ton.

Ore on the No.3 Level is completely oxidised at the eastern and western ends but is partially oxidised over the central portion between F.28 Block 45 and O.28 Block 56. The ore is similar to that exposed on No.2 Level and consists of manganese dioxides with the varying quartz content. Quartz occurs both in blocks and in small stringers and attains a maximum of 50% of the ore in P.30 Block 56. Rough banding is developed in places but is not conspicuous. Hematite and limonite occur irregularly throughout the lode but are more noticeable in the completely oxidised sections. Ore on the No.3 Level is somewhat more compact than on the No.2 Level above and shows an increase in the proportion of quartz, while a little unoxidised rhodocrosite was observed just west of No.4 Shaft.

Commercial ore above the No.3 Level has been stoped out except for a shaft pillar but the level has been kept open for drainage, filling and ventilation.

On the No.4 Level, about 21 metres (70 ft.) below No.3 Level, No.2 Lode is exposed for 115 metres (380 ft.) from F.28 Block 45 to No.4 Shaft in I.30 Block 56. The lode continues to the east but No.4 Level has not been driven east of No.4 Shaft. At the western end of the Level the lode is cut off by No.4 Fault, beyond which the drive has not been continued.

The lode strikes a little west of north-west and dips south at 60 degrees near No.4 Shaft and at 80 degrees to the western end of the Level. The average width is 1.5 metres (5 ft.) to within 33 metres (100 ft.) of No.4 Fault, where the lode narrows to the west until 12" wide at the Fault itself.

The lode is partially oxidised throughout, is much more compact than on higher levels and shows an increase in quartz and a decrease in manganese oxide. The ore is usually compacted and consists of large and small blocks of quartz and silicified wall-rock with some quartz-stringers and partial iron and manganese staining throughout. A little unoxidised manganite and rhodocrosite also occur. Faces of massive or partly vuggy quartz are found in places although the ore is usually of a compact rubbly nature. The values are good for about 45 metres (150 ft.) west of No.4 Shaft in a shoot including 21 metres (70 ft.) of ore averaging between ½ and 1 oz. gold per ton, but beyond this point values decline and the ore is sub-commercial. The lode has been stoped out above the level except toward the western extremity where the width decreases.

Below No.4 Level, No.2 Lode is cut off by No.4 Fault which rakes flatly to the east. Two winzes at the western end of the Level proved about 50 ft. of low grade ore before the fault was encountered, but no stoping has been carried out below the Level.

The 450 Level lies 44 metres (134 ft.) below No.3 Level, about 19.5 metres (64 ft.) below No.4 Level and has not been driven west of No.4 Shaft in Block 45. No.2 Lode is exposed for approximately 120 metres (400 ft.) between J.30 and O.30 in Block 56 and lies entirely in phyllite. The western limit of the lode is not exposed, although No.4 Fault is expected to cut it off within 15 metres (50 ft.) of the western end of the main drive. Toward the eastern end the lode is displaced by a fault in W.30 but is exposed again in the cross-cut to No.1 Lode and at the eastern end of the main drive. The eastern limit of the lode is not exposed in the drive but in a short intermediate drive lying 16 metres (53 ft.) above the main drive where the lode pinches to a stringer about 12 metres (40 ft.) west of Rise 126 and practically dies out at the porphyry contact. The lode lies in phyllite except for a lense or tongue of porphyry which forms the hanging wall of the lode for 33 metres (100 ft.) in MN.30.

The lode strikes a little north of west and dips south at 75-80 degrees throughout. For nearly 90 metres (300 ft.) east from the cross-cut to No.4 Shaft the lode averages about 4 ft. in width but farther east it pinches and makes irregularly. The ore is partially oxidised and resembles that exposed on No.4 Level. It is composed mainly of quartz (50 to 80%) within irregular iron and manganese content and with traces of brown rhodocrosite. Values in the lode are patchy but average between 5 and 10 dwts. gold per ton. The western 90 metres (300 ft.) of the lode has been partly stoped above the level but east of M.30 the lode proved too narrow and irregular for economic stoping.

No.2 Lode has not been exposed below the 450 Level, but appears to be weakening with depth and may or may not persist to the No.5 Level approximately 27 metres (90 ft.) below. The projected position of the lode on the No.5 Level is shown on Block 56, south of the main drive in an unexplored zone. Assuming a constant dip, the lode should lie in Blocks MNOP.30 limited in M.30 by a limb of No.4 Fault and to the east of P.30 by the phyllite-porphyry contact, but only a narrow low grade vein could be anticipated.

(4) <u>No.2a Lode</u> : No.2A is a small quartz manganese lode lying between No.2 Lode and No.4 Fault below No.1 Level toward the eastern end of Block 56. The lode occupies a fissure branching (?) from the main No.2 Lode fissure and is limited in the east by No.2 Lode and cut off at the western end by No.4 Fault. The only exposure of the lode is on the No.3 Level where it can be traced for about 52 metres (170 ft.) in OP.29 Block 56. The No.2a Drive continues along No.4 Fault for some distance beyond its intersection with the lode but exposes no further lode material.

The lode strikes 17 degrees north of west and dips south 55 degrees with an average width of less than 2 feet. Over 36 metres (120 ft.) at the western end the ore averages over a $\frac{1}{2}$ oz. gold per ton but the width has discouraged further development or stoping. The ore is similar to that in No.2 Lode and consists of partly banded manganese oxide with crystalline and granular quartz in numerous vugs and veinlets. Blocky quartz occurs less frequently than in No.2 Lode. The ore is not completely oxidised although oxidation is well advanced.

No.2a Lode is not exposed on the No.2 Level 21 metres (68 ft.) above, but its projected position is shown in PQ.29, Block 56 with a maximum length of less than 33 metres (100 ft.) owing to the closer approach of No.4 Fault to No.2 Lode. Above No.2 Level, No.4 Fault approaches the foot-wall of No.2 Lode and would cut off No.2a lode completely before the No.1 Level was reached.

No.2a Lode probably persists for some distance below No. 3 Level and is possibly represented on the 450 Level 37 metres (124 ft.) below, by a manganese vein exposed in the cross-cut from No.2 to No.1 Lode in O.30 Block 56. The vein strikes northwest-southeast and dips southwest at 40 degrees with a width of over a little over 1 ft.

(5) No.5 Lode : No.5 is also a small quartz manganese lode lying mainly in phyllite and chlorotoid schist on the footwall side of No.4 Fault. All exposures of the lode are now inaccessible and the following geological data are taken from Mine records and from plans compiled by Graham Hall and J. McDonald.

The lode is exposed on Nos. 1, 2, and 3 Levels but apparently dies out on No.1 Level before reaching the surface and is cut off below No.3 Level by a branch of No.4 Fault. No.5 Lode and the 1a Lode are the only ore-bodies exposed on the foot-wall side of No.4 Fault, but whereas 1a Lode is clearly a faulted segment of No.1 Lode, no.5 Lode occupies a separate fissure distinct from the No.1 and 2 Lode fissures between which it lies. The lode strikes a little north of west and dips steeply to the north except on the No. 1 Level and above where the Lode is turned over and dips to the south. All exposures of the lode lie within the zone of complete oxidation.

On the No.3 Level a drive in phyllite in R.29 exposed 36 metres (120 ft.) of ore cut off by a branch at No.4 Fault at the western end and drying out near the porphyry contact in the east. The strike is a little south of west and the dip predominately to the north. The lode is 3.3 metres (10 ft. wide) at the western end but narrows gradually to a little over a foot wide at the eastern end of the drive. The western half of the ore-body carries high values over ½ oz. gold per ton, which decline to between 5 and 10 dwts. gold per ton over the narrower eastern section.

The ore consists of quartz and manganese oxide and is similar to that found in No.2 and 2a Lodes. No.5 Lode has not been intersected below No.3 Level but is expected to be cut off by a branch of No.4 Fault within 7 to 10 metres (20-30 ft.) below the Level. (See Section 8). Above the Level the ore has been stoped almost to No.2 Level 19 metres (62 ft.) above.

On the No.2 Level, the lode develops greater length and is exposed for about 82 metres (270 ft.) in PQR.29. It is enclosed in chlorotoid schist and dies out in the western end in P.29 before encountering the branch of No.4 Fault responsible for its termination on No.3 Level. At the eastern end the lode is cut off by the main branch of No.4 Fault which here lies along the porphyry schist contact. The lode strikes west north-west and dips steeply to the north with an average width of about 1.5 metres (5 ft.). No record has been found in values in the western part of the ore-body but in the eastern half values are high and average over ½ oz. gold per ton. The drive was continued east of No.4 Fault on this Level and exposed a further 40 metres (130 ft.) of ore which may be a continuation of No.5 Lode in porphyry beyond the Fault. This section of the lode strikes a little north of west, dips steeply north and is lenticular in plan with 24 metres (80 ft.) of ore averaging 3 feet in width. Values average between 5 and 10 dwts. gold per ton and ore above the level has been partly extracted.

On the No.1 Level, a narrow ore-body 27 metres (90 ft.) long is exposed in a branch-drive near the eastern portal in PQ.29. The lode occurs on the foot-wall side of No.4 Fault and is probably the upward continuation of No.5 Lode, although the ore has not been followed through in rises from the No.2 Level below. The strike is parallel to that of No.5 Lode but the dip is to the south. The lode appears to die out to the west but is cut off by No.4 Fault at its eastern end. No trace of a surface outcrop has been found and the lode apparently dies out in the porphyry above No.1 Level. The ore averages less than two feet wide with an average grade of less than 5 dwts. gold per ton and has not been developed above the level.

C. FAULTING :

(1) Pre-Ore Faulting : Major faulting in the Edie Creek Mine took place prior to lode formation and was responsible for the fissures now occupied by lode material and for several unmineralised faults and shears.

(a) Lode Fissures : The fissures occupied by Nos. 1, 2,2a and 5 lodes usually show well defined foot and hanging walls, with little or no brecciation, and frequently no development of fault gouge. The fissures were presumably fairly open in contrast to the tight shear zones which characterise Nos. 1 and 4 Faults. Small post lode adjustments have taken place along the lode fissures, which show vertical slickensides and development of fault gouge in places, but there is no evidence of extensive movement.

Toward the eastern end of Block 56, where No.2 Lode fissure dies out and no.1 Lode fissure commences, lodes No.1, 1a, 2, 2a and 5 form a complicated pattern which strongly suggests faulting of the lode fissures before the lodes were introduced. No.1 and 2 Lode fissures appear to be separate fissures rather than disjointed segments of the same fracture. No.1a lode occupies a faulted portion of No.1 Lode fissure but no.2a Lode appears to occupy a separate fracture which is possibly a branch of that occupied by No.2 Lode.

No.5 Lode lies on the foot-wall side of No.4 Fault and may occupy an entirely separate fissure or a considerably displaced segment of one of the other fractures. Ore found in the so-called continuation of No.5 Lode across No.4 Fault on No.2 Level may occupy a separate fissure and not a faulted portion of No.5 Fault, since the fractures on both sides do not terminate on the Fault itself but die out before reaching it. Sections 8 and 9, Block 56, show that considerable displacement of the lode fissures has taken place, and pre-lode rather than post-lode faulting seems responsible.

Both No.1 and No.2 Lode fissures appear as shallow fractures dying out horizontally and showing unmistakable signs of weakening in depth. No.1 Lode fissure is strong over the entire length of its exposure on No.3 Level, but shows a break of about 24 metres (80 ft.) on the No.5 Level where the fracture is unmineralised and practically dies out. No.2 Lode fissure shows signs of weakening on the 450 Level and mineralisation may not persist to the No.5 Level below. In this case, the passage from weak chlorotoid schist downward into stronger phyllite appears largely responsible for the weakening of the fissure.

(b) Unmineralised Shears : Faults No.1 and 4 are largely unmineralised shear zones which intersect and displace the lodes. There has been repeated movement along these faults but there is evidence to suggest their establishment in pre-lode time. Nos. 2 and 3 Faults are minor fractures which intersect No.1 Lode in Block 57. These were exposed in the stopes and sub-level above No.3 Level in XY.31 and were considered by Hall as probably pre-lode fractures.

No.1 Fault intersects No.1 Lode toward its eastern end in Block 57. The Fault strikes 20-25 degrees south of east and dips steeply to the south. It is exposed at the eastern end of the No. 3 and 450 Levels and on the 5 Level below, and usually shows a shear zone up to 6.6 metres (20 feet) in width bounded by a foot and hanging wall fault. Sections 1, 2, 3 and 4 show the behaviour of the shear, which dips fairly steeply below the 3 level to the 450 level where it buckles and dips almost vertically to the No.5 Level below. The longitudinal section shows the westerly rake of No.1 Fault - steep to the 450 level but at a low angle from the 450 level to the 5 level and below.

The nature of the movement is difficult to determine beyond shearing with vertical and horizontal components. The lode has apparently been rotated from 35 degrees east of south to 70 degrees east of south on the No.3 Level but rotation dies out in depth and is not noticeable in the displaced segment of the lode on No.5 Level.

The evidence for suggesting the Fault as pre-lode is not conclusive. In the first place, the shear zone on No.5 Level carries calcite mineralisation as if the solutions which gave rise to the calcitic eastern end of No.1 Lode had penetrated the shear zone for some distance. On the 450 level, where the ore terminating against the fault is manganiferous, the No.1 Fault and wall-rock carries pronounced manganese staining and an occassional quartz-manganese stringer for as far as the Fault is exposed beyond the

Lode. The staining could be accounted for by secondary solutions but the stringer found along the Fault plane indicates primary mineralisation from some source.

In the second place, the extension of No.1 Lode east of the Fault has been explored on both the 3 and 5 levels but shows no clear relationship to any phase of the main lode exposed above the No.5 Level, although the downward displacement was probably not large. Above and below the 450 level at the eastern end, No. 1 lode is strong and wide carrying medium to high gold values in a primary shoot terminating against No.1 Fault. East of the fault however No.1 Lode is narrow and sub-commercial throughout, with no indications of primary ore shoots or of extensive secondary enrichment. Furthermore, No.1 Fault zone on No.5 Level shows no evidence of sheared and broken ore beyond the blebs and patches of calcite which appear the result of primary mineralisation rather than disrupted lode material. Calcitic ore shows a strong tendency elsewhere in the mine to penetrate and replace slate and phyllite, which manganiferous ore rarely if ever does.

The evidence suggests therefore that No.1 Lode fissure was disjointed by No.1 Fault before lode material was introduced. Strong mineralisation across along the western or main section of the fissure and developed primary ore shoots which terminated abruptly against the impervious fault gouge in the zone of No.1 Fault. The mineralisation of the eastern and western segments of the fissure would therefore be to some extent unconnected and may not have been strictly contemporanous.

No.4 Fault is similar to No.1 Fault. It extends over Blocks 45 and 56 and is encountered at the western end of Block 57. The Fault strikes roughly east and west and dips south at angles varying from 45 degrees to vertical. In section, it curves and buckles and frequently divides into numerous steeply dipping limbs (see Sections 8, 9 and 12 Block 56). A Fault zone varying from one to several feet in width extends along the fault and usually consists of sheared slate and impervious fault clay embracing a series of minor shear planes. Slickensiding is frequently found on the hanging wall or on minor planes within the fault zone and indicates late horizontal movements in some places and normal movements in others.

Movement has taken place repeatedly but the sequence cannot be determined. The only indication of the extent of displacement is the relative position of the chlorotoid schist - phyllite contact on the foot and hanging wall sides of the fault. This shows a downward displacement of approximately 60 metres (200 ft.) but there is no indication of the extent of horizontal movement.

Over most of its length, No.4 Fault roughly parallels No. 2 Lode on the northern or foot-wall side and may lie as far as 27 metres (90 ft.) away from the lode. In the west, in Block 45, the lode swings to the north and is intersected by No.4 Fault. In this section the Fault rakes to the east at a low angle (see longitudinal section) and cuts off the lode at the western end of No.3 Level and at about 12 metres (40 ft.) below No.4 Level in Block 45. In the east, No.4 Fault does not terminate No.2 Lode but continues to the south-east to cut off the western end of No.1 Lode in Block 57. The Fault then continues south-east on the foot-wall side of No.1 Lode but has not been exposed east of W30, No.3 Level, Block 57. The intersection of the Fault with No.1 Lode has been exposed on the 450 and 5 Level where the fault rakes steeply to the west.

Repeated movements have taken place along the fault which is regarded as of pre-lode origin, although the evidence is not conclusive. Many of the smaller branches of the main fault may have been established during post-ore movements, as seems probable in Section 12 Block 56 where a small segment of No.2 Lode has been displaced by a normal fault branching from the No.4 Fault zone. On No.2 Level at the western end of Block 45, No.2 Lode is exposed on both sides of the Fault. Unfortunately no workings above or below the Level were accessible but the segment of lode on the foot-wall of the fault should show the primary mineralogical changes characteristic of the main lode below the No.3 Level, but it does not. On No.5 Level No.1 Lode terminates at its western end where No.4 Fault swings into the lode channel in 029 Block 56. The Fault does not intersect the lode channel but follows it for about 42 metres (140 ft.) to the west before an arm of the fault finally cuts it off. The calcite ore ceases abruptly where No. 4 Fault first enters the lode fissure, but blebs of calcite are found in the fault itself at this point. To the west, narrow quartz manganese veins are found along the lode fissure and show no deformation to suggest shearing or major faulting after lode deposition. The inference drawn is that No.4 Fault is a pre-lode fracture which established itself along No.1 Lode fissure for a short distance in NO.29. Calcitic mineralisation terminated abruptly where the fault entered and affected the fissure, but quartz manganese solutions managed later to penetrate parts of this section and deposit irregular narrow veins.

In brief, the faulting along both No.1 and No.4 Faults can be more rationally interpreted if the faults are considered as pre-lode fractures, while the almost complete lack of mineralisation along the fault zones could be attributed to the impervious fault clay which fills the greater part of both fractures.

Two significant cross-fractures exposed on the 450 level also appear to be of pre-lode origin. In N.30 Block 56 a normal fault (?) striking north-east and dipping steeply south-east intersects No.2 Lode fissure and causes a strike slip of approximately 10 metres (30 ft.). In block 57 an overthrust fault intersects No.1 lode in T.29, striking east, south-east, and dipping steeply south. The fault shows a strike slip of 4 to 6 metres (15-20 ft.) on the 450 level and in the stope above causes a throw and heave of approximately 14 and 8 feet respectively. Exposures in the stope suggest that mineralisation extends across the fault without interruption in some sections, indicating a pre-lode origin for the fault. A major roll in No.1 calcite lode shown in stopes above the No.5 Level (see Section 8) may also be due to the effect of pre-lode faulting on the main lode channel.

(2) <u>Post-Lode Faulting</u> :

Apart from small movements along the major faults and lode fissures post-lode faulting in the mine is limited to small tension fractures which cross the lodes obliquely or at right-angles and cause displacements varying from inches to a few feet. The largest post-lode cross-fracture intersects No.1 Lode on the 450 and 5 levels in Q.29 Block 56, causing a strike slip of 3.3 metres (10 ft.) on the 450 level but a much smaller displacement on the 5 Level below. The fault strikes north-west, south-east and dips to the south-west at 70 degrees.

D. <u>DISTRIBUTION OF GOLD</u> :

(1) <u>No.1 Lode</u> :

(a) <u>No.1 Manganese Lode</u> : In the No.1 manganese lode, the highest values lie above the 450 level and particularly above the No.3 Level where ore averaging ½ to 1 oz. gold per ton right to the surface in the central portion of the ore-body, Blocks, V, W and X. The distribution of gold values outlines at least two primary ore shoots, which converge in the central portion of the lode above No.3 Level but diverge in the lower section of the ore-body, one pitching east and one pitching west like the legs of an inverted "Y". Thus, high gold values occur in the central section of the lode on 3 level, but on the 450 and 5 levels are grouped toward the ends of the ore-body in two primary shoots separated by a central section of lower grade ore.

On the No.3 Level the combined shoots lie between Blocks U and Y and contain ore averaging between ½ and 1 oz. gold per ton. Values decline sharply at the western end in Block U and in the east become poorer in Blocks Y and Z up to the contact of No.1 Fault. The continuation of No.1 Lode east of the Fault is narrow and of low grade.

On the 450 level, ore averaging over $\frac{1}{2}$ oz. gold per ton is found in Blocks T and U at the western end of the lode and at the eastern end in Blocks X, Y and Z extending to the No.1 Fault. Between the two shoots in Blocks V and W the lode is not as wide as further east or west and carries distinctly lower values. The lode channel also weakens in Block U and the western shoot appears to divide above the level, one leg pitching east through Blocks U and V to the No.5 Level. On the No.5 Level, the western ore-shoot, carrying $\frac{1}{2}$ oz. ore occurs in two sections, in Block T and Block V with lower grade ore intervening, while the eastern shoot is cut off above the level by No.1 Fault. The high values shown in this shoot on the 450 level are expected to continue downwards as far as the No.1 Fault but will not continue beyond it. The continuation of No.1 Lode east of the Fault on No.5 Level is very narrow and carries less than .25 ozs. gold per ton.

Within the lode, there is some relation between the gold content and the nature of the ore but the distribution of values cannot be fully explained on this basis. The most favourable ores are those containing a high percentage of granular (or sugary) quartz with iron and manganese staining, and those consisting entirely of block pulverulant manganese oxides, banded or otherwise containing small stringers of crystalline quartz. In the first type, the gold apparently accompanies the sugary quartz and iron pyrites and in the second type appears associated with the manganese oxides rather than the stringers of quartz although the latter probably carry a little gold. Manganese ores containing blocky quartz are of lower grade than those containing small quartz stringers but this is probably due to the higher proportion of barren quartz. The relation between gold values and ore type is more clearly shown on the 3 level, particularly at the western end, than on either of the lower levels. On the 450 level iron stained sugary quartz in Block U carries high values as usual, but no difference can be detected between the lower grade manganese ore in Blocks V and W and the ore to the west where values average over $\frac{1}{2}$ oz. gold per ton. Similarly on the No.5 Level, low grade quartz manganese ore in Block U does not differ from ore in Block V which carries $\frac{1}{2}$oz. gold per ton.

Gold values are also vaguely related to lode width. The highest values are not necessarily found in the widest section of the ore-body but they invariably occur where the ore-body is strong while low values are nearly always found if the lode noticeably weakens as in Block V No.3 Level, Block W 450 Level, and Block U on the 5 Level. This suggests that the more important factor controlling the distribution of gold values was the nature of the fissure itself when the ore was introduced. Those portions of the fissure which were strong and comparatively open apparently acted as channels for the rising ore solution and eventually became primary ore-shoots in the lode. The weaker or tighter portions of the fissure would be filled gradually as ore solutions forced their way out from the central channels, while the channels themselves would become enriched by the continued passage of fresh solution. The richest portion of the ore-body is on and above the No.3 Level where the eastern and western ore shoots converge and there is evidence that the original fissure was stronger and more consistent on this level than on the levels below where weakening in depth became evident.

(b) <u>No.1 Calcite Lode</u> : No.1 Calcite Lode is of a much lower grade than the manganese ore but gold values are more evenly distributed. The highest values are found in a narrow shoot of sulphide ore toward the centre of the lode in Blocks PQ on the No.5 Level. The shoot carries ore averaging over $\frac{1}{2}$ oz. gold per ton and extends for some 15 metres (50 ft.) along the level. It appears to pitch steeply to the west and presumably continues below the Level, although grading into 5 to 10 dwt. ore some 12 metres (40 ft.) above it. Elsewhere, the calcite lode averages under 5 dwts. gold per ton with the exception of some 5 to 10 dwt. ore toward the centre of the ore-body on the 450 and No.3 Levels and above the 450 level in Block S.

Gold values are associated with sulphide minerals , particularly iron pyrites, which occur in thin veins and occassional bunches in the calcitic guangue. The gold content does not always vary in direct proportion with the sulphides, however, since ore on the No. 5 Level from inside and just outside the primary ore-shoot shows no appreciable difference in sulphide content but a significant variation in grade. The distribution of high gold value, at least on the lower levels, appears largely the result of a primary concentration of higher grade ore in a narrow central shoot. No structural or chemical control is apparent but, as in the No.1 manganese lode, the shoot may represent an original channel through which ore solutions first ascended.

(2) NO.2 LODE :

In the No.2 Lode, most of the high grade ore, carrying over ½ oz. gold per ton, lies between the No.2 Level and the 1 intermediate level in the zone of complete oxidation. From the surface to below the 1 intermediate level, in the central section of the lode the ore is poorer and shows evidence of leaching while below the 2 level, in partially oxidised lode material, high values are restricted and indicate more definitely the outline of the primary shoots.

The segregation of high values in the oxidised zone above No.2 Level is considered partly due to secondary enrichment and partly the result of the primary ore shoots being larger and more consistent at this level. Below the oxidised zone, the distribution of gold indicates two main primary ore shoots, one on and above the No.4 Level west of No.4 Shaft and one further east on the 450 level. The more easterly shoot in block L and M 450 level, carries high values in very slightly oxidised ore. Above the level, values fall to 5 dwts. per ton on and below the No.3 Level, but rise again to over ½ oz. per ton before reaching No.2 Level, above which a wide zone of high values extends upwards to above No.1 Level to blocks L and M. High values are therefore not continuous over the exposed length of the shoot but the lower grade 5 to 10 dwt. ore on No.3 Level is significantly bordered east and west by a considerable body of sub-commercial ore.

The ore shoot exposed on and above the No.4 Level, block H, carries ore averaging about 1 oz. gold per ton and grades upwards through 5 to 10 dwt. ore into high values which extend from just above the 3 level almost to the surface in block G. The shoot pitches steeply east and was probably more extensive about the No.1 and 2 Levels than below.

Further west, two more shoots occur lying entirely in the oxidised zone. The first, in blocks D. and E, carries high grade ore from No.3 Level to the surface and the second, further west, reaches from the 3 level to the surface in blocks B and C but carries only 5 to 10 dwt. ore below the No.2 Level. Although these two shoots lie entirely within the oxidised zone, their primary origin is established by the comparatively low silver values associated with the gold, since secondary enrichment capable of introducing or concentrating gold would normally produce a significantly high silver content as well.

High gold values are associated with pulverulant manganese oxides carrying small quartz stringers or with sugary quartz, but ore of this character frequently carries low values outside the primary ore shoots. Below No.3 Level, where the ore becomes more siliceous, gold values appear associated with pyritic quartz stringers and with manganese rather than with blocky quartz material, but again ore from the higher grade shoots frequently resembles that exposed in adjacent low grade sections.

Much the same relationship between gold values and lode width is found in No.2 Lode as in No.1 manganese lode. Where high values occur the lode is almost invariably wide and strong and where the orebody is narrow or weak low values are usually found. On the other hand, some sections of the ore-body lying between ore-shoots are wide and carry promising ore but contain only low or sub-commercial gold value, as in block G on No.4 Level and block J, No.3 Level, Block 56. Hence, the distributions of gold in Nos. 1 and 2 have many features in common, and high gold values in No.2 Lode are also to be related to primary ore shoots controlled by the condition of the lode fissure when mineralisation commenced.

(3) NO.5 LODE :

All exposures of No.5 Lode are now inaccessible, but the lode is similar to No.2 Lode, and gold value will probably show the same relationship to ore type and low width. The distribution of gold in the lode (see longitudinal section) shows a concentration of high values toward the centre and western end of the ore-body, suggesting a steeply pitching primary shoot.

E. DISTRIBUTION OF SILVER :

(1) No.1 Lode

(a) No.1 Manganese Lode : High silver values are found on and above 450 level and their distribution appears largely dependant on the primary ore shoots outlined by the high gold value and referred to in the previous section. On the 450 level the two primary ore shoots are clearly defined in blocks T-U and blocks X-Y bearing ore with 20 or more ounces silver per ton, separated by ore carrying much lower silver values. Below the 450 level the westerly shoot is represented on the No.5 Level and the easterly shoot may or may not persist downwards to No.1 Fault.

Both shoots converge above the 3 level where practically the whole ore-body carries over 20 ozs. silver per ton. Secondary enrichment has undoubtedly taken place, particularly above the 450 level, but a dominant factor effecting distribution has been the concentration of silver values in the primary ore-shoot.

(b) No.1 Calcite Lode : In the calcite lode silver values are consistently lower than in the manganese lode and decrease sharply below the 450 level. Above this level, values are consistent between 10 and 20 ozs. silver per ton, with one small area of 20 to 30 oz. ore, while below the Level values decline to under 10 ozs. silver per ton with the exception of a few isolated patches and one rich area on the No.5 Level in block P. This rich ore lies close to the primary shoot indicated by the distribution of gold values and is probably a primary enrichment. On and above the No.5 Level the ore lies in the sulphide zone and outside the primary shoot is consistently poor in silver. Ore above the 450 level lies in the zone of partial oxidation and secondary processes may be responsible for its slight enrichment.

(2) No.2 Lode :

High silver values of over 20 ounces per ton are found almost exclusively between No.3 Level and No.1 intermediate level in a horizontal zone of enrichment 33 to 66 metres (100-200 ft.) thick extending from block G in the west to block Q in the east. Between this enriched zone and the surface the ore is poorer, averaging 10 to 20 ozs. silver per ton and in some places under 10 ounces per ton, while below the No.3 Level and at the western end of the lode most of the ore carries values of under 10 ounces per ton.

Leaching and secondary enrichment have been largely responsible for the present distribution and primary ore shoots above the No.3 Level have for the most part been obscured. Four primary ore shoots are indicated by the distribution of gold and at least two of these are represented in the distribution of silver below No.3 Level where secondary enrichment has been less pronounced.

In the east, 20-30 ounce ore on and above the 450 level in block M probably represents primary enrichment and 30 ounce ore above the No.4 Level and below, in Blocks H-I the Company's high primary gold values in the same area. Further west an isolated patch of rich silver ore, carrying over 20 ounces per ton, above the 3 level in Block E occurs in the third primary ore-shoot as indicated by the distribution of gold and may therefore be of primary origin. The fourth primary ore-shoot at the western limit of the lode is not represented by high silver values but both the third and fourth ore-shoots lie above the limit of complete oxidation where a re-distribution of silver would be expected.

(3) No.5 Lode :

Assay data on No.5 Lode show that the lode carries low silver values of under 10 ounces per ton above and below the No.2 Level, with an irregular band of higher values averaging 10-20 ounces per ton along or just below the 2 level itself. The distribution suggests some enrichment along No.2 Level by silver leached from the ore above.

F. SECONDARY ENRICHMENT :

(1) GOLD

(a) No.2 Lode : Clear evidence of secondary enrichment is found in the upper portion of No.2 Lode where a zone of rich gold ore is found along the No.1 Level below a leached zone, extending to the surface, in which values average well below a ½ oz. gold per ton. This is particularly noticeable in the central portion of the lode where the No.1 intermediate levels east and west lie in ore close to the surface which carries low value and which grades sharply into rich ore 16-33 metres (50-100 ft.) below. The leaching is more marked along the No.1 intermediate east where the ore averages less than .25 ounces gold per ton. At the western end of this level the lode is wide and strong and the ore is comparable with ore carrying high values on the 1 and 2 levels below. Below the Level no significant change occurs in the nature of the ore but gold values increase to .5 ounces per ton within a short distance and pass into .5 to 1 oz. ore within 18 metres (60 ft.). The No.1 intermediate west lies in ore averaging .25 to .5 ounces gold per ton, with poorer ore above the level, but values increase to over .5 ounces per ton before the No.1 Level is reached.

The evidence for solution and downward migration of gold in the central portion of the lode is considered conclusive, although the distribution of high gold values on the No.1 Level into distinct eastern and western zones separated by 66 metres (200 ft.) of lower grade ore suggests that secondary processes have not entirely destroyed the outline of primary shoots.

The fineness of gold on the various levels might be expected to provide a criterion of secondary enrichment, but no significant variations occur. Dr. N.H. Fisher, in an unpublished thesis on the fineness of gold on the Morobe Goldfields, refers to the lack of variation in fineness and suggests that on re-precipitation from solution the gold is deposited, with silver, as electrum of approximately the same fineness as the primary alloy.

(b) No.1 Lode : Secondary enrichment is less marked in No.1 Lode and no leached zone is found near the surface. The central portion of No.2 Lode outcrops on the top of a sharp spur where erosion has been slower than leaching and downward migration of both gold and silver and portion of the leach zone still remains. No.1 Lode, on the other hand, outcrops on the flank of the spur where erosion has kept considerably ahead of leaching and migration.

Solution and re-precipitation of gold have taken place to some extent, probably causing a re-distribution of gold values in the upper portion of the primary shoots, but the only evidence of secondary enrichment lies in the narrow belt of very rich ore lying along the No.3 Level in Blocks V-W and X (see longitudinal section).

(2) SILVER

(a) No.2 Lode : Leaching and secondary enrichment is more obvious in the case of silver than in the case of gold. A zone of leached ore is found in the central portion of the lode, extending downwards from the surface for as much as 24 metres (80 ft.), underlain by a belt of rich silver ore, carrying over 20 ounces per ton, extending along the No.1 Level from Block G to Block Q. Rich ore extends downwards as far as the No.2 Level in places, but grades sharply into low grade ore below that level and nowhere extends below the limit of complete oxidation. Ore carrying high silver values below this limit has already been mentioned and referred to primary mineralisation.

As in the case of gold the leached zone is best exposed on and above the No.1 intermediate east. The ore is essentially similar to that carrying high silver values below, but carries less than 10 ozs. silver per ton. Below the level a narrow belt of 10-20 oz. ore is found grading into 20-30 oz. ore before No.1 Level is reached. Both the upper and lower limits of the enriched belt are irregular, but high grade ore extends continuously from Block G to Block Q in the case of silver and does not grade into poorer ore in Block J as noted in the case of gold.

(unfinished)

REPORT ON THE FUTURE PROSPECTS OF THE EDIE CREEK MINE

NEW GUINEA GOLDFIELDS LTD

EDIE CREEK

Production at the Edie Creek mine ceased on March 17th of this year owing to a strike of underground miners. Mainly because of a shortage of men, particularly miners and winding engine drivers, it has not been possible to re-open the mine and the main workings below No.4 level are still under water. Operations are at present confined to developmental work in the adjoining Karuka mine where a new No.3 level is being driven.

The cost of de-watering the main workings and of placing the mine on a full productive basis will be large and it is not certain that this expenditure can be satisfactorily recovered. The Company's decision regarding the future of the mine will be largely influenced by the size and grade of the ore body idsclosed by the programme of development work now being carried out on the Karuka lode and by the ultimate outcome of the industrial dispute.

This report is intended asa summary of the present position and future prospects of the mine and includes the writer's estimates of tonnage, grade and profit based on recently re-calculated ore reserves and on working costs supplied from the Company's records. On the ore reserve sheet, the re-calculated recoverable grade of the ore appears in red against the calculated tonnage in each section of the mine. The table does include ore reserves from the Karuka mine, since development on the No.3 level at Karuka is in progress and the ore reserves cannot be finalised at this stage. Reserves calculated to date are referred to below.

The position in brief is as follows. De-watering, repairing and developing of the main mine is estimated by the Company to cost between £12,000 and £16,000 and would take from 6 to 9 months to accomplish. Karuka mine contains the only commercial ore immediately available, about 12,000 tons or 4 months ore, but owing to limitations of transport and stoping faces available, the ore could not at present be mined at the rate of 3,000 tons per month required to keep the mill running at normal capacity. However, 6 months would probably elapse before ore would be available from the main mine. Under these conditions, to attempt to recover and treat the 30,000 tons of ore available in both mines offers little encouragement.

The following details will make the position clear. In the main mine, all the ore shown on ore reserves cannot be profitably mined. All 'possible' ore must be eliminated since it lies below the present lowest level and its low grade would only allow development and mining if the cost could be spread over several years. Reserves of positive and probable ore must also be reduced since very little of the lower grade calcitic ore can be profitably mined. Considering the probable life of the mine, only 17,844 tons at an estimated recoverable grade of .40 oz. per ton appear profitable.

At Karuka, reserves of positive ore are estimated at 12,339 tons with a recoverable grade of .28 oz. per ton. This ore lies above the No.2 level and is fully developed. Below the No.2 level driving and rising will probably prove about 12,000 tons of additional ore but the grade is very low, up to the present under .2 oz. per ton recoverable, and it appears probable that little or none of this ore will be worth mining.

Ore of commercial grade available in both mines is then as follows:-

	Tons	Recoverable Grade
Main Mine ..	17,844	.40
Karuka ..	12,339	.28
Total ore	30,138	.35

The cost of production over the last financial year at the mine September 1939 to September 1940 was 55.20/- per ton. With this as a basis, but adding 2.38/- per ton for extra filling costs consequent on deeper mining, and allowing an additional 10% to cover rise in costs due to war conditions, any additional capital charges, the cost per ton is estimated at 63.34/- per ton. Development redemption is not included in this figure and may or may not be covered by the 10% increase above. Mining ore of recoverable grade .35 (fine) oz. per ton worth 74.20/-, the profit remaining is 10.86/- per ton. On 30,183 tons this represents a profit of £17,250. Against this must be offset the initial cost of re-conditioning the main mine, which was not allowed for in the cost per ton, so that estimated working profit is reduced to a maximum of £5,000 and cannot be placed with safety above £1,250.

The following factors must also be considered:-

1. Karuka mine will have to supply all the ore required by the mill (about 3,000 tons per month) for as long as possible. Present trucking facilities will not allow this amount to be supplied through the haulage crosscut and up the main shaft. Transport of portion of the ore by road will be necessary, involving additional transport costs.

2. At the end of the period necessary for reconditioning the main mine, no ore can, on present showing, be expected from Karuka and it will probably not be possible to produce ore from the main mine at the rate of 3,000 tons per month as required by the mill. This again would entail a slight rise in the cost of production.

In the light of these facts, it appears that continued working of the Edie Creek mine for approximately another year offers a very small margin of profit on paper likely, in practice, to become a loss.

Additional assured ore reserves would, of course, greatly improve the situation since the cost of re-opening could then be spread over a longer period of production.

There are, however, no additional reserves of known commercial grade available unless New Guinea Goldfields could obtain the ore from the mine property of Enterprise of New Guinea. The ore reserves at Enterprise include about 70,000 tons of positive and probable ore averaging about .35 oz. per ton (not reduced to a recoverable figure) which would provide an additional two years work for the Edie Creek mill. This in turn would probably allow the mining of the low grade ore now carried in reserve in the main mine which is unprofitable over a shorter term of production.

The chances of further ore by development may be summarised as follows -

1. Main Mine. Apart from the 'possible' ore at present anticipated below No.5 level (see ore reserve sheet) no further ore can be anticipated and no easterly or westerly extensions beyond the present workings carry any promise of commercial ore.

2. No.3 Lode. No.3 lode, outcropping south of No.2 lode, offers a possible 10,000 tons of ore but the available assays indicate a sub-commercial grade.

3. Karuka Lode.

(a) Karuka Lode will continue below No.3 level, but up to the present the grade on the No.3 level is too low to warrant further exploration in depth.

(b) The extension of No.2 level Karuka to the west does however carry promise of further ore. Karuka lode can be traced on the surface across Slate Creek to the west in the general direction of the Enterprise mine and there seems no reason why No.2 level, if extended, should not expose ore in depth west of Slate Creek. Grade and width however cannot be predicted and the possible ore in this sector cannot be considered in the immediate question of re-opening the mine.

The Company is faced, then, with three main alternatives:-

1. To cease all operations at the Edie Creek mine.

2. To re-open the main mine and work the available commercial ore there and in Karuka at the risk of loss.

3. Abandon the main mine and work Karuka only, at little or no profit, extending the No.2 level west in the hope of finding additional ore.

If the Edie Creek mine closes, the effect on both mining and commerce will be very considerable, and at least 11,000 fine oz. possibly over 30,000 fine oz. of gold in the Edie area will never be mined.

If the mine is re-opened, it seems very probable that production will not be limited to the 30,000 tons of commercial ore in sight representing about 118,000 worth of gold. Ore in the western extension of Karuka may well provide extended life for the mine, and it seems probable that eventually Enterprise ore will be milled at the Edie Creek mill, implying a possible 3 to 4 years of life for the Edie plant and a total yield of over £300,000 of gold.

In reviewing the various costs at the Edie Mine, the following facts regarding taxation are considered very significant. Production figures for the last financial year at the mine, September 1939 to September 1940 are as follows:-

	Value £A.	
Bullion produced	109,696	
Working profit	10,709	(before depreciation charged)
Royalty paid	4,658	
Comm. Excise	7,758	
Total Gold Tax	12,416	
Surplus before charging tax (working profit - tax)	23,125	
Royalty and excise calculated as a tax on profits	= $\frac{12,416}{23,125}$	= 54%

These figures are accurate and show that taxation, relative to profits, is very high.

In the present question of re-opening the Edie Mine, a nett profit of about £1,250 on 30,183 tons has been estimated, against which must be offset factors already enumerated which are likely to convert this profit into a loss. Royalty payable on the gold recoverable from this tonnage is estimated at about £5,000 and Excise at approximately £9,000, a total tax on production of £14,000.

The surplus to be expected from continued working of the mine is therefore £15,250, a surplus which would allow a much wider margin for risk and for any additional costs of production expected, than the working profit of £1,250 which alone can be considered if gold tax is deducted from gross revenue.

(Sgd) L. C. Noakes.
Assistant Geologist.

Wau. 23rd July, 1941.

ORE NOT INCLUDED IN ORE RESERVES

EDIE CREEK MINE
(Excluding Karuka Lode)
June, 1941.

Lode	Level	Block	Type of Ore	Positive	Probable	Possible	REMARKS
1A	3	R-3	Calcitic			894	
2	Below 450 level	K.L.M.	Manganese		—	1835	Development not warrant
2	450 "	J.K.L.M.N.O.	"	2173			Sub-commercial
2	Below interlevel 450 level	O.	"		430		
2	Western Extension 1 level No.2 Lode	A. & B.	"			167	Unstopable width.
	2 Level	B.	"			403	Isolated.
	Below 2 Level	B.	"			320 ?	
2A	3 Level	O.P.	"			500	Unstopable width.
	Below 3 Level	O.P.	"			413	
No.5	3 Level	S.	"			412	Isolated.
No.3		Block 56	"			10220	Undeveloped - easily mined but grade may be sub-commercial.

ORE RESERVES

Edie Creek Mine
(Not including Karuka June 1941)

le	Level	Block	Type of Ore	Recalculated Total Tonnage	Tonnage Mined to March, 1941	Positive	Recoverable Grade	Probable	Long Tons	Possible	
,1	450	P.G.R.S.	Calcite	6979	4063			2916	.25		
'	450	T.U.V.W.	Manganese	15506	10212	5294	.602				
'	No. 5 Level	P.Q.R.	Calcite	9602	5035	4567	.205				
'	"	S.	Calcite	974				974	.2		
'	"	T.U.V.	Manganese	3780				3780	.441		
'	"	W.X.Y.S.	"	4770				4770	.518		
"	Below 5 Level to 90 feet	P.Q.R.	Calcite	9800						9800	.235
"	Below 5 Level to 50 feet	T.U.V.	Manganese	1780						1780	.394
al No.1 Lode						9861	.418	12440	.406	11580	.25
2	No. 1 Inter E.	K.M.N.	Manganese					1783	.14		
	450 Inter	O.P.Q.	"	1533				1533	.2		
al No.2 Lode								3316	.167		
al Ore Reserves all Lodes:						9861	.418	15756	.355	11580	.25

Adjustment for dilution (14%) in Positive Ore only.

DETAILED ORE RESERVES

No. 1 Lode (Manganese)
450 Level, June 1941.

Block	Calculated Tonnage	Positive Ore allowing 14% dilution		
T.	128	146		
U.	1214	1385		
V.	856	976		.682
W.	574	654		
			3161	
X.	* 358	408		
Y.	596	680		.484
Z.	916	1045		
	Total Ore Reserves:	5294 Tons		.602

* Shaft Pillar Allowed.

Additional Data on the Future Prospects of the Edie Creek Mine

Development work at the Karuka Mine, Edie Creek, is now sufficiently advanced for ore reserves to be finished. These reserves are stated below, together with some revision, which is now necessary, of tonnage, grade and profit at the Edie Creek Mine.

The reserves of commercial ore at Karuka are as follows:-

Level	Tonnage	Recoverable Grade ozs. per ton.
above No.2 level	12,339	.329 Positive ore
below No.2 level	8,442	.281 Probable ore
TOTAL	20,781	.31

Ore reserves have been increased by 8,442 probable tons, representing ore of commercial grade which can now be anticipated immediately below No.2 level, and the recoverable grade of ore above No.2 level has been raised to .32.

The revised reserves of commercial ore available in both the main Edie Creek mine and in Karuka are as follows:-

Locality	Tonnage	Recoverable Grade
Main Mine	17,844	.40
Karuka	20,781	.31
TOTAL	38,625	.35

The surplus anticipated from working this tonnage £21,000, before deducting the cost of re-opening the Mine, and the estimated profit is approximately £5,000.

The increase in estimated profit, from £1,250 to £5,000 is not considered sufficient to alter conclusions previously drawn regarding the prospects of the mine, and it is anticipated that the main mine will not be re-opened.

On the other hand, the addition of 8,442 tons of probable ore on to the Karuka Mine reserves greatly improves the situation there. Karuka would now be capable of supplying the mill for approximately 7 months and the cost of production would be lowered if the main mine were abandoned. The actual decrease in cost per ton is not yet known, but if the total cost of production per ton, including tax and development, could be reduced to about 57/-, it seems possible a significant profit of £7 - 9,000 could reasonably be anticipated.

The position is, therefore, that the main mine will almost certainly be abandoned and that Karuka mine may eventually be worked on its own, although on account of labour shortage, production would hardly be possible before the conclusion of the industrial dispute.

(Sgd) Lyndon C. Noakes.

<u>Assistant Geologist.</u>

WAU,
31st July, 1941.