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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record No. 1966 / 179

The Geology of Southern New Ireland

by

D.J. French

THE GEOLOGY OF SOUTHERN NEW IRELAND

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THE GEOLOGY OF NEW IRELAND

SUMMARY

A geological reconnaissance of the southern portion of New Ireland was undertaken in 1964/65. The rugged, sparsely populated and heavily forested interior of the island restricted traverses to the coastal foothills and the Weitin/Kamdaru River Valley. The only previous geological information is given in a report by Dr Karl Sapper (1910) of an official German expedition to the Bismarck Archipelagö in 1908. Two new rock units are here added to those which he established.

The bulk of the area is composed of Middle and Upper Oligocene volcanics (Jaulu Volcanics). These overlie Lower Oligocene limestone and sandstone (Lagaiken Beds) and are in turn overlain by Lower Miocene and Pliocene limestones (Surker Beds and Punam Limestone respectively). The youngest rock units are Pliocene clay, marl, and tuff (Tamul Beds) and Pleistocene conglomerate (Maton Conglomerate) and coral benches.

Small bodies of granodiorite/diorite may be intrusive into the Tertiary sediments or alternatively may be part of the pre-Oligocene basement.

The structure of the area is dominated by two northwest-trending transcurrent faults. Some small normal faults occur around the margins of the island mass.

No economic mineral deposits were found, although pyrite, lignite and semi-precious stones occur in small quantities.

INTRODUCTION

Location

New Ireland is situated to the northeast of the larger island of New Britain, in the Territory of Papua and New Guinea. The portion of the island which was surveyed lies between latitude 4°00' and 4°55', and longitude 152°35' and 153°10' (Fig.1).

Communications

Communications within the area surveyed are poor. The southern part of the island is served by small coastal ships from Rabaul and there are good anchorages near Lambom Island off the southwest coast, and at Muliama. There are two airstrips suitable for light aircraft; one at Manga Mission and the other at Cape Naurum. Two more strips are planned, one to serve Lambom Island and the other for the plantations near the Kamdaru River.

Coastal hamlets are connected by a system of native tracks which in places have been developed to take tractors or light 4-wheel-drive vehicles. Tracks are scarce in the rugged hinterland.

Topography

The greater part of the area is mountainous with peaks of over 2,300 metres elevation, though on the southwestern tip there is a level, or gently undulating coastal strip consisting of alluvium and raised coral. The raised coral is commonly dissected.

The Weitin and Kamdaru Rivers are colinear in a prominent northwest-trending valley which bisects the map area.

Climate

The dominant climatic factor is the monsoon wind which blows from the southeast between May and October, and from the northwest between December and March. These two monsoon periods are separated by a period of doldrums interrupted by occasional erratic winds.

Rainfall averages about 130 inches a year. On the east coast there is a relatively dry period from December to April; whilst on the west coast the intermonsoonal periods are dry.

Previous Literature

In 1900 Dr Karl Sapper made a reconnaissance of New Ireland as part of an official German expedition to the Bismarck Archipelago. His "Contribution to the Geography of New Mecklenburg and Neighbouring Islands" is contained in Supplement 3 of the Reports from the German Protectorates (1910) and makes interesting reading.

In 1939 L.C. Noakes produced a report on the lignite at Matakan Plantation on the west coast of New Ireland.

Some general features of the geography of the island are contained in Terrain Study 52 (Allied Geographical Section, 1963).

Organization of the Survey

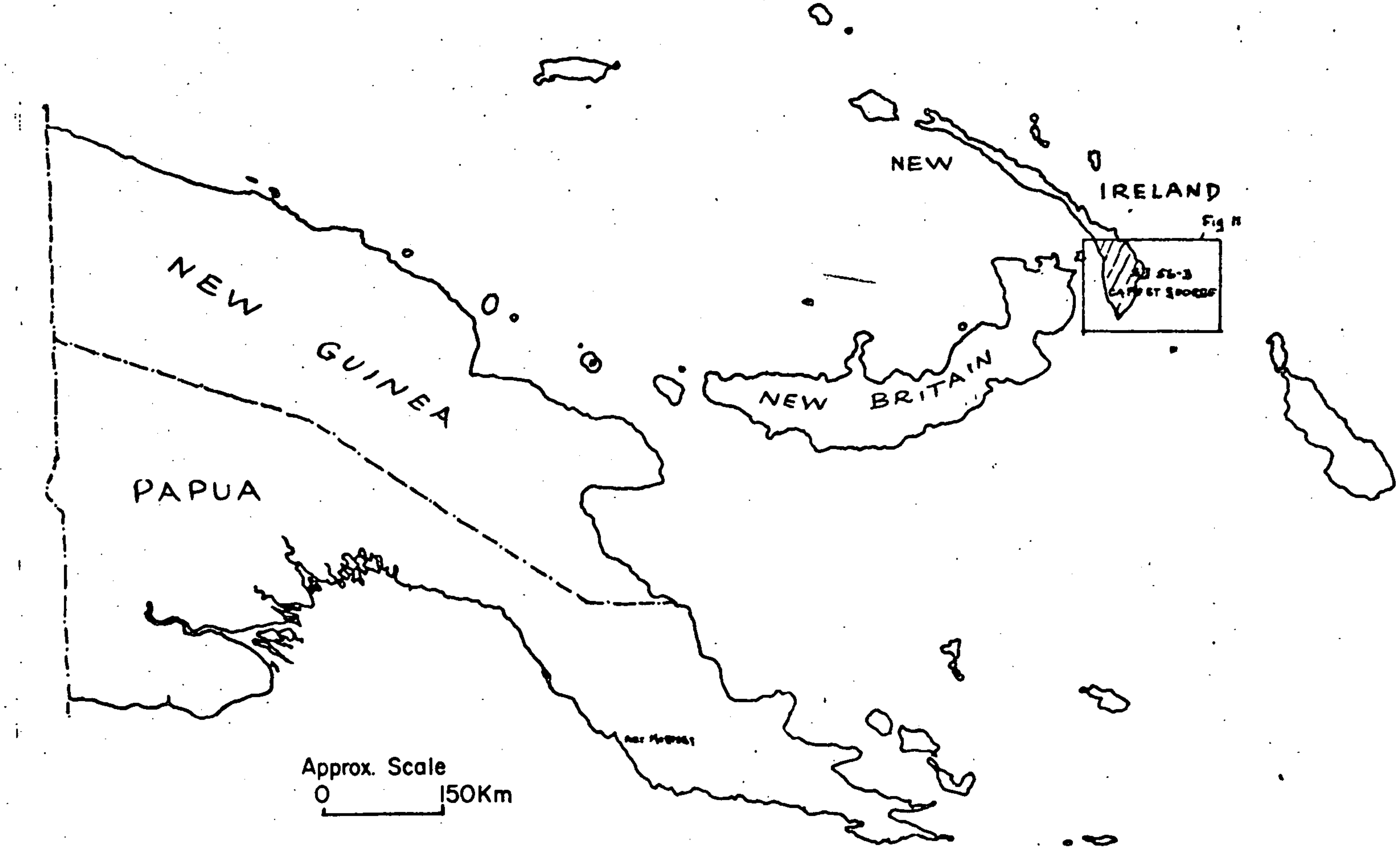
Initially, a base camp was established on the Tampaka River, and from this, reconnaissance traverses were made along the tracks in the surrounding area. Later, an Administration trawler was used as a mobile base and traverses were made up the major rivers. Longer traverses on foot and by canoe were then made to complete the necessary coverage of the area. Locally recruited carriers were used to transport supplies and equipment on the main traverses. They were found to be unsatisfactory for this work.

Availability of Maps and Aerial Photographs

1:250,000 and 1:50,000-scale maps of the area contoured at intervals of 100 metres and 20 metres respectively are available (Figs 1,2). These were produced from 1947-48 aerial photography (Fig.3) flown by the United States Air Force. Ground control is given by the coastline, which has been surveyed, and some peaks that have been triangulated.

Fig. 1

Territory of Papua and New Guinea.



Locality map showing Southern New Ireland and the area covered by the Cape St. George 1:250,000 sheet.

To accompany Record 1966/179

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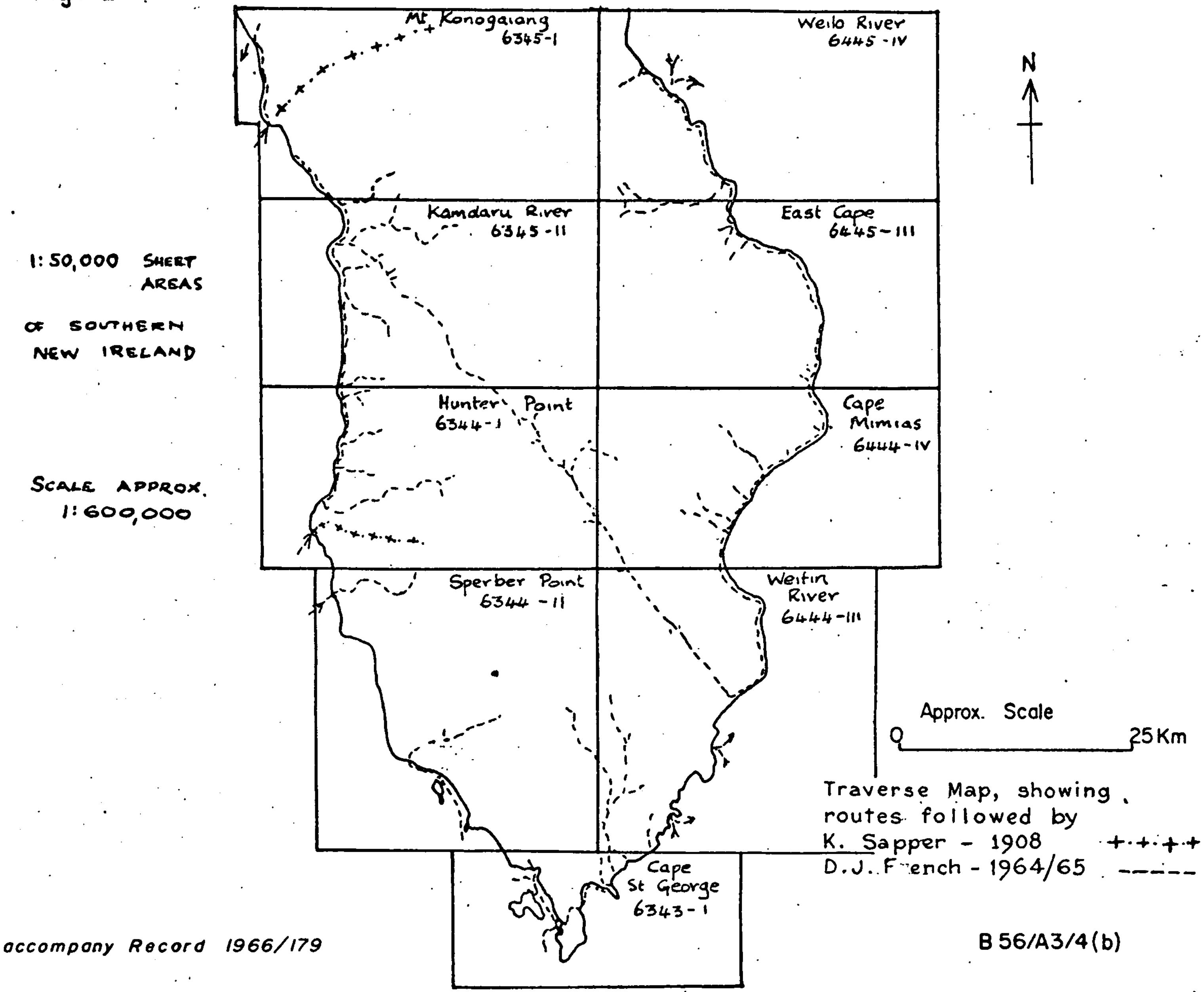
Fig: 2

Southern New Ireland



Traverse Map, showing routes followed by
K. Sapper - 1908 + + + + +
D.J. French - 1964/65 - - - - -

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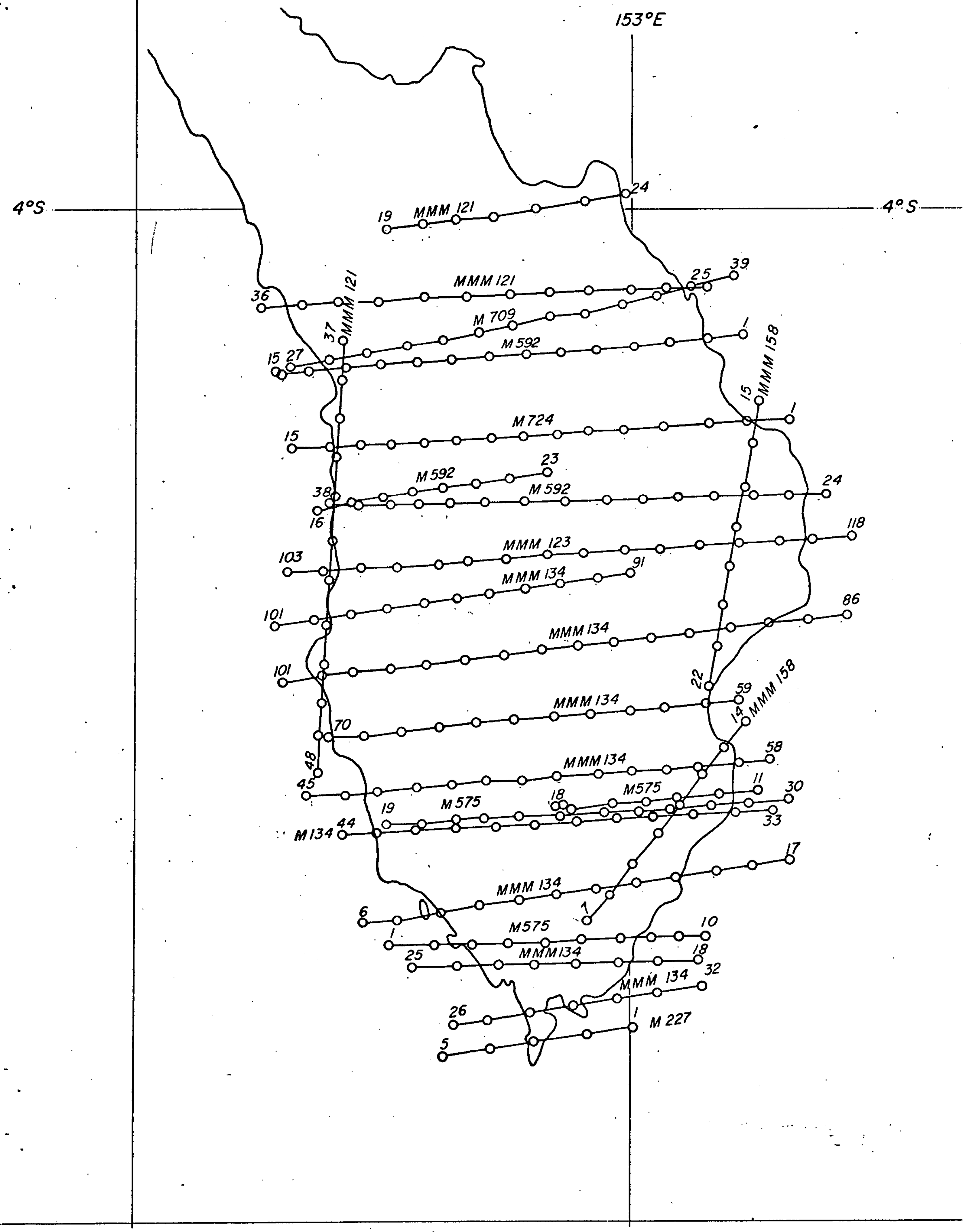
AERIAL PHOTOGRAPH COVERAGE

Fig. 3

SOUTHERN NEW IRELAND



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STRATIGRAPHY

The stratigraphic column is summarized in Table I, and the rock units are discussed below in order of decreasing age.

PRE-OLIGOCENE

Basement

It is not known whether pre-Oligocene basement is exposed. The area of plutonic igneous rocks at the head of the Tanpon River behind Maton Plantation may be basement, but on the other hand these igneous rocks may be intrusive into the Pliocene.

LOWER OLIGOCENE

Lagaiken Beds

Sapper (1910) applied the name Lagaiken Beds to limestone containing Operculina spp. and small specimens of Nummulites spp. The type locality is near Lagaiken.

These beds, comprising limestone and subordinate sandstone, occur behind Bakop village, near the Jau River. They are estimated to be about 500 metres thick. Sapper (1910) records Nummulites, Orbitolites and Alveolina from rocks in Kormaspirin Creek.

The limestone northeast of King Bay shows evidence of intrusion by the hypabyssal equivalent of the Jaulu Volcanics and for this reason is considered to be related to the Lagaiken Beds. Terpstra described Camerina cf. fichteli (Michelotti) from the exposure sampled in the bed of the Jau River (Specimen 6432/18) and determined the age as Oligocene (see Appendix V).

Sapper (1910) found boulders of limestone and glauconitic sandstone containing Nummulites in streams on the west coast of southern New Ireland, especially in the Kait River. He did not find any outcrop. He called these sediments the Kait Beds, and assigned them to the Lower Oligocene, regarding them as the oldest sediments in New Ireland. No outcrop was found on the present survey but it is probable that the Kait Beds are the equivalent of the Lagaiken Beds.

OLIGOCENE TO LOWER MIOCENE

Jaulu Volcanics (new name)

Definition

Rock type:	Intermediate porphyritic and tuffaceous marine volcanics with interbedded limestone
Distribution:	Southern New Ireland
Derivation of Name:	From the Jaulu River. Approx. long. 152°45'E, lat. 4°45'S
Type area:	The Jaulu River - no type section was measured
Stratigraphic relationships:	Apparently conformably overlie the Lagaiken Beds and are overlain conformably by the Surker Beds
Thickness:	About 2,000 metres
Age:	Oligocene to lower Miocene
1:250,000 Sheet area:	Cape St. George. SB56.3

The Jaulu Volcanics occupy most of the mapped area, the central mountainous core of Southern New Ireland, and they cannot be accurately subdivided. Intrusive and extrusive activity seems to have persisted over a long period in the lower Tertiary, possibly terminating in the lower Miocene (lower Tertiary f-stage).

Intermediate porphyritic and amygdaloidal tuffaceous rocks predominate, together with agglomerate derived from the tuffs. The hypabyssal equivalents of the volcanics are intrusive into the limestone in the Sapem River, and limestone breccia occurs in a number of adjoining streams.

The volcanic extrusives appear to have been laid down in marine conditions as foraminifera commonly appear in the groundmass of the lithic tuffs.

Diorite and gabbro were intruded into the core of the volcanic pile and these are exposed only at the heads of some of the rivers, e.g. Jaulu, Weitin, and Jau Rivers. Although the exposures were not actually seen, numerous dyke-like lineations are apparent on the photographs at the heads of the rivers in which dioritic and gabbroic boulders were found.

The volcanic rocks extend from sea level to the highest peak (near the head of the Weitin River) which is over 2,300 metres.

TABLE I : STRATIGRAPHY

Recent	Alluvium	Qra	Gravel	
Pliocene-Recent	Coral terrace	Qre	Coral	: up to 400 metres
Pleistocene	Maton Conglomerate	Qpm	Conglomerate	: 200 to 300 metres
Upper Miocene-Pliocene	Tamul Beds	Tpt	Siltstone, sandstone, conglomerate and coal measures	: less than 200 metres
		?Intrusive rocks*		
Miocene-Pleistocene	Punam Limestone	Tpp	Limestone, tuff	: 1200 to 1300 metres
Lower Miocene	Surker Beds	Tuh	Limestone	: up to 450 metres
Oligocene-Lower Miocene	Jaulu Volcanics	Toj	Intermediate volcanic and associated intrusives	: 2300 metres
Lower Oligocene	Lagaiken Beds	Tol	Limestone, sandstone	: 500 metres
		?Basement: ?Granodiorite and quartz-diorite*		

*Note:

There is insufficient information available to determine whether the Granodiorite is Neogene or pre-Oligocene basement.

LOWER MIOCENE

Surker Beds

The Surker Beds (Sapper, 1910), are composed of Lepidocyclina limestone. The type area is in the Surker River district (to the north of the area mapped). The maximum thickness appears to be at Mount Konogaiang, where about 450 metres are exposed in a prominent cliff face. The beds form a capping to the volcanic sequence from Mount Konogaiang northwards and westwards.

Sapper (1910) collected specimens of the limestone from the Huru and Surker Rivers. He describes it as a lepidocycline chalk which he says belongs to the lower Miocene (lower f-stage). The underlying volcanics in this region cannot therefore be younger than lower Miocene.

MIOCENE TO PLEISTOCENE (?)

Punam Limestone

The Punam Limestone (Sapper, 1910) is mainly composed of beds of chalky limestone and marl containing foraminifera such as occur in the Punam area of New Ireland. It occurs extensively elsewhere on the island and on the neighbouring islands. It is referred to younger Tertiary or Pleistocene. Tuff beds, associated with the formation, were called the Rataman beds by Sapper (op. cit.).

Within the mapped area, the Punam Limestone crops out from Cape Saint George northwards along the west coast and along the east coast northwards from Cape Mimias.

A very thick succession of limestone (specimen 6432/83), is found on the east coast extending from sea level to at least 1,200 or 1,300 metres. A specimen from near Muliama is described by Terpstra (see Appendix V) as an Amphistegina limestone containing coral fragments.

Coralline limestone also occurs along the west coast, where it is commonly faulted against the Jaulu Volcanics.

Grey to off-white bedded limestone, (containing upper Tertiary possibly lower Pliocene) Globigerina and Pulvinulina (Sapper 1910) are up to 1000 metres thick near Lamassa and Lambon Islands.

The Punam Limestone is described by Sapper (1910) as consisting of chalk, tuff, sandstone, marl and clay which are mostly distinguished by their more or less plentiful foraminiferal content. The main fossils in the succession, according to Sapper, are:-

1. Common:

   Globigerina bulloides, G. triloba, G. conglobata and Pulvinulina menardii-tumida

2. Common in places:

   Orbulina universa, Noigerina (sic, uvigerina) asperula, Sphaeroidina dehiscens, Pullenia obliqueboculata (sic obliquiloculata).

The faunal specimens collected from the west coast on the present survey consisted of corals and foraminifera, as did those fossils found as inclusions in the tuffaceous marginal portions of the volcanic succession.

Tamul Beds

Sapper (1910) applied the name Tamul Beds to sediments occurring on the east coast of southern New Ireland. They consist of clays, marls, and tuffs with thin lignite seams. These sediments are widespread; they immediately overlie the Jaulu Volcanics, and are well developed in the Tamul River area from which the name is taken.

They would appear to be contemporaneous with at least the lower part of the Punam Limestone and are therefore probably Miocene to Pliocene in age.

The thickness is believed to be less than 200 metres.

The lowest bed is on orange sandstone overlain by the coal measures, which comprise siltstone, clay, and contorted bands of lignite. These are in turn overlain by a succession of alternating boulder conglomerate and crossbedded siltstone.

The lower portions of the succession are slump folded, (e.g., the strike of the coal measures changes considerably within the width of a creek). The top of the highest siltstone band is taken as the boundary between the Tamul Beds and the overlying Maton Conglomerate.

The coal measures in a similar succession near Matakan Plantation (on the west coast immediately north of the mapped area) are described by Noakes (1939) as a folded lignitic series of basal upper Miocene age and gently dipping Pliocene sediments (see Appendix V).

The genera found by Sapper in the Tamul Beds include:

Conus sp. a; Ancillaria sp. a;
Tritonides sp. a; Murex sp. a;
Rimella sp. a; Cerithium sp. a
Cerithium sp. b.

Sulphur was found deposited from boiling mud in one locality, and elsewhere boulders had been coated with sulphur. Burning lignite is the heat source responsible for these effects in both the Tamul and Tamai valleys.

PLEISTOCENE

Maton Conglomerate (new name)

	Definition
Rock type:	Coarse conglomerate
Distribution:	On the eastern and western coasts of Southern New Ireland
Derivation of Name:	From the Maton River
Type area:	The Maton River Gorge on Mala Plantation at about lat. 4°16'S long. 152°43'E. No type section was measured
Stratigraphic relationships:	Overlies the Tamul Beds unconformably and is unconformably overlain by Pleistocene coral terraces
Thickness:	200-300 metres
Age:	Pleistocene
1:250,000 Sheet area:	Cape Saint George. SB56.3

The Maton Conglomerate consists of a succession of coarse conglomerates overlying the Tamul Beds. In the type area the conglomerate is no more than 200 to 300 metres thick, and dips towards the coast at 20°-30°.

The Maton Conglomerate is located along the east and west coasts and overlies the Tamul Beds close to the volcanic ranges.

The conglomerate is formed from boulders shed from the central volcanic ranges which were being rapidly uplifted in the Pliocene. The ranges are still shedding boulders onto the flanks and choking the water courses.

PLIOCENE TO RECENT

Coral Terraces

Coral terraces are developed all along the east coast but are rare or absent on the west coast.

The most important terrace is that behind Silur and Siar. It reaches a height of 400 metres and is uplifted by vertical movement of the Weitin River Fault. This coral terrace probably dates from Pliocene times.

Sapper (1910) has measured many terraces in New Ireland; he subdivided them into High, Middle and Low Terraces. They are continuing to form at the present day.

RECENT

Alluvium

Most alluvium consists of unconsolidated gravel and beach sands similar to the consolidated Maton Conglomerate. It indicates that present day geomorphological conditions are similar to those existing since Pliocene times.

IGNEOUS ROCKS

An area of plutonic igneous rocks is probably exposed at the head of the Tanpon River behind Maton Plantation. The outcrop could not be examined but from the abundant boulders shedding down the river it could be seen that the lithology is highly variable: diorite, quartz diorite, granodiorite and veins of pegmatite occur. Some boulders show that the quartz diorite and other more acid rocks intrude older dioritic rocks. These igneous rocks normally have pyrite and ? pyrrhotite as accessories.

At the head of the Danfu and Weilo Rivers there is a large basin-like area which shows up very distinctly on aerial photographs. An unsuccessful attempt was made to go up the Danfu River to approach the area which is extremely rugged. From boulders seen in the Weilo and Danfu Rivers the area is believed to be composed of an even-grained granodiorite composed of plagioclase, orthoclase, biotite, corroded hornblende, and quartz with pyrrhotite as an accessory sulphide mineral.

As no contact has been located in the field it is uncertain whether these igneous rocks are pre-Oligocene basement rocks or post-Miocene intrusives. However comparison of the rock types and the regional geological setting with nearby equivalents in New Britain suggest that they are probably intrusive into the Miocene and Pliocene sediments.

STRUCTURE

General

The island appears to consist basically of a fairly thick (2500 metres) succession of marine sediments and volcanics "draped" over a small area of rising basement rocks. Consequently there has been some crumpling and faulting of the sedimentary pile, especially on its margins. Nothing is known of the pattern of folding. Both normal block faulting and transcurrent faulting occur.

Weitin River Fault

A major fault, the Weitin River Fault, trends northwest across the centre of the mapped area; its position is clearly marked by the Weitin and Kamdaru River valleys. Geomorphological evidence (see page 10) suggests that the fault is of Plio-Pleistocene age and indicates that the east block has moved northward several kilometres - at least the width of the coral terrace, which, here, locally overlies the Jaulu Volcanics. The vertical displacement is of the order of 400 metres, the height of the coral terrace (Fig.4).

A parallel, partly extrapolated fault to the southwest has been called the Sapom River Fault after the Sapom River.

Minor north and east-trending faults with small displacements occur along the limestone/volcanics boundary and within the Pliocene to Recent sediments. Certain north-trending lineations occur near the Um River.

Figure 5 shows the very close structural relationship between Southern New Ireland and the neighbouring Gazelle Peninsula of New Britain. The structure of the Gazelle Peninsula has been interpreted from aerial photographs and topographic maps.

The small-scale faulting and slumping in the Tamul Beds (coal measures) is believed to have resulted from compaction and consolidation, following initial tectonic uplift.

GEOMORPHOLOGY

A number of erosion surfaces and terraces exist within the mapped area. The oldest and highest is between 2100 to 2300 metres above mean sea level, east of the Weitin River Fault. A residual plateau is clearly visible on the aerial photographs together with conspicuous evidence of intercepted drainage or deranged drainage patterns. To the west of the fault this erosion surface is at 1700 metres.

A second surface, closely related to the highest one, is 400 metres below the oldest surface on both sides of the fault. The type areas for this surface are the Weitin-Tamai headwaters on the east side of the fault and the Kamdaru headwaters on the west.

Displacement of these erosion surfaces on the Weitin River Fault indicates that the east block has moved up some 400 metres with respect to the west block. This vertical displacement, which appears to be uniform along the whole length of the fault, is believed to have taken place in the Pleistocene.

There are other erosion surfaces at 1700 metres, 1300 metres, and 900 metres. There are also a large number of terraces close to sea level, which were systematically measured by Dr Karl Sapper (1910).

GEOLOGICAL HISTORY

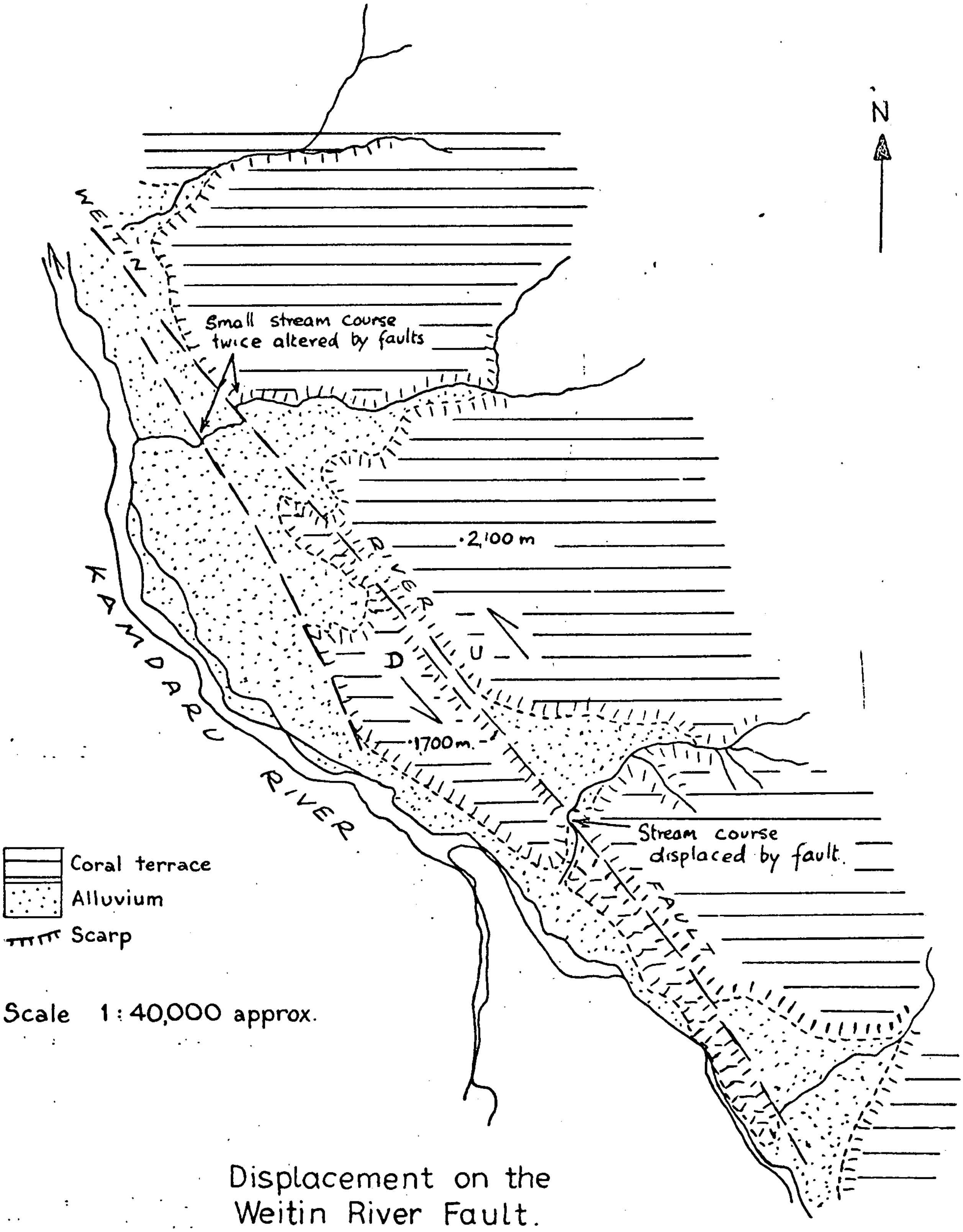
The oldest dated sediments are Lower Oligocene chalky limestones.

The Middle to Upper Oligocene were times of intense volcanic activity, basic extrusive rocks of varying composition being deposited on the limestone. Some limestone deposition probably continued - as some tuffs have fossiliferous inclusions - and some igneous rocks intruded the limestone. Later, as volcanic activity diminished, dioritic to gabbroic bodies were emplaced within the volcanic sequence, causing alteration of some of the bedded volcanics. The pyrite mineralization is probably related to this stage of igneous activity.

Limestone was once again in abundance during the lower Miocene stage and probably continued right through the Pliocene. Several large bodies of dioritic and granodioritic rocks were probably intruded into the sediments during this time. From the Pliocene onwards, coral terraces were being formed along with the deposition of coarser clastic and non-marine detritus.

Orogenic activity started vertical uplift of the order of 1,000 metres and terminated in the Plio-Pleistocene, with the Weitin River faulting. This uplift is responsible for the appearance initially of sandstone, siltstone and coal measures in the sequence, followed by coarse conglomerate. Present day sedimentation is essentially the continuation of the last stage: clastic deposition on the west and south coasts, and coral formation on the shallow east coast.

Fig. 4



Displacement on the Weitin River Fault.

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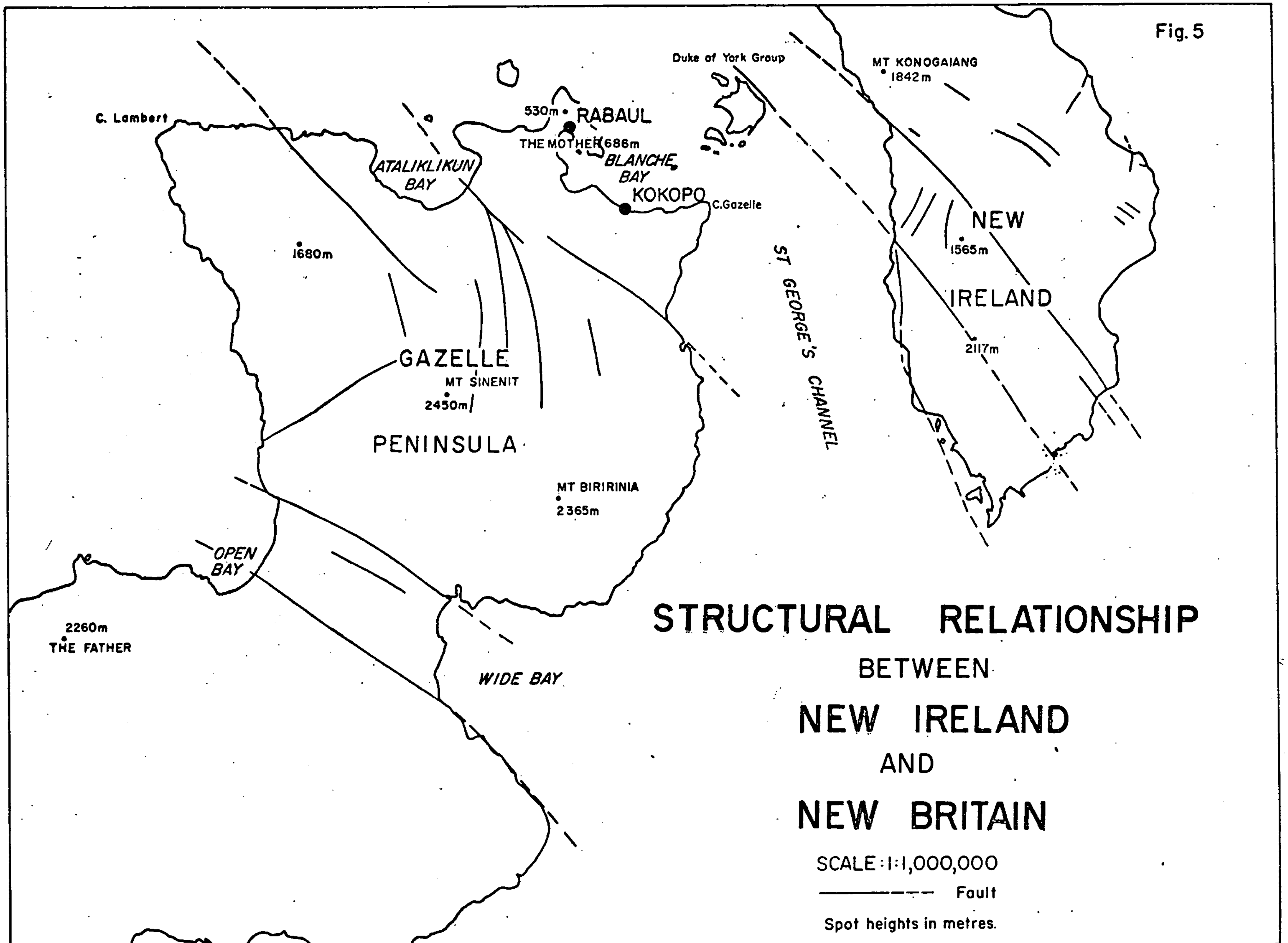

STRUCTURAL RELATIONSHIP BETWEEN NEW IRELAND AND NEW BRITAIN

SCALE: 1:1,000,000

Fault

Spot heights in metres.

To accompany Record 1966/179

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ECONOMIC GEOLOGY

No economic mineral deposits have been found. Pyrite is relatively abundant in a few areas but there are no workable deposits.

Minor occurrences of lignite and considerable quantities of limestone are present, but it is doubtful if even the proximity of these materials to one another would justify consideration of their commercial development. Their local use may, however, be practicable.

Some semi-precious stones, not of a high quality, have been found in amygdaloidal volcanic rocks.

PYRITE

The principal occurrences of pyrite are in the Dantilian-Toman River area and in a narrow defile on the Weitin River.

The occurrence in the Dantilian-Toman River are of two types. In the upper tributaries of the Toman River abundant yellow boulders are composed of finely disseminated pyrite in altered volcanic rocks.

In the Dantilian River the pyrite is restricted to a number of discrete bands within the volcanic rock.

In the Weitin River area, pyrite mineralization is widespread and is associated with the occurrence of abundant white zeolite in altered volcanic rocks, the zeolite itself being partially replaced by pyrite in many amygdales. Downstream, the pyrite occurs in a number of distinct bands of rock, thus repeating in the one stream bed the two modes of occurrence noted in the separate rivers of the first area described.

In both the areas mentioned above a variety of pyrite occurs which shows a tarnished appearance similar to that displayed by chalcopyrite. Analyses show, however, only low concentrates of useful elements in the mineral:

Element	Toman River Pyrite p.p.m.	Weitin River Pyrite p.p.m.
Cu	60	10
Pb	25	5
Zn	70	Less than 20
Co	20	6
Ni	4	1
Sn	2	1
Mo	4	1
Ag	0.2	-
Au	3	0.008
As	-	

Lignite

There are three localities where lignite has been found. These are at Matakan, on the Topajo River, and on the Tamul and Tami Rivers.

The first of these was investigated by L.C. Noakes (1939) who described the lignite there as being basal upper Miocene in age.

A sample from the second locality, collected during the survey, was analysed by A.M.D.L. and this showed a fixed carbon content very similar to that of the Matakan deposit.

Samples from the third locality were also analysed by A.M.D.L. and although these showed consistently higher fixed carbon contents than those from other localities, none of them approached the value of 50.97% fixed carbon quoted by Sapper (1910) for a sample from the Tamul River.

Details of the various analyses are given in Appendix IV. No determination was made of the real extent of the deposits, and for this systematic boring or pitting would be required.

Semi-Precious Stones

Many of the volcanic rocks are amygdaloidal and the amygdales are commonly filled with zeolite or agate. Zeolites were found in the King River and on the Upper Weitin River, whereas agate, not of a high quality, was found in the Tangat Creek on the west coast, and in the Cape Mimias beach gravels on the east coast.

Geochemistry

In conjunction with the Southern New Ireland regional mapping programme, stream sediment fines and panned heavy mineral concentrates were sampled. Commonly a panned sample and a stream sediment fines sample were taken at the same locality. (Of the 95 samples taken just over half were stream sediment samples.)

The relief is extreme and the samples were taken in fast flowing streams where there is little opportunity for extensive weathering. The samples were analysed spectrochemically for Ni, Co, Cu, Pb, and Zn. No Pb or Zn was found to be present.

The following conclusions were drawn from the geochemical analyses:

1. The mineralization present is restricted to the volcanic rock sequence.

2. The background values for the volcanics are in the order of Ni: 5-10 ppm; Co: 30-40 ppm; Cu: 40 ppm.

Stream sediment samples taken from within areas of sedimentary rocks show a much lower background than those from within the volcanics, but panned concentrate samples collected within sedimentary rocks only a short distance downstream from the volcanics/sediment boundary have similar background values to the volcanics.

In the area investigated it is possible that the panned concentrate samples are a more useful guide to mineralization than the samples of stream sediment fines. This might be due to the small amount of minerals going into solution as a result of limited weathering.

There are local variations in the concentrates derived from the volcanics, reflecting their varying composition.

The only significant Cu 'high' of 200 p.p.m. is associated with an area of extensive pyrite mineralization at the head of the Weitin River where the Co content also rises to 80 ppm. The highest cobalt value of 100 p.p.m. is in association with extensive pyrite mineralization in the Toman River. Cobalt and nickel 'highs' were found in fault zones. Two values of 50 p.p.m. Ni were found in samples taken on the Weitin River Fault, and 70 p.p.m. Co on an agglomerate/limestone fault contact in the Tangat River.

ACKNOWLEDGEMENT

The extreme helpfulness of many plantation managers, including Messrs Y.F. Seeto, C. Smith, A. MacCrae, C. Bell, R. Lanzarote and T. van't Hoff, and of the Silur-Siar Roman Catholic Mission under Fr A. Genduza, did much to make the survey possible and was greatly appreciated.

This report revised and partly rewritten by J.H.C. Bain, 1968.

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Appendix I

SPECTROCHEMICAL ANALYSIS OF STREAM SEDIMENTS FROM CAPE ST. GEORGE T.P.N.G.

(Refer to 1:50,000 scale maps for localities.)

by

A.D. Haldane

Following are the results for the spectrochemical analysis of 95 stream sediment samples, submitted by D.J. French and collected in southern New Ireland. No details of sample localities were given.

All results are expressed in parts per million. Pb and Zn were sought but not detected in any sample.

Sample No.	Ni	Co	Cu
64320001	5-	20	25
02	5-	15	25
03	5-	20	30
04	5-	15	20
05	5-	15	30
06	5-	20	35
07	5-	20	40
08	5-	15	40
09	5-	20	40
10	5-	20	25
11	a	12	15
12	5-	25	40
13	5-	20	20
14	5-	20	30
15	5-	15	20
16	10	20	20
17	40	40	30
18	10	20	25
19	5	70	50
20	5-	20	20
21	5	30	35
22	5	25	30
23	5-	20	30
24	10	20	15
25	5-	15	7
26	5	30	40
27	5-	15	10
28	10	30	40
29	5-	20	30
30	5-	30	40
31	5-	20	15
32	10	30	50
33	5-	15	15
34	10	30	40
35	5-	25	15

Sample No.	Ni	Co	Cu
64320036	10	30	30
37	5-	12	10
38	10	40	40
39	5-	15	10
40	5	40	40
41	5-	15	15
42	5	40	30
43	5-	20	30
44	5-	30	30
45	5-	15	30
46	5	30	50
47	5-	15	20
48	5	30	30
49	20	25	50
50	50	40	40
51	30	25	50
52	50	40	40
53	5	80	200
54	5-	20	40
55	5	60	200
56	5-	20	40
57	5-	30	40
58	5	20	50
59	5-	20	35
60	10	30	40
61	5-	20	30
62	10	25	15
63	5-	15	13
64	5	25	30
65	5-	15	15
66	5	40	30
67	5-	20	15
68	10	40	40
69	5-	20	30
70	5-	40	15
71	5-	20	25
64320072	10	50	60
73	7	20	30
74	12	30	50
75	5-	12	15
76	5	30	40
77	5-	20	30
78	5	40	40
79	5-	15	20
80	10	35	40
81	30	100	50
82	7	20	30
83	20	20	50
84	20	25	40
85	40	25	20
86	12	20	40
87	30	25	50
88	15	15	10
89	15	15	30
64320090	5-	12	7
91	30	60	5
92	5	25	10
93	5-	20	20
64320094	5-	20	15
64320095	5-	30	15

5- = less than 5 ppm
a = sought but not detected

Plate Nos. 884,887 -889

Serial No. 2020:

Appendix II Analysis of selected rock specimens for trace element content.

SEMI-QUANTITATIVE ANALYSIS
BY EMISSION SPECTROSCOPY

Parts per million

Sample Mark	Copper Cu	Lead Pb	Zinc Zn	Cobalt Co	Nickel Ni	Molybdenum Mo	Tin Sn
64.32.24	100	4	70	50	25	-	-
.40	3	x 1	x 20	x 1	-	x 1	x 1
.41	1	x 1	x 20	x 1	-	x 1	x 1
.43	x 1	x 1	x 20	x 1	-	x 1	x 1
.44	3	x 1	x 20	x 1	-	x 1	x 1
.70	5	x 1	x 20	x 1	-	3	x 1

<u>Note</u>: x indicates less than

Analysis by:
G.R.Holden A.M.D.L.

Appendix III.

Analyses of selected pyrite specimens for trace element content.

SEMI-QUANTITATIVE ANALYSIS
BY EMISSION SPECTROSCOPY

parts per million

		Weitin Headwaters 64320054	Toman River 64320081
Copper	Cu	10	60
Lead	Pb	5	25
Zinc	Zn	x 20	70
Cobalt	Co	6	20
Nickel	Ni	1	4
Tin	Sn	1	2
Molybdenum	Mo	1	4
Silver	Ag	-	0.2
Gold	Au	-	x 3

Note: x indicates less than
Cr not looked for
Br not determined by emission spectrograph

ANALYSIS
%

Sample Mark	Arsenic As
64320054	0.008

Analysis by:
G.R. Helden,
A.M.D.L.

APPENDIX IV.

Analysis of lignite samples from various localities.

ANALYSIS

Sample Mark	Calorific Value	Fixed Carbon	Arsenic As	Phosphorus pent-oxide P_2O_5
64.32.40	8895 btu/lb	30.8%	0.00020%	-
41	9345	35.8	0.00014	-
43	9525	37.7	n.d.	-
44	9550	36.5	n.d.	-
70	7370	29.8	0.00030	-
5	-	-	-	0.02%
85	-	-	-	0.03%

Note: n.d. indicates not detected ($<$0.00008% As)

Analysis by:

R.B. Oliver & M.R. Hanckel,
A.M.D.L.

SAMPLES SOUTH NEW IRELAND

by

G. R. J. Terpstra

INTRODUCTION

Samples have been received from South New Ireland submitted by Mr D. French (1:250,000 Regional Mapping program Sheet S.B. 5603, Serial No. 2046).

According to the list received the following numbers were originally to be submitted for palaeontological examination:

6432/4, 5, 6, 10, 12, 18, 21, 24, 39, 40, 41, 43, 44
61, 62, 62, 67, 70, 82, and 83.

Actually received for examination have been:-

6432/4, 5, 6, 18, 24, 40, 41, 43, 44, 67, 70 and 83.

OBSERVATIONS

6432/4 Jaulu River (Exact location unknown). Black fine-grained volcanic rock with grey fossiliferous inclusions. In section *Globigerina* sp. and coral fragments have been observed. No age determination can be made.

6432/5 Tongat River (9500125W., 469625E).

White massive coral limestone. A few foraminifera and coral fragments have been observed in sections. No age determination can be made.

6432/6 Tongat River (exact location unknown).

Massive volcanic rock with fossiliferous inclusions. In section tests of lamellibranchs have been observed, no age determination can be made.

6432/18 Metlik plantation area (9484525W, 4900000E.) Boundary of light grey volcanic rock and limestone. The sample appears to be a nummulitic rock containing *Camerina* of *fichteli* (Michelotti). The age of the rock is Oligocene.

6432/24 Maton River Siltstone (9526000N, 470.000E) Cross bedded siltstone. No microfossil have been observed.

6432/67 King River (exact location unknown). Contact volcanic rock and limestone. The limestone contains coral fragments. No age determination can be made.

6432/70 Topaio Side Creek (exact location unknown)
Silt and lignite
No foraminifera have been observed.

6432/83 Muliama (9550625N, 494125E).
White coral limestone.
This is an <u>Amphistegina</u> limestone containing also coral fragments. The age of the sample is not older than Miocene, but could well be younger.

The samples 6432/40, 41, 43 and 44, from Tamai Rivers, consist mainly of brown coal and have been passed on to Dr. Evans, for possible palynological examination.

MATAKAN AREA (FROM FISHER & NOAKES, 1942)

Sample Locality

Eighty feet above sea-level from a lens of carbonaceous mudstone associated with lignite deposits in a series of folded tertiary rocks on Matakan Plantation.

Description

Carbonaceous, shelly mudstone, with corals and patches of fragments of very thin-shelled mollusca. Washings contain foraminifera, corals, mollusca.

Foraminifera:- Elphidium craticulatum, Alveolinella bontangensis

Corals: Montipora dubiosa

Pelecypoda:- Bivalves chiefly indeterminate: Phacoides eucomia.

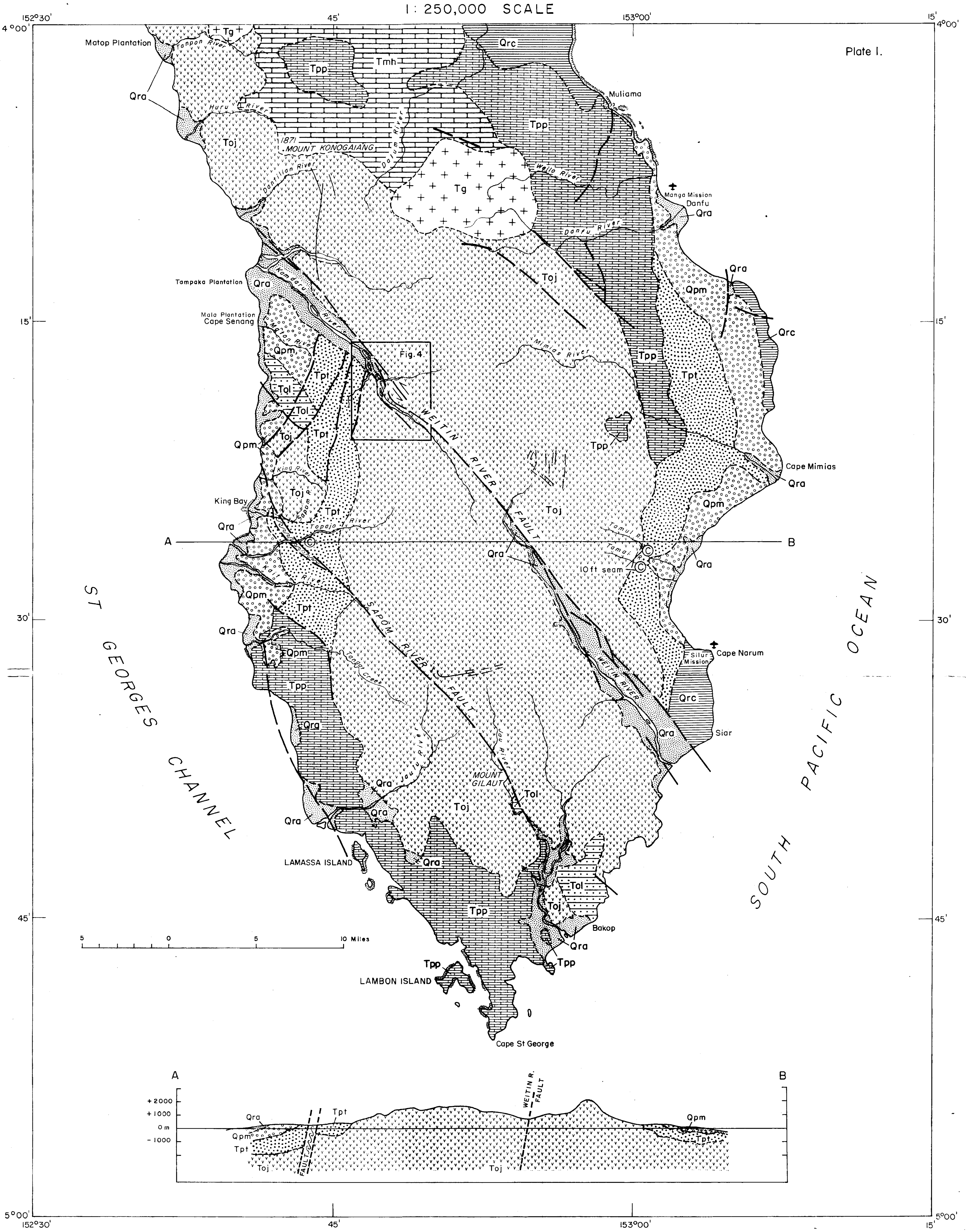
Gastropoda:- Turritella sp. Marginella sp. Patella sp. Ancilla cf. javana, Vexillum batavianum, Inquisitor cf. palabuanensis, Filodrillia cf. madiunensis, Carithium verbeeki, Latirus cf. njalindungensis, Nassarius ovum, Epitonium sp., Turbonilla sp., Pyramidella sp., Natica marochiensis.

The age of this rock is basal Upper Miocene, or the top of stage "f".

CAPE ST GEORGE GEOLOGY

S. NEW IRELAND

1 : 250,000 SCALE



RECENT		Qra	*Gravel*	LOWER MIOCENE	Surker Beds	Tmh	*Limestone*	*Geological boundary*
PLIOCENE TO RECENT		Qrc	*Coral*	LOWER MIOCENE TO OLIGOCENE	Jaulu Volcanics	Toj	*Volcanics, diorite*	*Fault*
PLEISTOCENE	Maton Conglomerate	Qpm	*Conglomerate*	LOWER OLIGOCENE	Lagaiken Beds	Tol	*Sandstone, limestone*	*Lineaments*
U. MIOCENE TO PLIOCENE	Tamul Beds	Tpt	*Coal measures, conglomerate*		Igneous	Tg	*Granodiorite*	© *Unworked coal deposit*
MIOCENE TO PLEISTOCENE	Punam Limestone	Tpp	*Limestone, tuff*					

To accompany Record 1966/179

B 56/A 3/1 EJ