1967/94
COPY 3

copy 3

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

RECORDS:

1967/94

SCHRADER RANGE, NEW GUINEA - RECONNAISSANCE GEOLOGY.

by

J.H.C.Bain

5928/65

SCHRADER RANGE, NEW GUINEA - RECONNAISSANCE GEOLOGY

by

J.H.C. Bain

Records 1967/94

CONTENTS

SCHRADER RANGE, NEW GUINEA - RECONNAISSANCE GEOLOGY

SUMMARY

A reconnaissance of the Schrader Range was made in March, 1967. The region is rugged, bush covered, and very sparsely populated. Airstrips at Aiome and Simbai Patrol Posts provide the only practicable access, and as there are few tracks, travel within the area is slow and arduous.

The only geological information available for the area was gained by Dow and Dekker in 1962 when they mapped the Bismarck Mountains immediately to the south and east. It has now been possible to trace their Asai Beds much farther to the north, and to redefine and rename them the Asai Shale.

During the Upper Cretaceous, basic volcanic agglomerate and pillow lavas called the Kumbruf Volcanics were laid down in a marine environment in the southern part of the area. A thick succession of siltstone and mudstone with small limestone lenses called the Asai Shale was then deposited in a shelf environment during the Upper Cretaceous and Lower Tertiary time. These beds were later folded and strongly sheared.

A succession of volcanic agglomerate, limestone, and shale (the Wulamer Beds) was deposited after the Asai Shale, probably in Miocene time. Both formations were then deformed in the late Tertiary.

The structure of the area is dominated by large north-west-trending faults. Displacement on the main fault zones has been largely horizontal, although many smaller normal faults occur in the more competent beds.

Access difficulties in the area seem to preclude economic deposits of minerals, although some sparsely disseminated chalcopyrite occurs in some of the gabbroic bodies (Oipo Intrusives) intruding Asai Shale and Wulamer Beds. A small alluvial gold deposit is worked in the more accessible Simbai Valley.

INTRODUCTION

A reconnaissance of the Schrader Range, New Guinea, was carried out by me in March/April 1967. This Range forms the northern extension of the Bismarck Mountains, and is drained principally by tributaries of the Yuat and Keram Rivers which flow into the Sepik River; though streams at the south-eastern end of the Range flow into the Ramu River. Reconnaissance geological mapping of this region was required to provide further information about the Asai Beds (Dow & Dekker, 1964), and to join the mapping of the Bismarck Mountains (Dow & Dekker op. cit.) with that done by the Sepik Party in 1966.

Access

Since World War II Patrol Posts have been established in the head of the Simbai valley (Simbai Patrol Post) and in the Ramu valley (Aiome Patrol Post), and these are linked by rough walking tracks through the Asai valley (Pl. 1). Some graded motor cycle tracks exist in the upper Simbai and Kaironk valleys. Access to the northern and western parts of the region is severely hampered by the extremely rugged terrain, and may be gained only by long, arduous, walks over very rugged country, or by helicopter to a very limited number of landing sites.

Population

There are several thousand persons living in the area, most of them in the upper Kaironk, Simbai, and Asai valleys. The people, though small in stature, are strong and generally industrious, and make excellent carriers. In the more populous areas they are engaged in subsistance agriculture, and produce a variety of native vegetables. In the remote and heavily forested areas the people spend much of their time hunting.

Method of Working

The area was mapped by one continuous ground-traverse of some ninety miles, with several minor side-traverses. Native carriers recruited from Simbai were used ot transport food, camping equipment, and rock specimens. A helicopter was used for four days, and though its usefulness was limited by the paucity of landing sites the mapping was considerably extended by this means.

Airphotographs and base maps

The eastern half of the area mapped is covered by vertical airphotographs taken in 1957; no airphotos of the western half are available. Australian Army 1:250,000 series topographical maps were used as a base map for the survey, but almost no topographical detail is shown in the western half of the map.

Acknowledgements

The survey was greatly assisted by the cooperation of officers of the Department of District Administration, and especially by Patrol Officer Greg. McGrath who accompanied me on the traverse through the Wulamer valley from Simbai to Aiome. The hospitality extended at Aiome and Simbai was also greatly appreciated.

Specimen numbers in the text refer to specimens held in the Bureau of Mineral Resources Museum.

PHYSIOGRAPHY

The region is extremely rugged, and the main range rises steeply from the swampy Ramu and Sepik plains, culminating in Mount Aiome which is 9,300 feet above sea level. Numerous small streams and waterfalls tumble from the tops of the range and join to form a number of large deeply incised rivers such as the Wulamer, Keram, and Asai, which flow swiftly to the plain below. Dense jungle covers all but the upper Asai, Simbai, and Kaironk valleys, where it has been stripped away by the local inhabitants.

The climate varies considerably with altitude; it is oppressively hot and humid on the lower slopes of the Ramu valley but quite pleasant above 5000 feet. Aiome at the foot of the hills in the Ramu valley receives over 250 inches of rain a year and has an average daily maximum temperature of 80-85° F. Simbai, on the other hand, is in a rain shadow area and receives only about 120 inches of rain per year, and as it is at 5000 feet it is much colder.

In the lower altitudes mosquitos, leeches, and bush mites make traverse conditions trying.

GEOLOGY

General

Most of the area is composed of sheared and contorted marine sediments and volcanics intruded by small bodies of mafic and ultramafic plutonic rocks. These rocks are part of a north-easterly dipping succession which range in age from Upper Triassic to ?Upper Miocene. Strong faulting throughout the region has greatly complicated the picture, and elucidation of many of the stratigraphic relationships was impossible during this short survey.

UPPER CRETACEOUS TO MIOCENE (TERTIARY'e' STAGE)

Asai Shale (formerly Asai Beds)

A sequence of sedimentary rocks cropping out between the Simbai and Ramu Rivers was named the Asai Beds by Dow (1962), the name being derived from the Asai River which drains a large area of these rocks. During this survey the formation was shown to be composed predominantly of soft, black, carbonaceous shale, and it is thus proposed to rename the formation Asai Shale.

Similar rock types crop out within the Bundi Fault Zone as far east as Bundi (Dow and Dekker, 1964). McMillan and Malone (1960) described sediments very similar to the Asai Shale in the Palaeozoic Goroka Formation which crops out still farther to the south east. From their description it seems probable to me that much of the Goroka Formation can be correlated with the Tertiary Asai Shale formation.

The formation appears to conformably overlie the upper Cretaceous Kumbruf Volcanics in the Simbai River area, and in turn is overlain, possibly unconformably, by the Wulamer Beds in the Schrader Range.

DEFINITION

PROPOSED NAME:	Asai Shale
AUTHOR:	Bain, J.H.C.
PROPOSED PUBLICATION:	Bur. Min. Resour. Rec. (unpubl.), and in B.M.R. Report.
ROCK TYPE:	Black carbonaceous shale and phyllitic mudstone with minor limestone lenses.
DISTRIBUTION:	Along the crest and southwestern flank of the Schrader Range, and extending southwards along the Simbai valley.

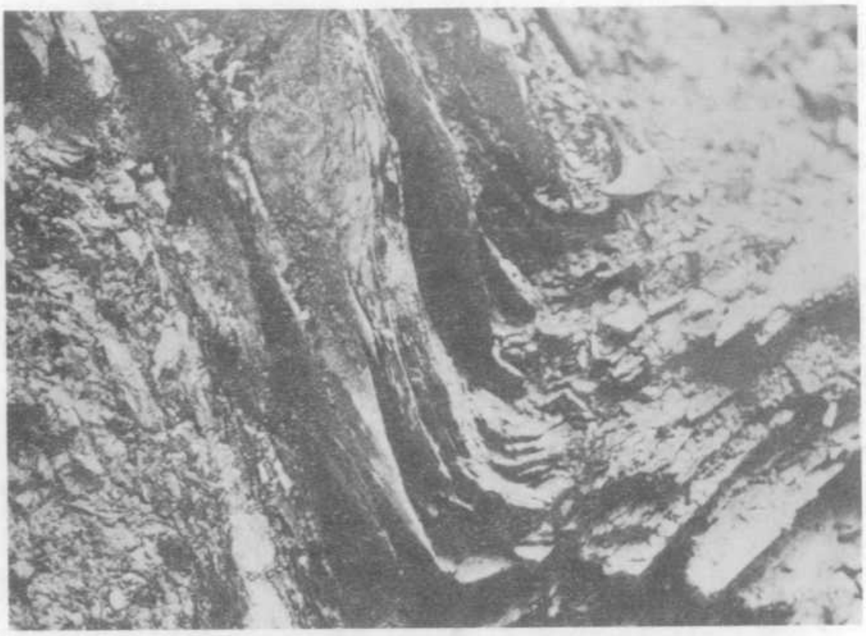


Fig.1. Folded cleavages in carbonaceous black shale of the Asai Shale Formation. (Neg. GA/47).

Fig.2. Typical topography in Asai Shale. Asai Valley, Madang District. (Neg.GA/44).

DERIVATION OF NAME:	The Asai River, a tributary of the Ramu River.
TYPE AREA:	The headwaters of the Asai R. (approx. 144° 35' E, 5° 12' S). No type section measured.
STRATIGRAPHIC RELATIONSHIPS:	Conformably overlies the Upper Cretaceous Kumbruf Volcanics in the Simbai valley and is overlain by the Wulamer Beds in the Schrader Range.
THICKNESS:	3350', but probably much thicker.
AGE:	Upper Cretaceous to Lower Miocene (Tert. 'e' stage)
1:250,000 SHEET AREA:	Ramu, SB 55-5

Soft black carbonaceous shale and siltstone containing many ramifying quartz and calcite veins, interbedded hard black shale and mudstone, and light grey phyllitic mudstone, constitute the bulk of the formation. Calcareous beds ranging from coarse dark grey foraminiferal limestone to fine black cherty limestone and highly indurated dark grey calcarenite occur as lenses within the sequence. Minor beds of dark greywacke, greenish feldspar porphyry and pebble conglomerate make up the rest of the formation.

Black carbonaceous shale (Fig. 1) is found at nearly all levels in the sequence. It is best exposed in the numerous slips at the heads of the Asai, Wulamer, and Keram valleys. Bedding is masked by well developed cleavage and tight mesoscopic folds (small scale: 1 to 5 feet amplitude, Fig. 1) which in places are revealed only by strongly contorted milky quartz veins. All exposures are strongly sheared, and the rock breaks easily into small flaky fragments which may be crumbled in the hand to form a carbonaceous powder.

Interbedded with the shale is hard black mudstone and shale and light grey phyllitic mudstone. These two rock types appear to form the few vague dip slopes visible on the airphotographs (e.g., on the northern side of the Kaironk valley along Campar Creek). In places these rocks are intensely sheared, and grade almost imperceptibly into a black carbonaceous shale containing small lenses and nodules of hard unsheared mudstone or beds of highly indurated phyllitic mudstone. These rocks have been intruded in places by basic plutonic rocks and some very minor leucocratic acid dykes which have caused them to become highly brecciated and indurated (almost hornfelsed) and veined with milky quartz.

The calcareous rocks in the sequence are: highly indurated dark grey calcarenite and a highly fossiliferous foraminiferal dark grey limestone which is probably a small lens. There are similar but somewhat recrystallised unfossiliferous lenses throughout the mudstone/shale beds. A fine black cherty limestone was collected from the Wulamer valley.

In Mindubrun Creek the calcarenite contains (Bivalves: Ostrea indet., Cucullaea sp. nov., ?Loripes sp.; and the Gastropod Cypraeidae indet. of possible Lower to Middle Tertiary age (Skwarko, pers. comm.). The foraminiferal limestone lens sampled above Salemp contains abundant Eocene Nummulites sp. Discocyclina sp. Pellatispira sp. Globigerina sp.. Terpstra (1967) has assigned to it an age of Tertiary 'b' stage (Upper Eocene, Bartonian-Auversian).

McMillan and Malone (1960) collected Tertiary Miocene 'e' stage foraminifera from the Bundi-Guebe area. These fossils were identified as Spiroclypeus margaritatus, S. orbitoides, Lepidocyclina (Eulepidina) cf. murrekana, L. verbeeki, and Operculinella, by Crespin and Belford.

TERTIARY ?MIOCENE

Wulamer Beds (new name)

A sequence, possibly 12,500 feet thick, of massive purplish green, volcanic agglomerate, buff-coloured limestone, sheared grey calcareous sandstone and grey phyllitic slate and shale has been called the Wulamer Beds.

DEFINITION

PROPOSED NAME:	Wulamer Beds
ROCK TYPE:	Massive limestone and basic volcanic agglomerate with minor beds of phyllitic slate and sheared pebble conglomerate.
DISTRIBUTION:	Along the northern flank of the Schrader Ra.
DERIVATION OF NAME:	From the Wulamer River (approx 144° 30' E 5° 05' S), a tributary of the Keram R.
TYPE AREA:	The Wulamer valley below the Wulamer Rest House at the junction of Angingar Ck and Wulamer R.. No type section was measured.
STRATIGRAPHIC RELATIONSHIPS:	The Beds probably unconformably overlie the Asai Shale, but the contact is almost entirely a faulted one. The top appears to be faulted against the Ramu/Markham Fault Zone.
THICKNESS:	At least 5000'; possible maximum of 12,500' if the succession is not repeated by faulting.
AGE:	?Miocene
1:250,000 SHEET AREA:	Ramu, SB 55-5

Lowermost in the sequence is the agglomerate, which is composed of rounded fragments (1-10cm) of basic and intermediate volcanics set in a highly indurated tuffaceous matrix. It is interbedded with red and green siltstone and some grey cherty argillite.

The agglomerate is overlain by 2500 feet of light buff-coloured, finely crystalline limestone which forms distinctive white cliffs where it crops out in the Wulamer gorge below the Rest House. In hand specimen the limestone is very thinly bedded, and varies in colour from pale yellow to pale green. In places it has been tightly folded on a mesoscopic scale (Turner & Weiss, 1963) to produce thin contorted layers of schistose chloritic material (probably remnants of small pelitic interbeds) that occur between thin limestone layers. The limestone is otherwise quite homogeneous in fabric, and despite close examination no fossils were found.

More agglomerate and interbedded siltstone of unknown thickness overlies the limestone.

Higher in the succession are highly indurated phyllitic shale, somewhat contorted grey slate, stretched pebble conglomerate, and dark grey sheared calcareous sandstone. Their precise thickness is unknown, but is about 6000 feet to 7000 feet. The sheared calcareous sandstone is unusual in that it has a pronounced foliation outlined by thin layers of carbonaceous material which enclose small schlieren of calcite. The slate, in places, is deformed into tight complex folds one to two feet in amplitude, and many speciments show fracture cleavage.

Unlike the less competent Asai Shale these beds have responded to applied stresses by normal faulting, and not by widespread shearing and deformation.

The formation is intruded by small gabbroic and ultramafic bodies of the Oipo Intrusives.

QUATERNARY

Elevated Alluvium

In the Ramu valley a flat to gently dipping sequence of some 400 feet of poorly consolidated sediments laps onto the Wulamer Beds in the foothills of the Schrader Range. The beds are mainly pebble conglomerate with thin beds and layers of mudstone and sandstone. Small lenses of blue-grey are common. The deposits are similar to alluvial fans being built up now by the larger streams draining the Schrader Range, and probably represent older elevated outwash fans. They are characterized by fine dendritic drainage.

RECENT

Alluvium

The flood plain of the Ramu River is composed mainly of coalesced, irregularly shaped deposits of mud, silt, sand, and pebbles. This sediment is very poorly consolidated, and is hence easily eroded by the meandering Ramu River. Although the deposits are clearly stratified it is impossible to trace any bed for more than a few yards.

INTRUSIVE ROCKS

?MIOCENE

Oipo Intrusives

The Oipo Intrusives range from gabbro to granodiorite in composition (Dow and Dekker, 1964), but within the area mapped only gabbro intrusions were observed. Most of the intrusive bodies are small stocks about 1 to 3 square miles in area, and are surrounded by numerous small dykes and sills of partly altered gabbro.

The gabbros are typically subophitic and consist of highly altered ragged augite (or pseudomorphs of chlorite and uralite after augite) and kaolinised twinned plagioclase. Accessory minerals are hornblende, magnetite, ilmenite, sulphides, and alteration products of the rock-forming minerals. They range in size from 1 mm to 7 mm; the coarser varieties generally having a spotted appearence resulting from patches of mafic, and patches of felsic crystals.

The coarsest variety observed had large (3-5mm), intricately formed, feathery magnetite crystals, in places intergrown with pyrite and forming 10 - 15% of the rock (speciment 67520311a). This rock, almost a pegmatite, probably occurs as a dyke intruding finer grained earlier differentiates.

Sulphide mineralization is widespread (though generally very sparse) throughout the Oipo Intrusives, and occurs mainly as disseminated pyrite and pyrrhotite and a few specks of chalcopyrite.

STRUCTURE

Faulting

Faulting dominates the structure of the Schrader Range, and appears to have been continuously active since Miocene time. Three major zones are recognised in the map area: the Bundi Fault Zone, the Ramu/Markham Fault Zone (Dow & Dekker, 1964); and the zone of faulting in the Wulamer Beds (Pl. 1).

Fig. 3. Bundi Fault Zone in the Kaironk Valley.
Neg. N. Ga/45.

Ramu/Markham Fault Zone: The existance of a major fault along the mountain front in the Ramu valley (Dow & Dekker, 1964) is clearly evidenced by the physiography and the strong deformation in the Wulamer Beds in its vicinity. The fault-zone in fact forms a trough extending the length of the Ramu and Markham valleys, and brings Upper Tertiary and Recent sediments in the north against Lower Tertiary and Mesozoic rocks in the south. This indicates a possible large vertical displacement, but not necessarily so, as the existing high scarp could have existed in Upper Tertiary time. In fact the latter seems probably as there is no evidence of late Tertiary sediments on the highlands. Evidence of recent movement is provided by the elevated Recent alluvial deposits that flank the Range and appear to have been raised by movement on the fault. It is not possible to determine what horizontal displacement, if any, has occurred.

Bundi Fault-Zone: The Bundi Fault Zone was first mapped near Bundi by McMillan and Malone (1960) and near Simbai by Dow in 1962. The fault-zone was further delineated and named by Dow & Dekker (1964). It has now been traced farther to the north west along the Kaironk valley as far as the Salemp Rest House, and it is most probable that the zone extends still farther to the north-west, roughly paralleling the Jimi Fault where it follows the Yuat River (Dow et al., 1967), and disappearing beneath the Sepik River foodplain to the north.

The zone consists of a number of slightly curved anastomosing faults which on the surface are expressed as wide, near vertical shear-zones. Vertical movement does not appear to have been great, and Dow & Dekker (1964) cite the following evidence in support of a largely transcurrent movement on the Simbai Fault:

1. Eocene foraminifera collected from limestone on both sides of the Simbai Fault near Tunonk Creek.

2. The courses of some of the rivers crossing - and partly following - the fault appear to have been displaced by fairly recent clockwise transcurrent movement on the fault.

Several strong faults within the zone have controlled the course of the Kaironk River and some of its tributaries above Salemp Rest House (Fig. 3), and given rise to Timbam Ridge.

Faulting in the Wulamer Beds: Unlike the less competent Asai Shale the Wulamer Beds have responded to the applied stresses moreby fracturing than by shearing. Thus the competent limestone and agglomerate beds are extensively broken by an anastomosing series of north-west-trending normal faults (Pl. 1). Vertical displacement has been about 2000 feet to 3000 feet, as deduced from the airphotographs. Sheared rocks are restricted to small zones along the actual fault lines and do not comprise the bulk of the formation as they do in the Asai Shale. No transcurrent movement has been detected in this zone of faulting.

Folding

In this short survey it was impossible to obtain sufficient data to elucidate fully the pattern of folding in the Schrader Range. Although the structure shown by the massive beds is apparently simple (most of the rocks dip consistently at low angles to the north-west), small-scale (mesoscopic) folding of cleavage in the Asai Shale (Fig. 1) indicates a more complex picture. Small milky quartz veins which transgress the cleavage in the shale have been folded concentrically (specimen Ra3), indicating at least two periods of deformation. The cleavage trends generally from 90° to 150°, and dips at high angles. In places thin ($\frac{1}{4}$ - $\frac{1}{2}$inch thick) beds of the Wulamer limestone interlayered with chloritic material show small-scale (1 - 2 inches amplitude) similar folding.

Almost all the sedimentary rocks in the Schrader Range show some signs of recrystallisation, and in most places an incipient schistosity, due to very low-grade regional metamorphism. Morgan (1960) has examined in thin section some metamorphosed rocks collected by Corbett (1962) from the Wulamer Beds in the lower Asai, Tigananse, and Aunja valleys. These rocks are low-grade derivatives of arkosic siltstone (possibly crystal tuffs) and intermediate lavas, and Morgan believes that they can be placed in the Greenschist Facies of regional metamorphism.

ECONOMIC GEOLOGY

Gold: Auriferous gravel deposits in the Tunonk Creek valley at Kumbruf were discovered by Leahy in 1954 whilst accompanying the first Government Patrol into the area. Initially J.C. MacKinnon and W. Babbington worked the deposit by ground sluicing. For a while MacKinnon used a small monitor, but work on the prospect ceased in May, 1962, after 677.8 ounces of 877-900 fineness gold had been taken out (Dow & Dekker, 1964). However, the prospect has since been reworked and expanded using unsupervised teams of local labour. When I visited Kumbruf in April nine sluice boxes had been installed, and MacKinnon had obviously planned further expansion. Total gold production figures are:

	Fine ounces	Value
From 11/1/58 to 3/4/67	993.85	$31,057.44

The prospect is a remnant of an elevated and weathered auriferous terrace. The terrace was probably formed by blockage of the ancestral Tunonk Creek by movement on the Simbai Fault (Dow & Dekker, 1964). Dow believes the gold in the terrace to have been derived from prophyritic microdiorite intrusions at the head of Tunonk Creek.

Copper: Very sparsely disseminated copper, mineralization was found in the gabbro bodies of the Oipo Intrusives. However, none of the occurrences appeared at all promising, especially as the geographical setting would make all but extremely large deposits uneconomic. A single sample (Speciment No. 67520314c) of quartz-veined, basic volcanic conglomerate, containing chalcocite, with bornite and covellite in the quartz, and magnetite, chalcopyrite, and pyrite in the volcanic part, was collected from the Wulamer Beds in the upper Keram River.

REFERENCES

CORBETT, D.W.P., 1962 - Geological reconnaissance in the Ramu Valley and adjacent areas, N.G. Bur. Min. Resour. Aust. Rec. 1962/32 (unpubl.).

DOW, D.B., and DEKKER, F.E., 1964 - The geology of the Bismarck Mountains N.G. Bur. Min. Resour. Aust. Rep. 76

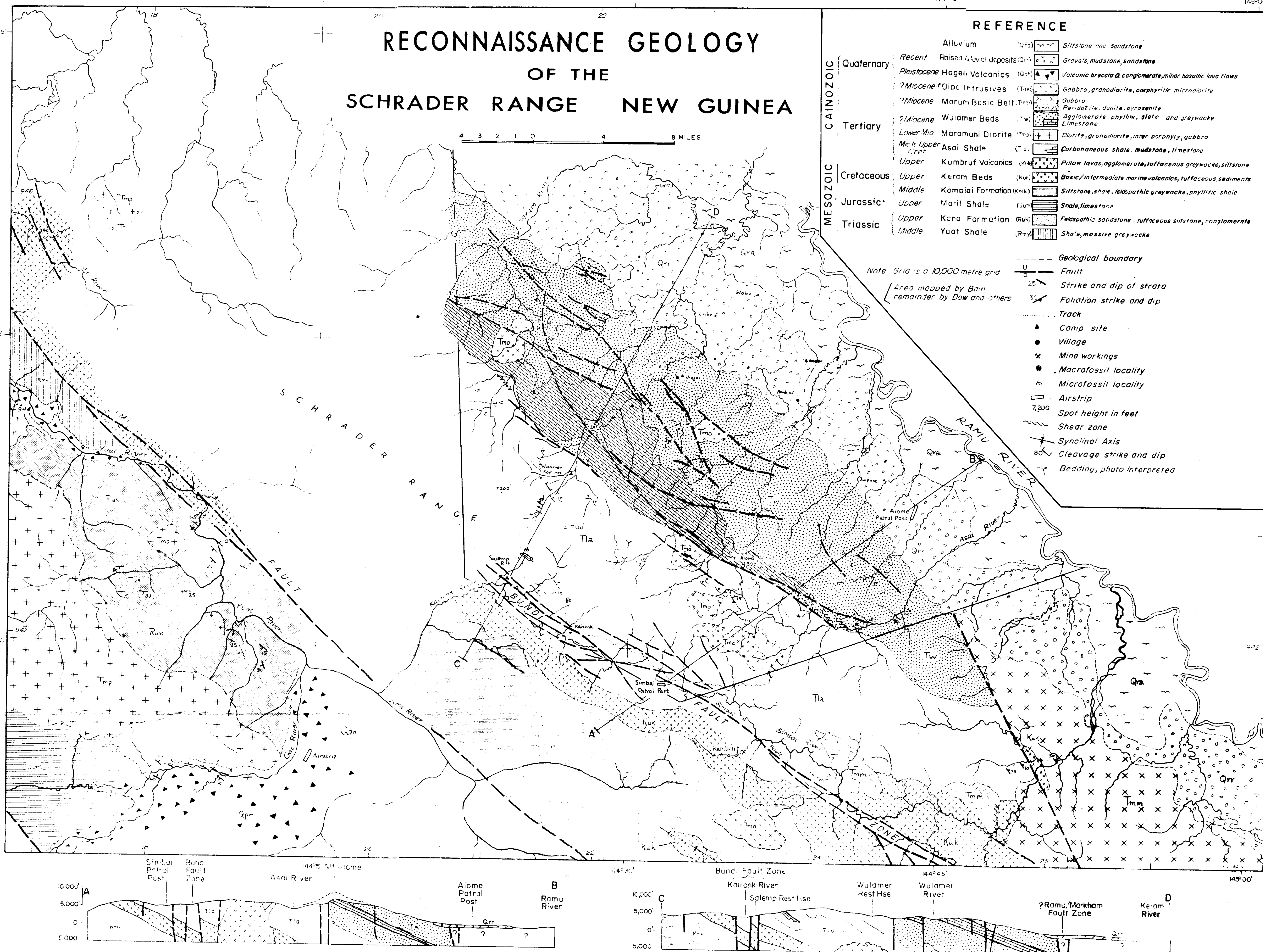
DOW, D.B., SMIT, J.A.J., and BAIN, J.H.C., 1967 - The geology of the South Sepik Region Progress Report for 1966. Bur. Min. Resour. Aust. Rec. 1967/26

McMILLAN, N.J., and MALONE, E.J., 1960 - The geology of the Eastern Central Highlands of N.G. Bur. Min. Resour. Aust. Rep. 48

MORGAN, W.R., 1960 - The petrography of specimens collected from the Lower Ramu and Atitau area T.P.N.G. Bur. Min. Resour. Aust. Rec. 1960/6 (unpubl.)

TERPSTRA, G.R.J., 1967 - Surface sample Sepik area, New Guinea. Bur. Min. Resour. Aust. Minute 65/1660

TURNER, F.J., and WEISS, L.E., 1963 - Structural Analysis of Metamorphic Tectonites McGraw-Hill, New York.



Geology by J.H.C. Bain, D.B. Dow, F.E. Dekker, J.A.J. Smit

Scale 1:250,000 No vertical exaggeration

To accompany Record 1967/94

P/A173