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REPORT ON COPPER OCCURRENCES, DURACK RIVER - SALMOND RIVER, DISTRICT, KIMBERLEY DIVISION, WESTERN AUSTRALIA.

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H.G.Roberts, G.M.Derrick &J.F.Ivanac

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SUMMARY

During 1963 and 1965 three new copper occurrences were found in the Durack River-Salmond River area of the Kimberley region of Western Australia by joint parties of the Bureau of Mineral Resources and Geological Survey of Western Australia. Two of the occurrences (the "New York" and "Pentecost Range") are in a bed of chloritic siltstone near the base of the middle subdivision of the Pentecost Sandstone, which is of Carpentarian age. The occurrences are 26 miles apart and because of extensive superficial cover, their discovery was fortuitous.

Malachite is the sole copper mineral and when leached it leaves an off-white powdery residue. Because of soil cover the thickness of the mineralized section is unknown, but up to 5 feet of cupriferous siltstone carrying 0.36% copper is exposed in gullies. The mineralization is possibly syngenetic and should be prospected for by geochemical methods.

The third copper occurrence is of minor interest and is associated with vein quartz introduced during brecciation of the host rock, the Elgee Siltstone, which lies stratigraphically above the Pentecost Sandstone.
below.

INTRODUCTION

J.E. Harms of the Broken Hill Pty. Company, during the course of a regional geological mapping programme, discovered several copper occurrences in the East Kimberley region of Western Australia, and visited other, known, occurrences (Harms, 1959). Two of these - the "Campbellmerry" and "Karunjie" occurrences - lie between the Durack and Salmond Rivers, 60 to 80 miles south-west of Wyndham. Subsequently, during the course of a Bureau of Mineral Resources - Geological Survey of Western Australia regional mapping project, three further occurrences of copper minerals were found in this general district. The locations of the various occurrences are shown on Plate 1, which is a geological map incorporating parts of four 1:250,000 Sheet areas (Cambridge Gulf - Plumb & Veevers, in prep; Lissadell - Dunnet & Plumb, 1964; Ashton - Derrick, 1966; and Mount Elizabeth - Roberts & Perry, 1966).

Geological Setting

With the exception of the "Karunjie" occurrence, the mineralization occurs in sedimentary rocks of the Kimberley Group; at Karunjie the copper minerals are found in a dolerite sill (Hart Dolerite) which intrudes the strata of the Kimberley Group.

The Kimberley Group is of Carpentarian age (1800 - 1400 m.y.) and makes up a large part of the sedimentary pile deposited in the Kimberley Basin. The Group is made up of five formations - a generalized stratigraphic section is given in Table 1.

Table 1

Rock Unit		Thickness in feet	Lithology
Pentecost Sandstone	Upper	800	Medium - and coarse-grained quartz sandstone
	Middle	2100	Medium-and fine-grained quartz sandstone and feldspathic sandstone; siltstone; shale
	Lower	550	Medium-grained quartz sandstone
Elgee Siltstone		300	Red-brown siltstone and claystone
Warton Sandstone		1300	Medium-grained quartz sandstone
Carson Volcanics		1800	Basalt, agglomerate, feldspathic sandstone
King Leopold Sandstone		4000	Medium-and coarse-grained quartz sandstone

In the Durack River - Salmond River district the strata of the Kimberley Group are generally shallow-dipping; dips of more than 5° are rare. The rocks have been folded into broad anticlines and synclines. A few faults are present but they have only minor throws.

COPPER MINERALIZATION

"New York" and "Pentecost Range" occurrences

Two of the three newly discovered occurrences - the "New York" and "Pentecost Range" occurrences - lie in strata near the base of the middle subdivision of the Pentecost Sandstone (symbol Pkpm on Plate 1). A stratigraphic section measured at the "New York" locality is set out below and shown diagrammatically in Figure 1.

20'+	Pink weathering, pink, fine-grained, blocky, laminated to thin-bedded quartz sandstone. Resistant - forms bench.
80'	Purple or steel-grey weathering, purple to grey, fine - to medium-grained, flaggy, laminated, ferruginous, micaceous, glauconitic feldspathic sandstone. Generally friable, but a more resistant bed towards the top forms a bench. Thin sections show that some of the glauconite pellets have been replaced by apatite.
50'	No outcrop except near the base of the section in a gully along a vehicle track where five feet of section is exposed; this consists of grey-green, thinly flaggy to fissile, laminated, cupriferous micaceous siltstone.
20'	Purple-brown, fine to medium-grained, flaggy, weakly laminated, silicified, feldspathic sandstone; forms rubbly outcrop.

_____Base of middle Pentecost Sandstone_____

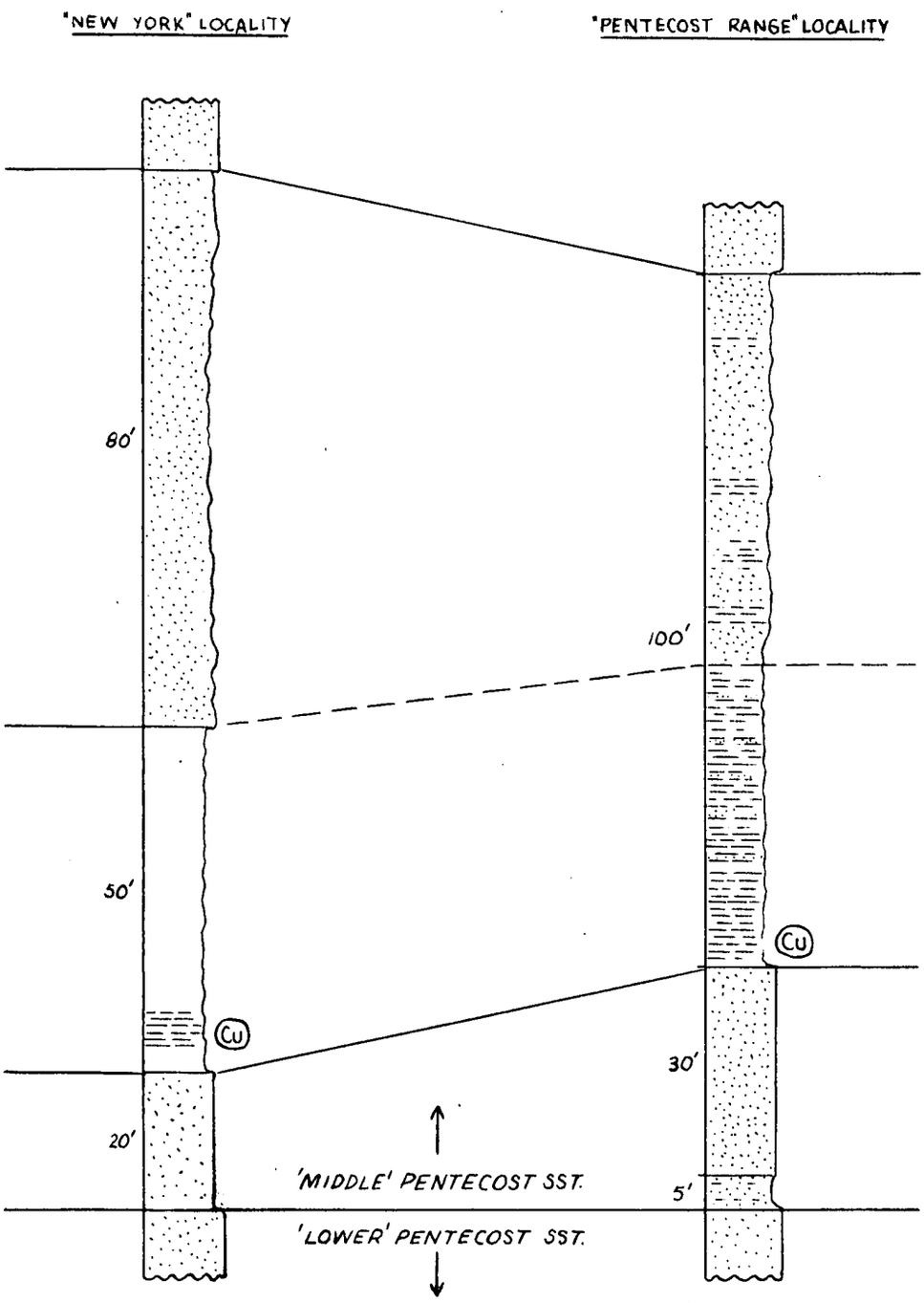
A section measured through the equivalent strata at the "Pentecost Range" locality by K.A. Plumb (pers. comm.) is set out below and shown diagrammatically on Figure 1.

?	Massive to blocky sandstone
100'	Interbedded flaggy, purple, micaceous sandstone and fissile, green micaceous, fine-grained sandstone and siltstone, grading downwards into fissile, grey-green siltstone with flaggy green micaceous sandstone interbeds at base. Malachite occurs along bedding planes in lower-most 5 feet of section.
30'	Pale green, blocky, fine-to medium-grained, silicified quartz sandstone
5'	Pale green, flaggy to fissile, silty sandstone.

_____Base of middle Pentecost Sandstone_____

From a comparison of the two sections it can be seen that the copper mineralization lies in lithologically similar beds holding identical positions in the stratigraphic sequence. The two occurrences are 26 miles apart and were found independently, and fortuitously, during regional geological investigations. Most significantly the localities are two of only three places around the flanks of Menuairs Dome where outcrops of the copper-bearing part of the sequence were examined - the beds are poorly resistant to erosion and are generally covered by soil, scree or alluvium. The third place where the beds have been examined is 2½ miles west of the "New York" occurrence. No sign of mineralization is evident at this locality and a sample of siltstone assayed only 58 ppm. copper.

Fig. 1



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The host rock is a grey-green, thinly flaggy to fissile, laminated, micaceous chloritic siltstone. The mineralized section is known to be at least 5 feet thick at both the "New York" and "Pentecost Range" localities. Pontifex (1966) reports that graphite is present in the rock in accessory amounts. The presence of glauconite in the strata overlying the chloritic siltstone beds suggests that the sequence may have been deposited in a marine environment.

The copper occurs as pale apple green, radiating clusters of malachite flakes up to one-quarter of an inch across and one-fortieth of an inch in thickness. The flakes are mostly parallel to the bedding planes and laminations; in some cases they have been noted in cross-cutting fractures. Where the malachite is leached it leaves off-white powdery blebs with fine serrated edges. A random sample of siltstone from the "New York" occurrence assayed 0.36% copper.

Bindoola Creek Occurrence

The Bindoola Creek mineralization occurs along a small fault zone cutting rocks of the Elgee Siltstone. Derrick (1966) records that copper is present as malachite coatings on bedding planes of fissile red-brown siltstone and mudstone, and that it is associated with a gypsum gangue. Traces of malachite are also present in a quartz-chlorite mudstone-breccia and Derrick suggests that the introduction of the copper and vein quartz may have been contemporaneous with the brecciation of the host rock.

Karunjie Occurrence

The copper mineralization near Karunjie is in a sill of medium-to coarse-grained dolerite (the Hart Dolerite) which intrudes along the contact between the lower and middle subdivisions of the Pentecost Sandstone. The sill is probably about 50 feet thick to the south-west of the Homestead but it pinches out to the north-west. It extends only a few miles to the south of the area shown on Plate 1. Equivalents of the cupriferous sequence of the Menuairs Dome district overlie the sill but they show no evidence of having been mineralized.

The copper minerals occur as disseminated discrete grains scattered through the dolerite. The dolerite generally crops out as large boulders surrounded by areas of black soil and because of this it is not possible to assess the extent of the mineralization. Harms (1959) has pointed out that the proportion of copper-bearing boulders to barren boulders is small and that the average grade is low.

Campbellmerry Occurrence

The Campbellmerry occurrence lies in about the middle of the middle subdivision of the Pentecost Sandstone and has been described by Harms (1959) as consisting of "narrow veins of siliceous lode carrying copper oxides and carbonates". The source of the mineralization is not apparent.

SIGNIFICANCE OF THE MINERALIZATION

The Karunjie", "Campbellmerry" and "Bindoola Creek" copper occurrences are regarded as being of little economic interest. On the other hand the "New York" and "Pentecost Range" occurrences, on present evidence, could possibly be parts of more extensive copper bodies. Features of significance in this regard are-

(i) the occurrences are in beds of identical lithology and stratigraphic position;

(ii) the copper minerals occur mainly as discrete laminae parallel to the bedding;

(iii) the cupriferous beds are poorly exposed (the "New York" occurrence would not have been observed but for recent erosion along the edge of a newly graded track); and

(iv) the occurrences lie on the flanks of the Menuairs Dome and are at two of only three places inspected during the mapping programme.

Thus it might reasonably be expected that the mineralization may (i) extend along strike and down-dip and (ii) be found over a greater stratigraphic thickness. Greater concentrations of copper may possibly be found in favourable localities.

Most evidence suggests that the copper is of syngenetic origin, but the possibility that it may have been introduced by a hidden sill of Hart Dolerite cannot be entirely dismissed, particularly in view of the fact that such a sill, carrying copper, intrudes along a similar stratigraphic level near Karunjie. The lack of boxworks or cavities indicative of primary mineralisation is puzzling, and could indicate that the malachite has migrated to its present position. However in the absence of evidence of dolerite we favour the syngenetic theory.

CONCLUSIONS

The cupriferous chloritic siltstone beds constitute an exploration target and should be prospected. Regardless of whether the mineralization is of syngenetic or epigenetic origin, other occurrences could be found by geochemical prospecting of the areas underlain by the favourable beds.

It is recommended -

(i) that preliminary geochemical sampling be carried out at the "New York" and "Pentecost Range" localities to determine the extent of the mineralization along strike and to give some indication of the grade, and

(ii) that detailed geological mapping and reconnaissance geochemical sampling be conducted over the chloritic siltstone beds and the overlying strata around the full extent of the Menuairs Dome.

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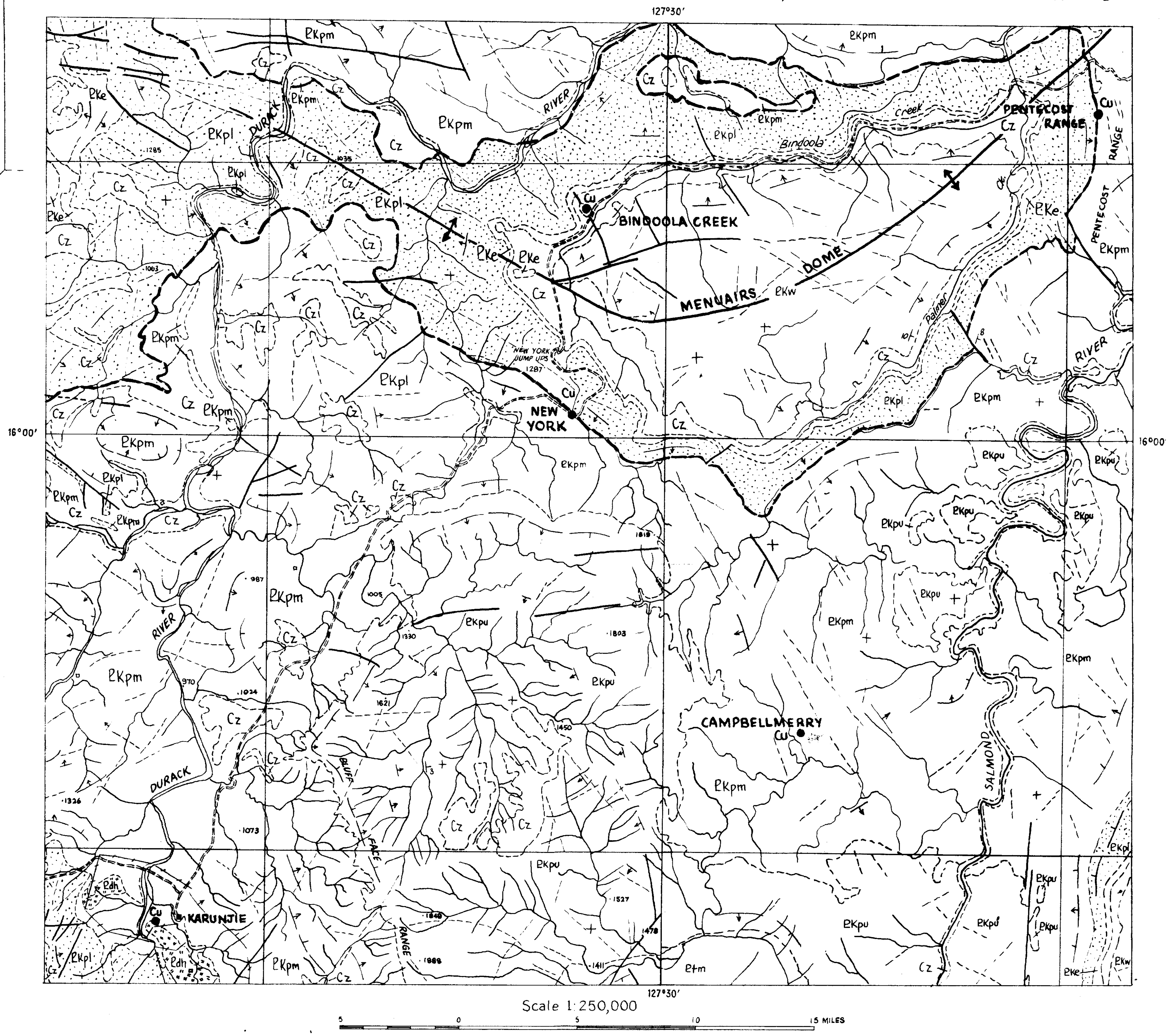
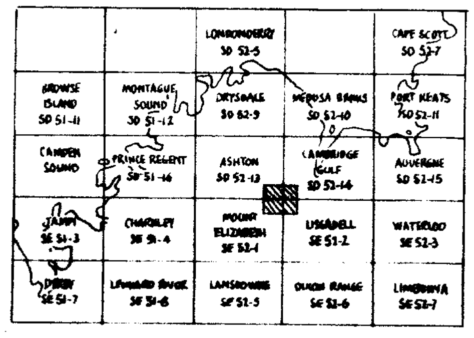
GEOLOGICAL MAP — DURACK RIVER DISTRICT, W.A.

PLATE 1





REFERENCE:—

		Cz	*Soil, sand, alluvium*
	Mendena Formation	Ƌtm	*Siltstone, quartz sandstone*
	Hart Dolerite	Ƌdh	*Dolerite*
KIMBERLEY GROUP	Pentecost Sandstone	ƎKpu	*Quartz Sandstone*
		ƎKpm	***Quartz sandstone**, feldspathic **sandstone**, siltstone, shale*
		ƎKpl	***Quartz sandstone***
	Elgee Siltstone	ƎKe	*Siltstone, claystone*
	Warton Sandstone	ƎKw	***Quartz sandstone***

- - - -	*Geological boundary*
———	*Fault*
>×//	*Joints*
.1527	*Spot height in feet*
●Cu	*Copper occurrence*
↑	*Regional dip (>5°)*
— —	*Favourable bed*
↕	*Anticlinal axis*

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