

COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.
BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS.

RECORDS.

1950/31

NOTES ON PALAEOZOIC STRATIGRAPHY, CAMBRIDGE

GULF AREA

by

A. A. Opik.

The information contained in this report has been obtained by the Department of National Development, as part of the policy of the Commonwealth Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

NOTES ON PALAEOZOIC STRATIGRAPHY, CAMBRIDGE.

GULF AREA.

by

A. A. Opik

RECORDS 1950/31

CONTENTS

	<u>PAGE .</u>
INTRODUCTION	1
AREA BETWEEN BUTTONS CROSSING (ORD R.) AND MT. SEPTIMUS (BURT RANGE)	1
MAIN RESULTS	1
Upper Devonian	2
Cockatoo Sandstone	2
Burt Range Series	2
The Devonian at Buttons Crossing	2
CARBONIFEROUS	3
Burt Range and Mt. Septimus	3
AREA BETWEEN CARLTON AND NIMBING	5
PREVIOUS INVESTIGATIONS	5
CAMBRIAN	5
ORDOVICIAN	5
DEVONIAN (Burt Range Series)	5
AREA BETWEEN ORD RIVER AND VICTORIA RIVER (CAMBRIDGE GULF - QUEENS CHANNEL AREA)	6
POINT SPRING	6
SANDY CREEK	6
FLAPPER HILLS	6
CORRELATION	6
FEATURES TO BE LOOKED FOR IN FUTURE EXAMINATIONS	7
REFERENCES	7

NOTES ON PALAEOZOIC STRATIGRAPHY, CAMBRIDGE GULF AREA

by
A.A. ⁿOpik

Records 1950/51

INTRODUCTION

At the end of the 1949 field season A.A. ⁿOpik, accompanied by D.M. Traves, collected fossils and made stratigraphical observations in the area between the lower reaches of the Ord River and the Victoria River. This report gives a preliminary summary of the results of the journey.

Geological maps, sections, and reports on the area are in preparation by D.M. Traves and W.C. Smith. (4-mile Geological Series, Sheet D52-14, first edition July 1950.)

AREA BETWEEN BUTTON'S CROSSING (ORD RIVER) AND MT. SEPTIMUS (BURT RANGE), W.A.

MAIN RESULTS. The preliminary examination of fossils collected by D.M. Traves, W.C. Smith, and A.A. ⁿOpik in the 1949 field season confirms the stratigraphical relations in the area established by R.S. Matheson and C. Teichert (1948). In addition, the age of the Carboniferous Mt. Septimus limestone was determined as equivalent to the upper part of Lower Mississippian because of the occurrence in it of Marginirugus. Also the author suggests a Lower Mississippian age for the unfossiliferous sandstone on top of the Upper Devonian Burt Range "Series". The suggested stratigraphical interpretation is summarized in the following table :

Devonian and Carboniferous between Mt. Septimus and the Ord River

General subdivision and interpretation, Acc. Matheson & Teichert 1948	Subdivision, mainly acc. Matheson and Teichert, without interpretation of the age.	Suggested age determination
Carboniferous limestone	Fossiliferous limestone of Mt. Septimus Sandstone with worm burrows.	Lower Carboniferous (Lower part of the Mississippian)
		Passage Beds
Burt Range Series (Upper Devonian)	Limestone ridges W. of Mt. Septimus Limestone at Button's Crossing (Ord River)	Upper Devonian
Cockatoo Sandstone Lower Upper Devonian	Cockatoo Sandstone	

UPPER DEVONIAN
Cockatoo Sandstone

Lepidodendron (Leptophloeum) australe (McCoy) is the only fossil yet known from the Cockatoo sandstone. It is an Upper Devonian plant, widely distributed in Victoria and also N.S. Wales. Leptophloeum was recorded from the foot of Mt. Cecil (between the Ord River and Burt Range) by R.S. Matheson and C. Teichert (1948).

In the 1949 field season D.M. Traves and A.A. Opik collected more fossils in an amphitheatre-like gully at the southern end of Mt. Cecil, in a reddish, soft, coarsely grained sandstone. The fossils, which are very poorly preserved, are indistinct plant impressions, perhaps a fragment of a nautiloid cephalopod, and some pelecypods. The pelecypods represent Palaeonatina ? sp. and Edmondia ? sp., genera which are known from the Devonian (Palaeonatina) and Devonian to Permian (Edmondia).

Upper Devonian Burt Range "Series" or Burt Range Limestone.

The Burt Range "Series" was first described by R.S. Matheson and C. Teichert 1948, from an extensive area west of Burt Range. The Burt Range "Series" represents the upper part of the Devonian.

Fossils were collected in the 1949 field season by W.C. Smith, D.M. Traves, and A.A. Opik. Generally the collections confirm the results previously obtained by R.S. Matheson and C. Teichert. The collection made by W.C. Smith, though a small one, reflects well the sequence of the limestones. The following localities yielded additional and new material :

- (1) A limestone outcrop 3.7 miles west of Mt. Septimus, (W.C. Smith)
- (2) Limestone ridges 5 miles W. of Mt. Septimus, (D.M. Traves and A.A. Opik).

The first locality, 3.7 miles west of Mt. Septimus, obviously represents the top of the Devonian fossiliferous limestone of the area visited. The limestone contains Leptaena cf. analega, Fenestrellina sp., Camartoechia cf. pleurodon, Naticopsis sp., and ostracods. The fauna is very like that collected from the Carboniferous of Mt. Septimus. It confirms the suggestion of a possible continuous sedimentation from the top of the Devonian into the Carboniferous. It seems natural that the sandstone overlying the Devonian limestone may represent in reality the base of the Carboniferous as has been pointed out in the next chapter on the Carboniferous of Mt. Septimus.

The second locality is represented by several extended limestone ridges, 19.6 miles east of the Ord River and about 5 miles west of Mt. Septimus. Numerous silicified fossils have been collected. The gastropods especially deserve mentioning, because most of them are new records for the area, and also for the whole Kimberley district. It is unusual in that some Lower Carboniferous gastropods are represented, although the whole fauna is definitely a Devonian one.

The fossils are : Syringopora sp., Productella (numerous in one band), Athyris sp., Schuchertella sp. (?), and the gastropods Bellerophon, Euomphalus, Straparelus, Platyschisma, Naticopsis, Geraunochilis, Murchisonia, Trochena (Trochonemopsis), Eunema, Neekospira. The list is still incomplete; more gastropods are present, but can only be determined properly after they have been separated from the matrix.

The Devonian at Button's Crossing (Ord River) or Burt Range Limestone.

The occurrence is well described by R.S. Matheson and C. Teichert (1948) as the Devonian of the Ivanhoe Graben. It represents the lower part of the Burt Range "Series" overlying the Cockatoo Sandstone.

It corresponds approximately to the Productella limestone at Fitzroy River to the west.

Lithologically the Devonian limestone at Button's Crossing does not differ very much from the limestones west of Mt. Septimus. The limestone at Button's Crossing is rich in Syringopora and Productella. Numerous loose spines of Productella are present amongst the detrital part of the limestone. In the collection from Button's Crossing the following fossils were identified - Several genera of ostracods; Brachiopods, Productella sp., Meristella sp., and Chonetes sp.; gastropods, Straparolus, Trochonema, Murchisonia; a species of rugose corals, and Syringopora in abundance; stromatoporoids and calcareous algae.

Chonetes has been recorded previously by R.S. Matheson and C. Teichert from higher horizons of the Burt Range "Series", but this appears to be the first time it has been recorded from the limestone of Button's Crossing. The gastropod fauna of Button's Crossing is nearly the same as that given in this report from the limestone W. of Mt. Septimus. It now appears quite possible that the limestone 19.6 miles east of Ord River is represented at Button's Crossing also, and that it forms there the top of the Devonian sequence of the Ivanhoe Graben.

CARBONIFEROUS

Burt Range and Mt. Septimus

Carboniferous rocks were observed previously by R.S. Matheson and C. Teichert in 1945 and their report was published in 1948. At this time it was the only known occurrence of Carboniferous rocks in W.A. Although Carboniferous beds have since been discovered in the North-West Basin, W.A., The Burt Range - Mount Septimus Carboniferous still represents the only area of rocks of this age in the north-western part of Australia.

The fossils listed in the present communication were collected by geologists D.M. Traves and W.C. Smith, and by D.M. Traves and A.A. Opik, during two visits to Mt. Septimus in 1949. These collections are the first ever made from Mt. Septimus. Matheson and Teichert collected Carboniferous fossils about 4-5 miles south of Mt. Septimus, and predicted that the Carboniferous limestone would be found at Mt. Septimus also.

The Carboniferous is represented in general by limestone. Except for a few bands of pure crinoidal limestone, the rocks at Mt. Septimus always contain some quartz sand. Practically all types of sediments from pure limestone, through sandy limestone to sandstone cemented by calcite, are present. Current bedding, and in places ripple marks, are common in all types of rocks, fossiliferous and unfossiliferous in the Carboniferous sequence at Mt. Septimus.

The Carboniferous age of the sequence has been deduced by Matheson and Teichert from its position above unfossiliferous sandstone which overlies limestone with Upper Devonian fossils. The fossils they collected, were described as follows: "assemblage, although in a general way resembling that of the Upper Devonian limestone, is yet distinctly different" (Matheson and Teichert, 1948, p.14). They conclude that the Carboniferous age of the limestone described can therefore not be questioned. "It is, however, at present impossible to say for certain what part of the Carboniferous it represents" (ibid, p.15).

Now the presence of Leptaena analoga Phillips indicates a definite Lower Carboniferous (Mississippian) age for the limestone of Mt. Septimus. The presence of Productus (Marginirugus) is perhaps even more important. A.H. Sutton (1938, p.576) states that Marginirugus is confined to the Keokuk and Warsaw formations of the Mississippian of the Mississippi Valley. These formations represent the top of the lower half of the Mississippian (Lower Carboniferous). Until further work is done the position of the Mt. Septimus limestone can be summarized as in the following table:

General Time Unit	Formations in Mississippi Valley (Sutton, 1938)	Burt Range, N.W. Australia
Mississippian (Lower Carboniferous)	11. U. Chester 10. M. Chester 9. L. Chester 8. Ste. Genevieve 7. St. Louis 6. Salem 5. Warsaw) <u>Margini-</u> 4. Keokuk) <u>fugus</u> 3. Burlington 2. Fern Glen 1. Kinderhook	Mt. Septimus Limestone Sandstones with worm burrows (Top of Burt Range "Series"). Or Snowie Sandstone.

The sandstone with worm burrows on top of the fossiliferous Devonian (Burt Range Series) is tentatively placed here in the Carboniferous too, as Matheson and Teichert, p.14, state that "the two series are more or less "conformable".

The distribution of fossils in the section of Mt. Septimus suggests that it might be possible to subdivide the limestone into two parts. The lower part is rich in Camarotoechia, spiriferids and productids. The top part is characterized by the abundance of Rhipidomella and Composita. This distribution is shown very well in a collection made by W.C. Smith, who collected fossils from five different horizons.

Fossils are abundant and are mostly silicified on the exposed bedding planes. Over twenty-five genera could be recognized. Corals are represented by a rugose ("Zaphrentis"), Michelinia and Syringopora; Echinodermata by abundant fragments of crinoids; Bryozoa by Penestrellina, Chaetetes, and some Trepostomata; Brachiopoda by Rhipidomella cf. australis (differing from australis McCoy by its larger muscle scars), Leptaena analega Phillips, Orthotetes sp., Productus (Productus) sp., Linoproductus (?) sp., Productus (Marginifugus) n. sp., Spirifer (Spirifer) sp., Spirifer (Tylothyris?) sp., Spirifer, gen. indet. (large, costate and costellate), Spirifer, gen. indet. (perhaps new, small, with a cardinal process, and costae on the fold-sinus in an advanced age only), Reticularia ? (perhaps a Torrynifer?), Athyris sp. (very large), Composita (abundant, fold and sulcus obscure), Camarotoechia aff. pleuredon Phillips; Gastropoda by Euomphalus, Platyceras (Orthenychia), Trilobitae by a fragmentary pygidium; Ostracoda by three genera of little stratigraphical value.

2. AREA BETWEEN CARLTON AND NINBING

PREVIOUS INVESTIGATIONS. The area has been mapped and described by F. Reeves (1949). The fossils he collected were examined by C. Teichert, and Devonian and Cambrian have been recorded. The Devonian rocks along the Carlton-Ninbing track represent, according to C. Teichert, a part of the Burt Range "Series", perhaps the lower part equivalent to the Productella Limestone of the Fitzroy River area. Cambrian (Reeves, 1948, p.16) has been identified by a trilobite, Solenoparia n. sp., indicating a Middle Cambrian age. The Cambrian shows two divisions: (1) a lower one, about 1000 feet thick, of red sandstones, which is correlated with the Mt. Elder Sandstone overlying the Negri Series at Ord River; (2) an upper sequence of sandstones and oolitic limestone nearly 800 feet thick, according to the section measured by F. Reeves. Near the base of this part of the section Solenoparia occurs.

MAIN RESULTS. During the 1949 field season W. C. Smith, D. M. Traves and A. A. Opik collected additional material from this area, from localities apparently not visited by Reeves. The interpretation of the Cambrian and Devonian by C. Teichert (in Reeves, 1949) has been generally confirmed. In addition, in a piece of glauconitic sandstone collected W.C. Smith, Ordovician fossils have been identified.

CAMBRIAN. 1) About 7.5 miles N.E. of Carlton on the N.W. side of the Carlton-Leguna track, in a ridge of very sandy oolitic limestone, just overlying the lower sandstone of the Cambrian sequence (the equivalent of the Mt. Elder sandstone), a small fauna has been collected. The fossils are: Trilobitae:- Solenoparia n. sp., Damesella sp., Blackwelderia sp.; Brachiopoda:- Acrotreta sp., Obolus sp., Lingulella sp.; and problematical worm tracks.

The presence of Damesella and Blackwelderia indicates a very young Middle Cambrian age of the sediments. The fauna represents practically the top of Middle Cambrian. It belongs to the Chinese palaeogeographical province. Above this horizon, according to W.C. Smith, some thousands of feet of similar sediments are present in this area. Obviously a part of them represents Upper Cambrian, overlying the fossiliferous top of the Middle Cambrian.

ORDOVICIAN. 2) In the N.E. of the belt of Cambrian outcrops, an Ordovician formation, mainly sandy in composition, overlies the Cambrian without a visible break in the sedimentation. A glauconitic sandstone with conodonts and Lingulella contains the only Ordovician fossils collected so far. The conodont genera cf. Drepanodus Pander and cf. Acontiodus Pander, besides perhaps a new genus, indicate a possible Lower Ordovician age for the formation. The rock is a friable, only slightly consolidated, glauconitic sandstone, identical in lithology with the Upper Tremadocian Baltic "Glauconite Sandstone" from which Ch. Pander more than a century ago discovered and described the first known assemblage of conodonts, which is still matchless in preservation and abundance of forms.

DEVONIAN (BURT RANGE "SERIES"). The Ordovician is covered by Devonian limestones, but the (character of) the contact is still unknown. Besides an erosional hiatus, a certain disconformity can be expected by analogy with the relation of the Devonian to the Ordovician at Price's Creek in the West Kimberleys.

The lowest part of the Devonian is very poor in fossils. A piece of limestone collected by W.C. Smith near the supposed contact with the Ordovician contained a little Spirifer, non-diagnostic Radiolaria, identified by Miss I. Crespín, and few indeterminate ostracods. Whether this limestone belongs to the top of the Middle Devonian, or the base of the Upper Devonian, cannot be recognized from the meagre fossils. The beds above these that are exposed along the Ninbing track are described by Teichert in Reeves (1948). D.M. Traves collected samples in several spots, which practically repeat the results of Reeves and Teichert.

- 1.) Carlton formation
- 2.) Pander Sandstone, type locality is Pander Hill (new name)

AREA BETWEEN ORD RIVER AND VICTORIA RIVER (CAMBRIDGE
GULF - QUEENS CHANNEL AREA).

POINT SPRING.

The sandstones in the cliff at Point Spring can be divided into two parts. (1) Upper sandstone, with current bedding, clay pellets, and various tracks and burrowings, rich in plant remains; cf. Cordaites-like leaves, Calamites stems (perhaps Phyllothea), and Stigmaria (roots), are observed on some exposed bedding planes. Representatives of the Glossopteris flora are noticeably absent. The preservation is poor. The character of this flora, combined with the absence of the Lower Permian Glossopteris elements, suggest a high position in the Permian for this sandstone. Of the same character is the Erskine Sandstone in the West Kimberley Division, according to C. Teichert (1941, p.388). (2) Lower sandstone, with marine fossils - brachiopods. A relatively small species of Dictyoelostus (fam. Productidae), is common; a Spirifer sp. is rare. By the fossils and the position immediately below the plant-bearing horizon, this sandstone represents, perhaps, the recession of a marine formation, comparable with the top of the Upper Ferruginous beds, or Liveringa Series of the West Kimberleys.

It seems natural to expect that deeper horizons of the Permian in this area will yield more marine fossils than have been found near the contact of the top of the marine beds with the younger plant-bearing sandstones at Point Spring. These lower marine beds are represented at Sandy Creek, and at Flapper Hills, near Leguna.

SANDY CREEK. The partly dolomitic limestone and the sandstone of Sandy Creek yielded several marine fossils, without plant remains. Amongst the forms represented are a Dictyoelostus, perhaps the same as at Point Spring; a Chonetes, which is very like one of the species attributed to Chonetes pratti in W.A.; an indeterminable nautiloid cephalopod; gastropods; a rugose coral; and a Syringopora-like coral.

From the marine character of the Sandy Creek beds, and the presence of Dictyoelostus, the limestone is considered to have a stratigraphical position below the sandstones of Point Spring.

FLAPPER HILLS. At Flapper Hills a white hard quartzite interbedded with brown soft sandstones, is well exposed. Fossils are abundant and the composition of the fauna is richer than at Sandy Creek.

In the Flapper Hill sandstones the Chonetes sp. from Sandy Creek limestone and the Syringopora are represented, and the Chonetes is the dominant fossil here. These fossils link up the Sandy Creek limestone with the Flapper Hill sandstone. Other recognizable fossils are Cleiothyridina sp., Rhipidomella sp., two species of Spirifer, a Productus, and a genus of Orthotetinae.

It is the richest fauna of the area, and shows a definite relationship to the fauna of the Liveringa Series. The Flapper Hill sandstone by its fauna is nearly equivalent to the one of Sandy Creek. But the Flapper Hill sandstone is perhaps richer, more "marine", and therefore represents perhaps a slightly older horizon than the Sandy Creek limestone.

CORRELATION. In the correlation table the succession is summarized on the assumption of the recession of the marine faunas. The indentation of Sandy Creek limestone and Flapper Hill sandstone is an assumption also, which can be changed by putting Flapper Hill sandstone completely below the Sandy Creek limestone.

Only three fossiliferous localities were examined, no contacts were observed, the preservation of fossils is poor - so the present interpretation may be considerably changed in the future.

Correlation of Permian strata in the coastal area between Carlton and Legana.

Carlton - Legana Track

W. Kimberleys

Point Spring sandstone (upper)
lacustrine, with plants.

Erskine
Series

Point Spring sandstone (lower),
marine, with brachiopods.

Sandy Creek sandstone,
limestone
(marine)

Flapper Hill
sandstone (marine)

Upper Ferruginous, or
Liveringa Series

Weaber Range Group has been proposed for the Permian of this area.

FEATURES TO BE LOOKED FOR IN FUTURE EXAMINATIONS.

1. The presence of a lacustrine plant-bearing facies is an indication of possible coal deposits in association with the Point Spring sandstone.
2. Older, marine, more fossiliferous horizons can be expected.
3. Between the Point Spring sandstone, and the Sandy Creek - Flapper Hill beds, more stratigraphical members are likely to occur.

REFERENCES.

- Matheson, R.S., and Teichert, C., - 1948 Geological Reconnaissance in the Eastern Portion of the Kimberley Division, Western Australia. Report of the Department of Mines for the year 1945, Perth.
- Sutton, A.H., - 1938 Taxonomy of Mississippian Productidae. Journal of Paleontology, vol.12, no.6, p.537.
- Teichert, C., - 1941 Upper Paleozoic of Western Australia. Bull. Amer. Ass. Petroleum Geologists, vol.25, no.3.

MAP

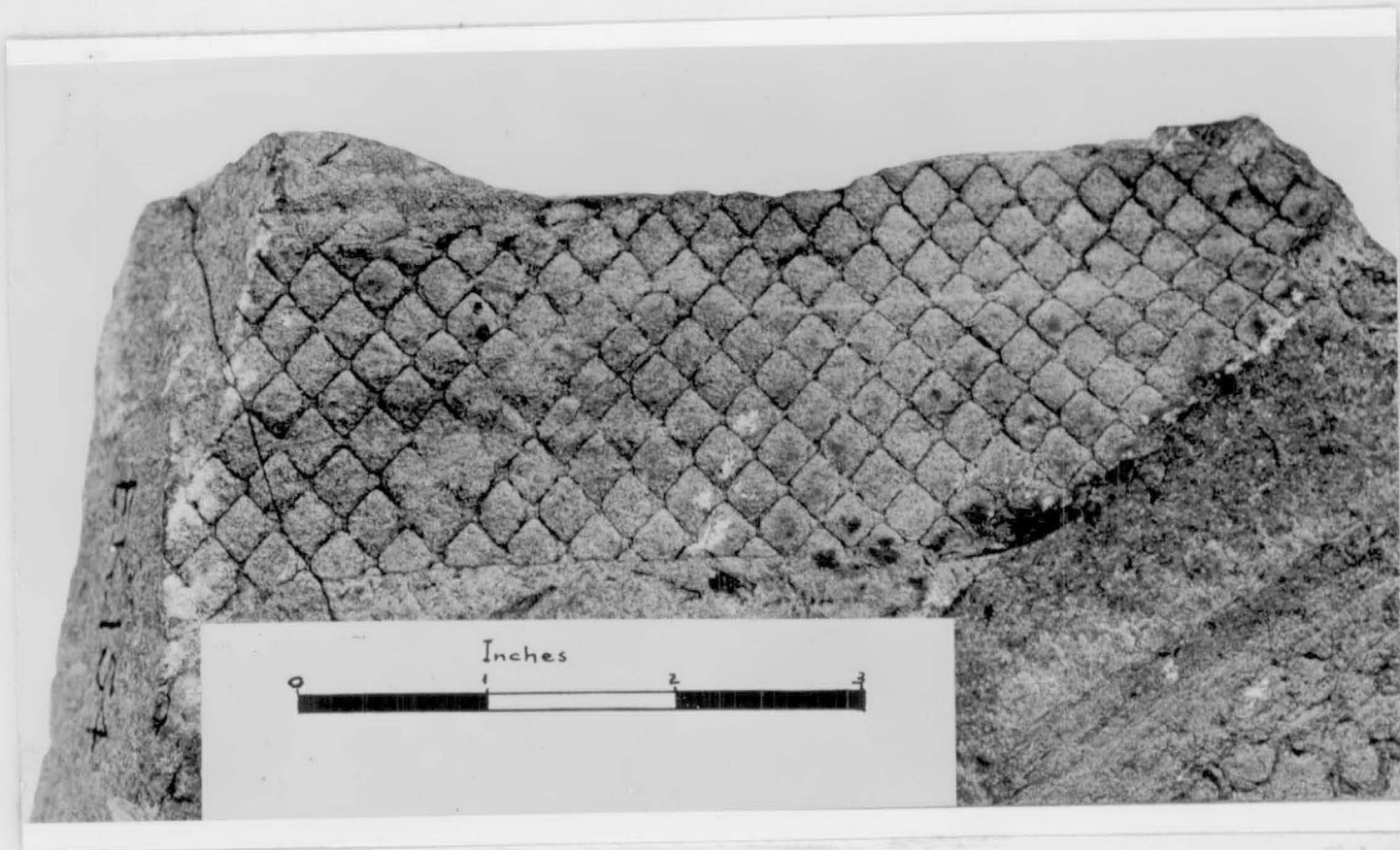
Map was not supplied in the
hardcopy of record 1950/31.

Cambridge Gulf, W.A., 4-mile Geological Series, Sheet D52-14. First edition, July, 1950, Bureau of Mineral Resources, Geology and Geophysics.

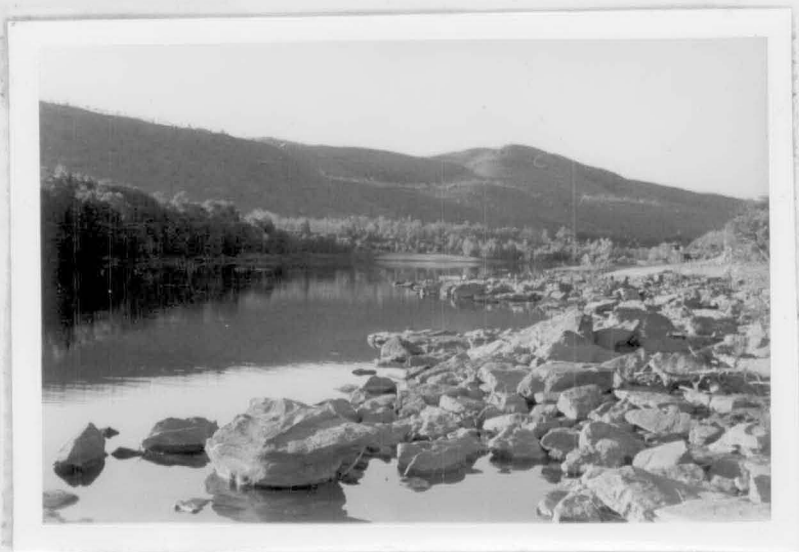
The names of stratigraphical Units, Carlton Formation, Cambrian; Pander Sandstone, Ordovician; Burt Range Limestone, Upper Devonian; Snowie Sandstone, Lower Carboniferous as "Passage Beds"; Weaber Range Group, Permian, are first used in this map.

ILLUSTRATIONS

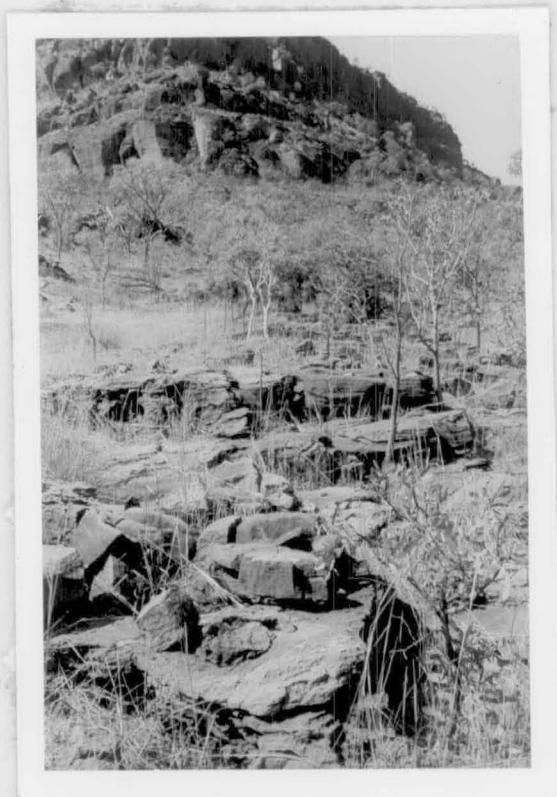
1. Leptophloeum cf. australe McCoy, from Mt. Cecil. Coll. by Matheson and Teichert. Courtesy, Mr. Ellis, Geol. Survey, W.A.
2. Devonian limestone at Button's Crossing over the Ord. Pre-Cambrian (Victoria River Group) in the background.
3. Mt. Septimus, Carboniferous limestone, with unfossiliferous Permian sandstone on top.
4. Carboniferous limestone, Mt. Septimus, with irregular current bedding. White dots represent fossils.
5. Ordovician conodonts, from Pander Formation, east of Carlton. Enlarged 15 diameters.
6. Cambrian beds 7.5 miles east of Carlton, the fossiliferous locality at the Leguna track.
7. Hieroglyphic worm tracks, Cambrian at Carlton, on top of the Ridge, fig. 8
8. Plant remains in the Upper Point Spring sandstone, Permian. At the lens a Stigmaria.
9. Flapper Hills at Leguna. Permian marine quartzite.



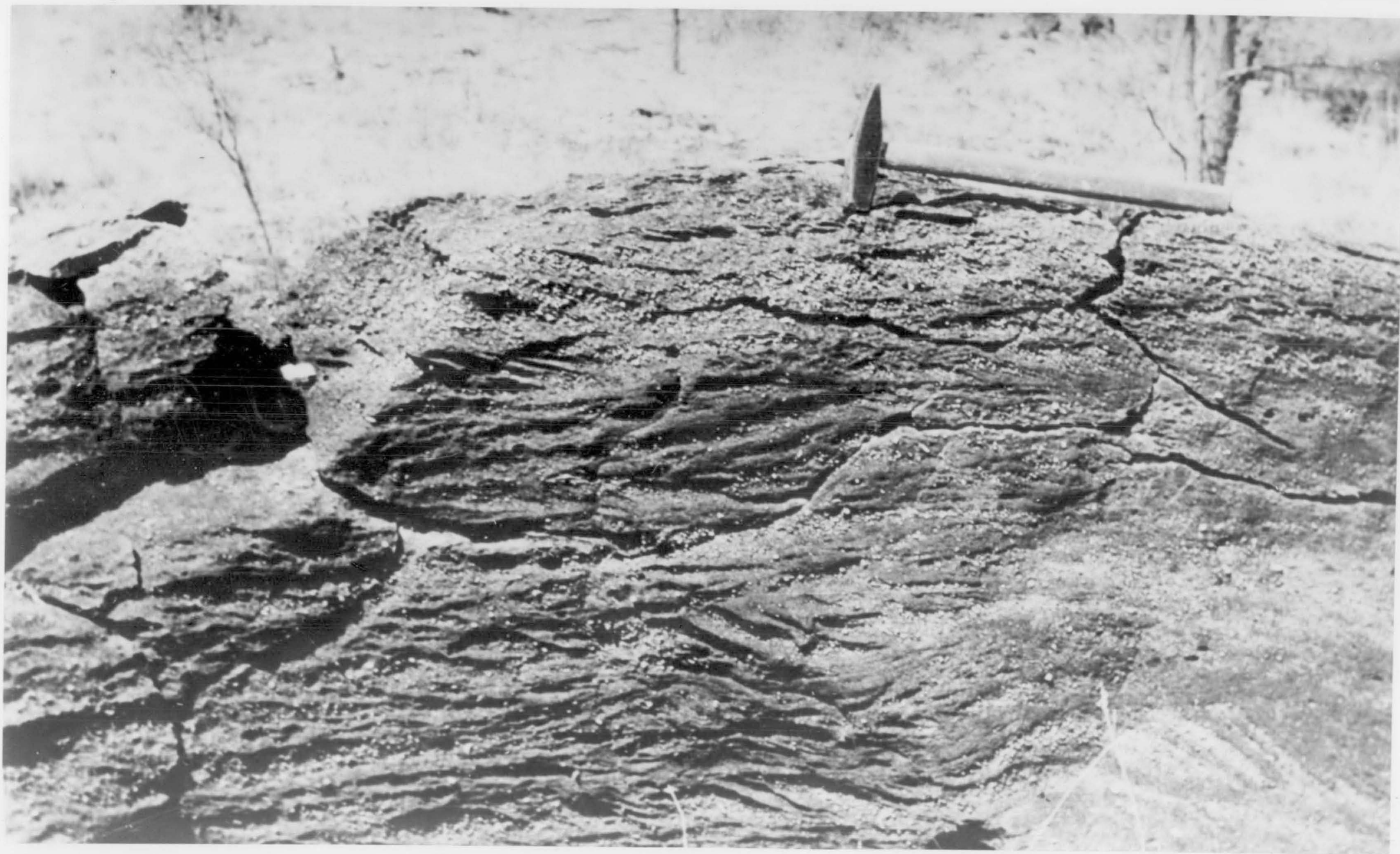
1.

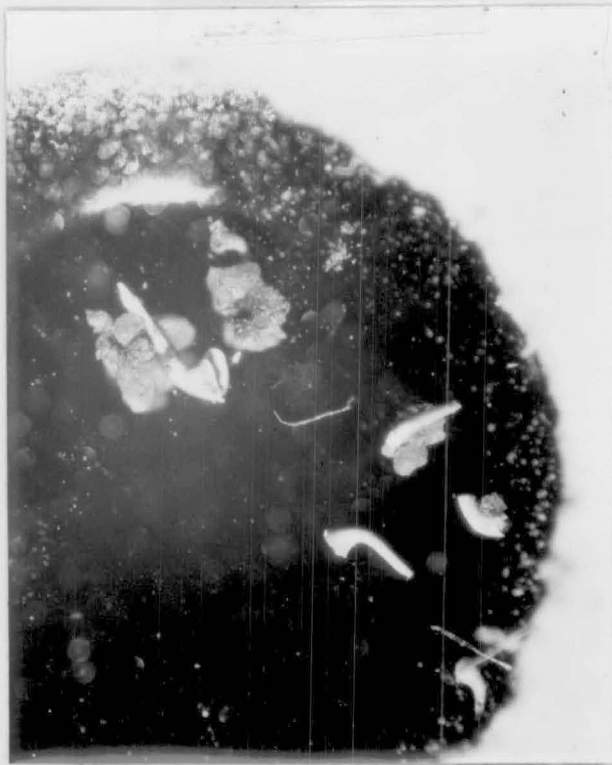


2.



3.





5.



6.



7.





Q.