COMMONWEALTH OF AUSTRALIA.

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

RECORDS:

1964/91

SOME PALYNOLOGICAL OBSERVATIONS ON THE MESOZOIC OF THE BARALABA, MONTO, TAROOM, & MUNDUBBERA 1:250,000 SHEET AREAS, BOWEN-SURAT BASIN, QUEENSLAND.

by

P.R. Evans

SOME PALYNOLOGICAL OBSERVATIONS ON THE MESOZOIC OF THE BARALABA, MONTO, TAROOM, & MUNDUBBERA 1:250,000 SHEET AREAS, BOWEN-SURAT BASIN, QUEENSLAND.

by

P.R. Evans

RECORDS 1964/91

CONTENTS

SOME PALYNOLOGICAL OBSERVATIONS ON THE MESOZOIC OF THE BARALABA, MONTO, TAROOM, & MUNDUBBERA 1:250,000 SHEET AREAS, BOWEN-SURAT BASIN, QUEENSLAND.

SUMMARY

Surface and near surface Mesozoic samples from the Baralaba, Monto, Taroom, and Mundubbera 1:250,000 Sheet areas of the Bowen-Surat Basin of Queensland, which have been palynologically examined in the Bureau of Mineral Resources during the past five years are listed, and their contents noted. The samples are allocated to palynological units which were originally determined in subsurface sections in the Surat Basin. The symbols used for these units are modified to accord with those used for the Upper Palaeozoic. Every subsurface unit is represented in outcrop, and an allocation of the outcropping formations to the unit sequence is suggested, as follows:

Age	Unit	Formation
Jurassic	? J4	Injune Creek Beds
	J3	Hutton Sandstone
	J2	Evergreen Formation Oolite member
	J1	Boxvale Sandstone Member Precipice Sandstone
	UNCONFORMITY	
M.-U Triassic	Tr3	Moolayember Formation Clematis Sandstone
L. Triassic	Tr2	Rewan Formation
	Tr1	
Permian	P4	Coal measures (Baralaba C.M. & Bandanna Formation)

INTRODUCTION

The stratigraphy of the early Mesozoic outcrops across the northern margin of the Surat Basin, and along the axis of the Bowen Basin, have been studied by many workers since the first reconnaissances of Jensen (1926). Important contributions to knowledge of these strata have resulted from studies of their economic potential as a source of artesian water (Whitehouse, 1955), or oil and gas (Reeves, 1947; Mott, 1952; Mack, 1964; Tissot, 1963a,b). Unfortunately, the early Mesozoic of the region appears to be devoid of macrofossils other than plant remains, very rare vertebrates, and rarer freshwater pelecypods. Whitehouse, Reeves, and Mott had no palaeontological means of firmly establishing the age of stratigraphic units encountered, or of correlating outcrops with the subsurface.

With the advent of Commonwealth subsidy to drilling operations, particularly in the Bowen and Surat Basins, palynological investigations of these basins' stratigraphy were undertaken by the author, commencing with a study of A.A.O. Pickanjinnie No.1 in 1959 to determine the age relationships and correlations necessary to understand the geological history of the basins.

Relationships indicated by these investigations have been progressively determined and demonstrated in subsidized well completion reports. The data supplied, together with palynological studies by Dr. de Jersey and his colleagues of the Geological Survey of Queensland, have been used by Moran and Gussow (1964), Tissot (1963a,b), and Mack, (1964) in their syntheses of the stratigraphy of the Bowen and Surat Basins, but all these authors lacked the necessary outcrop data from which a more complete picture could be obtained.

However, samples collected at intervals since 1960 by geologists of Mines Administration Pty Ltd, by Mr. V. Forbes of the Geological Survey of Queensland, and by the author during the 1962 and 1963 field seasons, and material from seismic shot holes and B.M.R. shallow drill holes related to the critical outcrop sections, combined with recent mapping of the Baralaba and part of the Monto 1:250,000 Sheet areas (Olgers et al., 1964), and the Taroom, and part of the Mundubbera areas (Jensen et al., 1964), have provided enough information for a general comparison of the outcrop and subsurface to be now made.

The purpose of this report is to summarize the data obtained and to briefly consider the relation of previously determined subsurface palynological units to the outcrop sequence. Further discussion of the subsurface extension of the units thus recognized will follow at a later date. Discussion is limited to the Triassic and Lower-Middle Jurassic of the area. The underlying Permian and the overlying Middle-Upper Jurassic and Lower Cretaceous of the Bowen and Surat Basins are considered in Evans (1964a,b).

Palynological correlations of these early Mesozoic sediments have been previously expressed in a variety of informal terms, such as "Zone 1" and "TR 1". Although some of these terms are widely used by oil exploration geologists, it is proposed to replace them with a terminolgy consistent with that used for the Upper Palaeozoic (Evans, 1964a). To facilitate conversion, the old nomenclature is bracketed with the new throughout this paper.

STRATIGRAPHIC SUCCESSION

A geological sketch map of the area discussed showing the approximate location of samples examined, is presented in figure 1. Further details of these locations may be found on maps prepared by Olgers *et al.* and Jensen *et al.* (*loc. cit.*).

Considerable variations in formation thickness are recorded by these authors. The following table of units recognized in the Taroom and Mundubbera areas was supplied by A.R. Jensen (pers.comm.).

	Formation	Thickness (feet) West (Taroom)	East (Mundubbera)
Jurassic	Injune Creek Beds	500+	500+
	Hutton Sandstone	450	400
	Evergreen Formation		
	shale	100	150
	oolite member	20	30
	Boxvale Sst.	100	-
	shale	200	330
	Precipice Sandstone	250-350	100-400
Triassic	Moolayember Formation	2000	4,500
	Clematis Sandstone	800	1,000
	Rewan Formation	1,300-2,500	12,000

LOWER TRIASSIC

The Permian and Triassic of Eastern Australia cannot be satisfactorily distinguished from each other because of the general lack of marine faunas in critical sections. The end of the *Glossopteris* flora has been long regarded as the end of the Permian (David, 1950). The last appearance of *Glossopteris* in the Bowen-Surat Basin occurs in coals of the Bandanna Formation in the Springsure area, and in the Baralaba Coal Measures near Cracow. No satisfactorily preserved floras have been recorded from between the coal horizons and the *Dicroidium* floras of the Clematis Sandstone. The lack of fossils in the intervening Rewan Formation led to varying age determinations of that formation. The unit was referred to the Permian (as part of the Upper Bowen Coal Measures or Series) by Jensen (1926) and Reeves (1947), to the Triassic by Shell (Queensland) Development Pty Ltd (1952) and Hill (1957), and again to the Permian by Phillips (in Hill & Denmead, 1960).

The end of the *Glossopteris* flora in the Sydney Basin also corresponds to the cessation of coal formation at the top of the Newcastle Coal Measures. As in the Bowen-Surat Basin, the *Dicroidium* flora was not well developed in the Sydney Basin until sometime after the disappearance of the *Glossopteris* flora, i.e. not until the Gosford Formation, at the top of the Narrabeen Group had been deposited.

The microfloral change between the Newcastle Coal Measures and the overlying Narrabeen Group has been indicated by Balme & Hennelly (1956) and Hennelly (1958). The author examined the change in the Strevens Enterprises Terrigal No.1 Well, on the north-eastern margin of the basin, while Helby (1963) studied the south-western margin. Assemblages characterized by striate pollens of the "Lueckisporites"* amplus and "Lueckisporites" limpidus types, associated with Laevigatosporites vulgaris Balme & Hennelly, Marsupipollenites triradiatus f. striatus B. & H. and rare Dulhuntyispora parvithola (B. & H.) and Acanthotriletes ericianus B. & H., is rapidly replaced by striate pollens of the Taeniaesporites type, non-striate Alisporites (including "Pityosporites" nigricostatus Hennelly), Nuskoisporites radiatus Hennelly and new monosaccate species of Trizonaesporites, by many new pteridophyte spores, and the appearance, at least briefly, in considerable numbers of Quadrisporites horridus Hennelly. For the present, this microfloral change is taken as the palynological Permian-Triassic boundary. It is noted, however, that the Scythian microflora in the Kockatea Shale of the Perth Basin, Western Australia, (Balme, 1963) is closer in many respects to the Unit Tr 2 microflora discussed below. It is possible that a portion of Unit Tr 1 should also be included in the Permian, as suggested by Helby (1963). Until the microflora of the only known Tartarian marine horizon in Australia, the Hardman Member of the Liveringa Formation in the Fitzroy Basin, Western Australia, is studied, no proof of Helby's proposition will be available, and the microfloral version of the macrofloral system boundary in eastern Australia is retained for the present. The same microfloral change occurs above the highest major coal developments in the Bandanna Formation of the Springsure area (Evans, 1964a).

The upper limit of the Lower Triassic is not so well defined. The Gosford Formation, where the Dicroidium flora is well established for the first time in the Sydney Basin, was regarded by David (1950) as late Lower or Middle Triassic in age. The Terrigal No.1 Well showed that the establishment of Dicroidium is associated with the disappearance of Taeniaesporites, which is replaced by the dominance of Alisporites spp. (pteruchid types), and the incoming of several new pteridophyte genera. This microfloral change is taken to represent the palynological Lower Middle Triassic boundary.

As explained below, this change takes place within the Clematis Sandstone of the Bowen-Surat Basin. The entire Rewan Formation is therefore referred to the Lower Triassic.

Subdivision of the Lower Triassic seems possible, to the extent that broad assemblage changes observed in Terrigal can also be recognized in Queensland. Details of these changes, based mainly on the disappearance of the large saccate pollens such as Trizonaesporites and the appearance of momolete spores such as Aratrisporites and Saturnisporites have yet to be worked out, but to facilitate later investigations, the Lower Triassic is here subdivided on this basis into Units Tr 1 and Tr 2.

Unit Tr 1 (Rewan Formation)

1. A.A.O. No.7 (Arcadia)

The Permian Bandanna Formation does not crop out in the western Taroom area. Shell (Queensland) Development Pty Ltd (1952) thought that this formation was represented at the surface

---

* "Lueckisporites" in its currently used sense is not the correct genus for these species described by Balme & Hennelly. As the nomenclature of these striate pollens is still much confused, no amendment to their taxonomy is attempted at this stage. Where possible the suprageneric term striatiti is used.

in the Arcadia anticline. Derrington (1957) followed Shell's suggestion and recognized Bandanna Formation from surface downwards in the A.A.O. No.7 (Arcadia) Well. Evans (in Mines Administration Pty Ltd, 1962) noted the palynological and lithological distinctiveness of the well section above the highest coal at 350 feet, and suggested that it should best be regarded as part of the Rewan Formation. Jensen *et al.* (1964) remapped the Arcadia outcrops as Rewan. The A.A.O. No.7 well section is then considered to represent the lowest Rewan Formation in the western part of the Taroom area.

Cuttings at 305 feet, 50 feet above the highest coal, yielded:

Todisporites sp.
Granulatisporites sp.
Thymospora sp.
Discisporites sp.
Nuskoisporites triangularis (Mehta)
N. radiatus Hennelly
"*Pityosporites*"* *reticulatus* Hennelly
Alisporites nigricostatus (Hennelly)
Taeniaesporites spp.
Striatiti spp. undiff (incl. *limpidus* type)

Cymatiosphaera sp.
Quadrisporites horridus Hennelly

Cuttings at 205 feet yielded:

Leiotriletes directus Balme & Hennelly
Granulatisporites sp.
Apiculatisporis spp.
Thymospora sp.
Nuskoisporites cf. *N. triangularis* (Mehta)
Nuskoisporites sp.
Trizonaesporites sp.
"*Pityosporites*"* *reticulatus* Hennelly
"*Pityosporites*"* sp.
Alisporites spp. (pteruchid types) (common)
Taeniaesporites spp.
Striatiti spp. undiff. (incl. *limpidus* type)

Marsupipollenites cf. *M. triradiatus* B. & H.

Micrhystridium sp.
Quadrisporites horridus Hennelly.

---

* These species should probably be referred to Helby's MS genus *Hennellisporites*.

Other samples from between and above these horizons have been examined, but they gave poor yields. The coal at 350 feet contained a typical Permian, Unit P4, microflora (Evans, 1964a). The two assemblages listed above are to be found in the basal Narrabeen Group in the Sydney Basin. N. triangularis, Striatiti spp. of the limpidus type, and M. triradiatus, present throughout most of the Permian, make their last appearance at this level.

2. Planet Warrinilla North No.1

Spores from the basal Rewan Formation in Warrinilla North No.1 were recorded by Evans (in Myers, 1963) from core 8, (2047 feet). The spores and pollens were fairly common, although organic debris formed the bulk of the residue. They included:

Todisporites sp.
Apiculatisporis spp.
Thymospora sp.
Nuskoisporites radiatus Hennelly
N. triangularis (Mehta)
"Pityosporites" spp. inc. "P". reticulatus H.

3. Planet Warrinilla No.1

Core 3 (1320-34 feet), taken from about 135 feet above the base of what is here considered to be the Rewan Formation yielded:

Apiculatisporis sp.
Granulatisporites spp.
Thymospora sp.
Taeniaesporites sp.

Quadrisporites horridus H.

4. B.M.R. No.23 (Taroom)

The basal Triassic on the eastern flank of the Mimosa Syncline has not yet been examined. B.M.R. Nos. 24 and 25 (Taroom) probably represent this interval, at the base of the Rewan Formation, near Theodore. B.M.R. No. 23 (Taroom) was taken from an unspecified level in the lower part of the Rewan Formation in that area (Malone, 1963).

It yielded:

Cyathidites sp.
Todisporites sp.
Discisporites sp.
Thymospora sp.
Trizonaesporites sp.
"Pityosporites" spp. incl. P. reticulatus H.
Vitreisporites pallidus (Reissinger)
Alisporites spp. (pteruchid types)
Taeniaesporites spp.

Few pteridophyte spores were present, and *Q.horridus* could not be found. However, the bulk of large saccate types links this horizon with the lower division (Unit Tr 1) of the Lower Triassic.

5. Union-Kern-A.O.G. Burrunga No.1

The Burrunga No.1 Well is located on the southern border of the Mundubbera Sheet area. The well section was divided by Union Oil Development Corp (1962b) as follows:

Jurassic	Walloon Formation	0 - 296 feet
	Bundamba Formation	296 -2030 feet
	--------------unconformity---------------	
Triassic	Wandoan Formation	2030 -2083 feet
	--------------unconformity---------------	
Permian	Kianga Formation	2083 -4657 feet
	Back Creek Formation etc.	

Tissot (1963) divided the well thus:

Jurassic	Unit A 1660 - 2034 feet
	------unconformity-----
M.-U. Triassic	? Unit T 2034 - 2100 feet
	------unconformity------
Permian	Unit R 2100 - ? feet

Dr de Jersey (in Union Oil Development Corp., (1962b) identified core 6 (2385-90 feet) as Lower Triassic.

Core 6 was cut from the Kianga Formation (=Baralaba C.M.) or Unit R, both of which elsewhere are regarded as Permian in age. To test these apparent anomalies, samples from the following depths were examined:

2050 - 2060 feet
2080 - 2090 feet
2110 - 2120 feet
2140 - 2150 feet
2160 - 2170 feet
2190 - 2200 feet
2210 - 2220 feet (coal picked by hand from sample)
Core 6, 2385 - 2390 feet.

The cuttings at 2080-90 feet yielded *Quadrisporites horridus* Hennelly and *Taeniaesporites* sp. *Q. horridus* was also recognized at 2140-50 feet. The coal at 2210-20 feet yielded abundant Striatiti spp. (*amplus*, *limpidus* and *cancellatus* types) with very rare *Dulhuntyispora parvithola* (B.& H.), *Marsupipollenites sinuosus* B. & H. and *Laevigatosporites* cf. *vulgaris* B. & H.; i.e. an assemblage typical of the Permian Unit P4. The sample from Core 6 yielded only a few spores, but these included *Dulhuntyispora parvithola* and *Marsupipollenites sinuosus*.

It is concluded that the palynological Permian-Triassic boundary in Burunga No.1 occurs within the interval 2150 to 2210 feet, and that no Wandoan Formation or Tissots' Unit T is present in the well section, but that lower Rewan Formation occurs between 2034 feet and 2210 feet.

6. Planet Warrinilla No.1

Core 1, 492-507 feet, taken from about 1000 feet above the base of the Rewan Formation, yielded abundant spores and pollens which included:

Leiotriletes sp.

Todisporites sp.

Rugulatisporites sp.

Distalanulisporites sp.

Nuskoisporites radiatus Hennelly

Trizonaesporites sp.

"Pityosporites" sp.

Taeniaesporites spp. (fairly common)

Although cores were taken from comparable levels in Warrinilla North No.1, none was suitable for examination as they consist of red beds. The top of the Rewan Formation in A.A.O. Westgrove No.1, drilled just west of the margin of the Taroom Sheet area boundary, still contained e.g. Nuskoisporites radiatus, and is thus allocated to Unit Tr 1.

Unit Tr 2 (Rewan Formation)

Although Unit Tr 2 is perhaps limited on the west of the Mimosa Syncline, it seems to be well developed along the structure's eastern flank.

1. B.M.R. No.18 (Baralaba)

Core from 202-206 feet in the hole yielded:

Leiotriletes directus B. & H.

Todisporites sp.

Granulatisporites sp.

Cyclogranulatisporites sp.

Apiculatisporis sp.

Kraueselisporites spp. (fairly common)

Alisporites spp. (pteruchid types) (rare)

Taeniaesporites spp. (fairly common)

Discisporites sp.

Micrhystridium sp. (rare)

2. B.M.R. No.21 (Baralaba)

Located at the base of the Clematis Sandstone and the top of the Rewan Formation. A core sample at a depth of 106 feet, in the Rewan Formation, yielded:

Cyathidites sp.

Calamospora sp.

Todisporites sp.

Granulatisporites sp.

Apiculatisporis sp.

Paraconcavisporites sp.

Aratrisporites spp. (fairly common)

Thymospora sp. (fairly common)

Saccate pollens were conspicuously absent.

Both these samples lack the large monosaccate and disaccate pollens which characterize Unit Tr 1, while B.M.R. No.21 (Baralaba) yielded Aratrisporites spp. These samples are best referred to Unit Tr 2 which occupies the Collaroy Claystone of the Narrabeen Group of the Sydney Basin.

MIDDLE - UPPER TRIASSIC

The pteruchid Alisporites app., which first appear at the base of Unit Tr 1, become dominant in the Gosford Formation of the Sydney Basin, a situation maintained throughout the Hawkesbury Sandstone and Wianamatta Group (at least to within the Prudoe Shale, the highest outcropping formation of the Wianamatta Group). The basal Wianamatta Group contained the labyrinthodont Paracyclotosaurus davidi, which Watson (1958) regarded as being late Keuper, if not Rhaetic in age. The Alisporites microflora may therefore be considered to be of Middle - Upper Triassic age. The problem of subdividing this unit awaits further research. For the present, it is referred to as Unit Tr 3. Previous references have nominated the unit "Zone 1".

The Alisporites microflora occurs throughout the Moolayember Formation and part at least of the Clematis Sandstone. The change from Unit Tr 2 to Unit Tr 3 seems to take place within the Clematis Sandstone. The precise position of the transition in the Clematis Sandstone is not determined, because of the lack of fossiliferous samples from the lower part of that formation.

Unit Tr 3 (Clematis Sandstone and Moolayember Formation)

1. Ohio Oil (Marathon) Bauhinia Downs Seismic Survey, Line 1.

Line 1 of seismic shot points was traversed across the Mimosa Syncline, following the Rolleston - Bauhinia Downs - Banana Road. A number of bottom-hole from this line have been examined, commencing with the stratigraphically oldest, SP 134, at 320 feet, taken from just above the Clematis Sandstone. It contained:

Granulatisporites sp.

Thymospora sp.

Aratrisporites sp.

Alisporites spp. (pteruchid types) (common)

All samples examined were abundantly fossiliferous. The stratigraphically youngest sample cannot be determined accurately, as the Mimosa Syncline is asymmetric, and there are insufficient exposures to determine dip directions along the seismic line or to show whether the structural axis corresponds to the depositional axis. It seems likely that SPP. 60 and 56 were about the closest to the axis. Of these, SP 60, 135 feet, yielded

Calamospora sp.

Todisporites sp.

Granulatisporites sp.

Aratrisporites sp.

Alisporites spp. (pteruchid types) (common)

Ginkgocycadophytus sp. (fairly common)

2. B.M.R. No.19 (Baralaba)

This hole was located in the stratigraphically highest section of Moolayember Formation in the Mimosa Syncline, just below the Precipice Sandstone, as judged from regional structural trends. Only a few broken and barren pieces of the core were recovered, but cuttings at 60-70 feet contained a fairly abundant microflora, which included:

Granulatisporites sp.

Conbaculatisporites sp.

Thymospora cf. T. ipsviciensis (de Jersey)

Aratrisporites sp.

Alisporites spp. (pteruchid types) (common)

Ginkgocycadophytus sp. (fairly common)

There seems to be very little change in assemblage throughout the exposed sequence of Moolayember Formation in the Mimosa Syncline.

3. Carnarvon Highway

The Carnarvon Highway, from Injune to Rolleston, traverses the type area of the Moolayember Formation, and passes through the gorge cut by Moolayember Creek into the Clematis Sandstone. Several samples have been obtained from this section. Except for that at T227*, it is impossible to estimate the level within the section from which the samples were taken.

a) T227. Shale intercalated with fine light-grey, quartz sandstone towards the top of the Clematis Sandstone, south of Moolayember Gorge. Very low yield. Alisporites spp. (pteruchid types) and Ginkgocycadophytus sp. observed.

b) T232. In the Moolayember Formation. Samples were collected from approximately the same locality by the author and Mines Administration Pty Ltd. They yielded:

Granulatisporites sp.

Leiotriletes sp.

Todisporites sp.

Calamospora sp.

Aratrisporites sp.

Alisporites spp. (pteruchid types) (very common).

4. T286. In Moolayember Formation below waterfall on Hungry Creek, collected by Mines Administration Pty Ltd.

Todisporites sp.

Granulatisporites sp.

---

* T227 (and similar combinations correspond to field numbers marked on the Taroom 1:250,000 Sheet geological map).

aff. Zebrasporites sp.

Thymospora spp.

Alisporites spp. (pteruchid types) (common)

Veryhachium sp.

Micrhystridium sp.

This sample is unusual on account of the presence of acritarchs, recorded by Evans (1962a), suggestive of brackish conditions of deposition.

JURASSIC

The sandstone - shale - sandstone sequence which unconformably overlies the Moolayember Formation in the Taroom area has long been regarded as a westerly development of the Triassic Bundamba Group or Series of the Ipswich Basin. One of the first results of palynolocial studies of the Surat Basin was to show that this basal section to the artesian sequence was best regarded as Jurassic in age. The reasons why the basal formation, the Precipice Sandstone, should be placed in the Jurassic were outlined by Evans (1964c). Only one outcrop of the Precipice Sandstone has so far yielded spores and pollens. The assemblage includes a very high proportion of Classopollis, typical of those referred to previously as "Zone 2". For the sake of conformity, "Zone 2" is herein renamed Unit J1.

Unit J1 (Precipice Sandstone)

The one outcrop of Precipice Sandstone to yield spores and pollens was noted by Evans (1964c). It occurs in a tributary of the Dawson River, about 1.5 miles north-east of Baffle Creek Homestead (T285 on the Taroom geological map), where a carbonaceous intercalation, 7 feet thick, and about 50 feet from the base of the formation, contains a well preserved microfloral assemblage from which Evans (loc. cit.) listed "species of Classopollis (34% of a count of 150 microfossils), numerous bisaccate gymnosperm pollens, and a variety of pteridophyte microspores referable to Cyathidites, Baculatisporites, Lycopodiumsporites, Ischyosporites, Perotrilites and several undescribed genera". The undescribed forms include Apiculati sp. nov." which usually occurs in Unit J1 (= "Zone 2") in the subsurface near Roma (Evans, 1963).

Unit J1 (Evergreen Formation - below Boxvale Sandstone Member)

Outcrop of the Evergreen Formation along the Carnarvon Highway has failed to yield spores, but two samples from the Mundubbera area, below the oolite member, contained a Unit J1 (= "Zone 2") microflora.

1. T653. On Cockatoo Creek, from near the base of the Evergreen Formation, where indeterminate pelecypods were also obtained (Jensen et al., 1964). It contained:

Cyathidites cf. C. minor Couper

"Apiculati sp. nov."

Laricoidites sp.

Disaccites spp. undiff.

Classopollis sp. (very common).

2. T735. Three quarters of a mile south of Dawson Vale Homestead. An abundant, but somewhat oxidized yield was obtained:

Stereisporites sp.
Lycopodiumsporites spp.
Perotrilites cf. P. tenuis de Jersey
Disaccites sp.. undiff.
Classopollis sp. (very common)

Unit J2(Oolite member and upper Evergreen Formation)

1. B.M.R. No.29 (Taroom)

The transition between Units J1 and J2 (= "Zone 2" to "Zone 3"), marked by the first appearance of Tsugaepollenites (al. Callialasporites), has become a widely determined marker horizon in the Surat Basin. It was shown by Evans (1962) to be associated with a widespread, but stratigraphically thin, acritarch (al. hystrichosphere) band. An associated pellet occurrence in the Roma area has been sometimes called the "hystrichosphere band" (e.g. Mines Administration Pty Ltd, 1963), which has proved to be a reliable marker for drilling calculations. The possibility that the pellet horizon overlay the Boxvale Sandstone became apparent after drilling A.A.O. Arbroath No.1. It also became apparent to Jensen et al during field mapping that the same horizon might be a subsurface development of the outcropping oolite member of the Evergreen Formation. B.M.R. No.29 (Taroom) was sited to test this among other hypotheses. All samples from this hole have been examined for a) their acritarch content, b) their Classopollis content, c) the presence of "Apiculati sp. nov." and Tsugaepollenites segmentatus (Balme). The results of this examination are plotted in Table 1. The percentage abundances were determined by Miss H.M. McKenzie.

The table shows that:

a) a decrease in the percentage of Classopollis is followed by an increase in the acritarch content,

b) the high acritarch count is directly associated with the oolite member,

c) the ranges of Tsugaepollenites segmentatus and "Apiculati sp. nov." probably overlap (the possibility of mixing by caving must, however, be considered),

d) the Unit J1 - J2 (= "Zone 2" - "Zone 3") boundary could be taken between 100 and 120 feet; it may roughly correspond to the introduction of oolites.

It should be noted that the Classopollis count at the end of Unit J1 is substantially lower than its acme in the Precipice Sandstone.

2. Injune - Wallumbilla Seismic Survey

Samples from the shot point line east of Injune as far as Pony Hill Homestead were originally submitted by Mines Administration Pty Ltd to determine if any surface expression of the subsurface Hutton - Wallumbilla Fault could be identified. SP 241 was the first point near outcrop where the acritarch horizon at the base of Unit J2 (="Zone3") was discovered (Evans, 1962a). Mapping of the area by Jensen et al. (1964) now permits an approximate correlation between the shot points and outcropping formations. Selected examples of the yields from these shot point samples are as follows.

SP 241, at 95 feet *

Spores and pollens

Cyathidites cf. C. minor Couper
Baculatisporites cf. B. comaumensis (Cookson)
Lycopodiumsporites spp.
Perotrilites cf. P. tenuis de Jersey
Laricoidites turbatus (Balme)
Tsugaepollenites segmentatus (Balme)
Classopollis sp. (common).

Microplankton (Evans, 1962)

Micrhystridium sp.
Micrhystridium (al. Multiplicisphaeridium) sp.

The acritarchs, particularly Micrhystridium (al. Multiplicisphaeridium) sp. suggest a correlation of the sampled horizon with the oolite member. According to Jensen et al., the hole was sited at about the base of the Hutton Sandstone, which is mapped as resting directly on the oolite. However, Jensen (pers. comm.) points out that the upper Evergreen Formation is generally obscured in this region by talus from the Hutton Sandstone, and that the base of the Hutton is possibly drawn too low in the succession.

The presence of T. segmentatus indicates that the sample is at least of Unit J2 age.

Unit J2 (Hutton Sandstone)

1. SP 221, at 45 feet

Located within the Hutton Sandstone.

Cyathidites cf. C. minor Couper
Baculatisporites sp.
Ischyosporites sp.
Lycopodiumsporites spp.
Perotrilites cf. P. tenuis de Jersey
Disaccites spp. undiff.
Laricoidites reidi de Jersey (common)
Laricoidites turbatus (Balme)
Tsugaepollenites segmentatus (Balme)
Classopollis sp. (fairly common)
aff. Quadrisporites horridus Hennelly

---

* Depths following the shot point numbers in the following examples refer to the depth of the base of the hole. The microflora listed could have come from any level below the weathered zone in the hole, unlike the assemblages listed from the B.M.R. shallow drill hole from which samples were collected at regular intervals.

Striatiti sp. ("Protosacculina" type)
Thymospora hamata (Balme & Hennelly)
Nuskoisporites triangularis (Mehta)

The relatively high proportion of Classopollis in this sample associates it with Unit J2 (="Zone 3"). aff. Q. horridus, Striatiti sp., T. hamata, and N. triangularis are thought to be reworked fossils from the Permian.

2. SP 211, at 110 feet

Cyathidites australis f. rimalis Balme
Cyathidites minor Couper
Baculatisporites sp. (fairly common)
Lycopodiumsporites rosewoodensis de Jersey
"Sporites" cicatricosus Rogalska
Zonati sp.
Disaccites spp. undiff.
Laricoidites reidi de Jersey
Laricoidites turbatus (Balme) (common)
Tsugaepollenites dampieri (Balme)
Tsugaepollenites segmentatus (Balme)
Classopollis sp. (rare)

This sample differs from SP 221 in the lower proportion of Classopollis and establishment of T. dampieri. It probably should be allocated to a high level in Unit J2 (= "Zone 3").

Unit J3 (Injune Creek Beds and upper part of Hutton Sandstone)

Unit J3 (="Zone 4") was never a well defined unit. It was originally noted towards the top of the Hutton Sandstone in A.A.O. No.1 (Roma) and A.A.O. Pickanjinnie No.1 as a unit marked by a substantial increase in the abundance of Zonati sp. This species has since been found to have a range from Unit J1 to the base of the Lower Cretaceous. Its abundance never reached the proportions of e.g. Classopollis in Unit J1, and obviously another criterium to mark the horizon is needed. Of the species listed below Murornati sp. is possibly confined to about this level, but more work on this and the overlying Unit ? J4 is required. Neither unit is of immediate significance to the stratigraphy of the Surat Basin, but preliminary studies of sections in the Eromanga Basin (e.g. Evans, 1962b; 1964d) have shown that further work on them will be necessary.

SP 203, at 95 feet

Sited towards the base of the Injune Creek Beds. Yield low, but it included:

Cyathidites australis f. rimalis Balme
Cyathidites minor Couper
Leiotriletes sp.
Baculatisporites sp.
Neoraistrickia sp.
Lycopodiumsporites spp.
"Sporites" cicatricosus Rogalska

Murornati (rugulate) sp.
Zonati sp. (fairly sommon)
Disaccites spp. undiff.
Tsugaepollenites dampieri (Balme)
Laricoidites turbatus (Balme)

The lack of Classopollis, general abundance of Zonati sp., and presence of Murornati sp., link this assemblage with Unit J3 (= "Zone 4").

? Unit J4 (Injune Creek Beds)

As previously stated, further work on these levels is required. Attention should be concentrated on its content and lower boundary. Its upper boundary is taken at the first appearance of Contignisporites cooksonii (Balme) and Murospora florida (Balme) which characterize Unit J5. Unit J5 first appears in the uppermost beds of the Injune Creek Beds. Its upper boundary has yet to be finally determined. Unit J4 is mainly recognized by its content of Lycopodiumsporites rosewoodensis de Jersey, Rugulatisporites ramosus de Jersey and Annulispora folliculosa (Rogalska) de Jersey. It seems to be confined to the Injune Creek Beds of the Surat Basin.

1. SP 195, at 65 feet

Cyathidites australia f. rimalis Balme
Leiotriletes sp.
Baculatisporites cf. B. comaumensis (Cookson)
Ischyosporites sp.
Lycopodiumsporites austroclavatidites (Cookson)
Lycopodiumsporites rosewoodensis de Jersey
Lycopodiumsporites spp.
Murornati spp. (not the Unit J3 types)

Zonati sp.
Disaccites spp. undiff.
Laricoidites reidi de Jersey (common)
Laricoidites turbatus (Balme) (common)
Tsugaepollenites dampieri (Balme) (oommon)
Tsugaepollenites segmentatus (Balme) (fairly common)
Tsugaepollenites trilobatus (Balme)
Classopollis sp.

2. SP 161, at 75 feet

An abundant yield similar to SP 195, with, in addition:

Annulispora folliculosa (Rogalska)
aff. Styxisporites sp.
Coronatispora spp.
Gleicheniidites cf. G. cercinidites (Cookson)

Both SPP 161 and 195 were drilled into the Injune Creek Beds. They lack the coarsely rugulate Murornati sp. and common Zonati sp. which characterize Unit J3, and contain a generally higher proportion of Tsugaepollenites.

COMMENTS

The samples listed above demonstrate the existence in outcrop of all major subsurface palynological units. The position of both samples and palynological units relative to the rock succession is illustrated in Table 2. Practical use of any such palynological scheme cannot be made unless the boundaries between units are well defined. Due to the lack of sufficient samples in certain instances, positioning of boundaries in Table 2 was influenced by previously obtained data from the subsurface. The positions of the P4/Tr1 and Tr3/J1 boundaries are clear because they represent major microfloral changes. The J1/J2 boundary represents a minor, but easily recognized change. The remaining boundaries indicate slight variations in a steadily changing assemblage plexus for which distinctive criteria are often lacking. They are employed, however, as they are regarded as useful at this stage of regional stratigraphical analysis.

The local, informal terminology is listed in Table 2 against its probable "standard international" correlates. That this correlation is only tentative cannot be over emphasized. A local terminology must be employed if any sense of accuracy in basinal stratigraphic studies is required.

A number of stratigraphic terms have been employed in the past for the Mesozoic of the Bowen - Surat Basin. Jensen et al. discuss their history which need not be repeated here.

In a scheme not discussed by Jensen et al., Mack (1964) divided the early Mesozoic of the Bowen - Surat Basin into the Cabawin and Bundamba Formations, separated by a major unconformity. Subsurface usage of these terms was challenged by Evans (1963). Subsequent to drilling of Union-Kern-A.O.G. Wandoan No.1, Union Oil Development Corp. (1963a) recognized the Wandoan Formation between the Cabawin and Bundamba Formations. In the Union-Kern-A.O.G. Yarril Creek No.1 well completion report Union Oil Development Corp. (1963c) rejected Bundamba Formation for the Precipice Sandstone, Evergreen Shale and Hutton Sandstone. They regarded the Boxvale Sandstone as a member of the Hutton Sandstone. All these names have been published without explanation in summaries of well histories by Allen & Sanker (1961) Allen (1962), and Sanker (1963). It seems unnecessary to the author to use the terms Cabawin and Wandoan. The outcrop Cabawin Formation can be subdivided into Rewan Formation, Clematis Sandstone and Moolayember Formation on both sides of the Mimosa Syncline, and the subsurface Wandoan Formation, as originally defined, appears to be a correlate of part of the Clematis Sandstone and Moolayember Formation.

REFERENCES

ALLEN, R.J., 1962 - Occurrence of petroleum and natural gas in Queensland. Geol.Surv.Qld Publ. 299, Suppl.2.

ALLEN, R.J. & SANKER, I.G., 1961 - Occurrence of petroleum and natural gas in Queensland. Geol.Surv. Qld Publ. 299, Suppl.1.

*BALME, B.E., 1963 - Plant Microfossils from the Lower Triassic of Western Australia. Palaeontology. 6(1), 12-40.

BALME, B.E., & HENNELLY, J.P.F., 1956 - Trilite sporomorphs from the Permian of Australia. Aust.J.Bot. 4(3), 240-260.

DAVID, T.W.E., 1950 - The geology of the Commonwealth of Australia, 1 Edward Arnold, London.

DERRINGTON, S.S., 1957 - Final Report Associated Australian Oilfield N.L. Well A.A.O. No.7 Arcadia. Mines Administration Pty Ltd Rep. No. Q/R/33 (unpubl.).

EVANS, P.R., 1962a - Microfossils associated with the "Bundamba Group" of the Surat Basin, Queensland. Bur.Min.Resour.Aust.Rec. 1962/115 (unpubl.).

EVANS, P.R., 1962b - The stratigraphy of Magellan Corfield No.1 Bore, Great Artesian Basin, Queensland. Ibid. 1962/174 (unpubl.).

EVANS, P.R., 1963 - Palynological observations on Union-Kern-A.O.G. Cabawin East No.1 Well, Surat Basin, Queensland. Ibid. 1963/21 (unpubl.).

EVANS, P.R., 1964a - The distribution of some Carboniferous and Permian microfloras in central Queensland. Ibid. (in prep.).

EVANS, P.R., 1964b - Palynology and the Jurassic - Cretaceous boundary in Australia. Ibid. (in prep.).

EVANS, P.R., 1964c - The age of the Precipice Sandstone. Aust.J.Sci. 26(10), 323-324.

EVANS, P.R., 1964d - Some palynological observations on samples from the north-eastern Eromanga Basin, central Queensland. Bur.Min.Resour.Aust.Rec. 1964/76 (unpubl.).

*ASSOCIATED AUSTRALIAN OILFIELDS N.L., 1962 - Injune Wallumbilla Area Seismic Survey A to P 55/56P Queensland. Report (unpubl.).

HELBY, R., 1963 - An introductory study of the palynology of the Narrabeen Group. M.Sc. Thesis, Sydney (unpubl.).

HENNELLY, J.P.F., 1958 - Spores and pollens from a Permian-Triassic transition, N.S.W. Proc.Linn. Soc.N.S.W. 83, 363-369.

HILL, D., 1957 - Explanatory notes on the Springsure 4-mile geological sheet, 4-mile Geological Series. Note Ser.Bur.Min. Resour.Aust., 5, 1-19.

HILL, D. & DENMEAD, A.K. (ed), 1960 - The geology of Queensland. J.Geol.Soc.Aust., 7.

JENSEN, H.I., 1926 - Geological reconnaissance between Roma, Springsure, Tambo, and Taroom. Geol.Surv.Qld Publ., 277.

JENSEN, A.R., 1964 - The Geology of the Taroom 1:250,000 Sheet area and the Western part of the Mundubbera 1:250,000 Sheet area, Queensland Bur. Min.Resour.Aust.Rec. 1964/61 (unpubl.).

MACK, J.E., 1964 Reconnaissance geology of the Surat Basin, Queensland and New South Wales, Australia. Bur.Min.Resour.Aust.Pet. Search Subs. Act Publ. 40 (in press)

MALONE, E.J., 1963 -Bowen Basin shallow drilling programme 1963. Bur.Min.Resour.Aust.Rec. 1963/153 (unpubl.).

MARATHON PETROLEUM AUSTRALIA, 1962 - Seismic Survey of Bauhinia Downs Area, A to P 89 P. Queensland Report (unpubl.).

MINES ADMINISTRATION PTY LTD, 1962 - Associated Australian Oilfields N.L. A.A.O. Westgrove No.1, Well Completion Report No.Q/55-56P/109 (unpubl.).

MINES ADMINISTRATION PTY LTD, 1963 - Associated Australian Oilfields N.L. A.A.O. Arbroath No.1, Well Completion Report No.Q/55-56P/131 (unpubl.).

MORAN, W.R., & GUSSOW, W.C., 1964 - The history of the discovery and the geology of the Moonie Oilfield, Queensland, Australia. Aust.Oil & Gas J. 10 (2),44.

MOTT, W.D., 1952 - Oil in Queensland. Qld Govt.Min.J., 53, 848-861.

MYERS, N., 1963 - Planet Oil Warrinilla North No.1 Well Completion Report. (unpubl.).

OLGERS, F., WEBB, A.W., SMIT, J.A.J., & COXHEAD, B.A., 1964 - The geology of the Baralaba 1:250,000 Sheet area, Queensland. Bur.Min.Resour. Aust.Rec. 1964/26

REEVES, F., 1947 - Geology of the Roma district, Queensland, Australia. Bull.Amer.Ass. Petrol. Geol. 31, 1341-1371.

SANKER, I.G., 1963 - Occurrence of petroleum and natural gas in Queensland. Publ.Geol.Surv. Qld 299, Suppl. 3.

SHELL (QUEENSLAND) DEVELOPMENT PTY LTD, 1962 - General report on investigations and operations carried out by the company in the search for oil in Queensland, 1940-1951. (unpubl.).

TISSOT, B., 1963a - Correlations of the Jurassic and Middle-Upper Triassic in the Bowen-Surat Basin. I.F.P. Mission in Australia. Rep AUS/66 (unpubl.).

TISSOT, B., 1963b - Correlations of the Permo-Triassic in the Bowen-Surat Basin. Ibid. AUS/80 (unpubl.).

UNION/OIL DEVELOPMENT CORPORATION, 1962a - Union-Kern-A.O.G. Wandoan No.1 Well Completion Report No.5 (unpubl.).

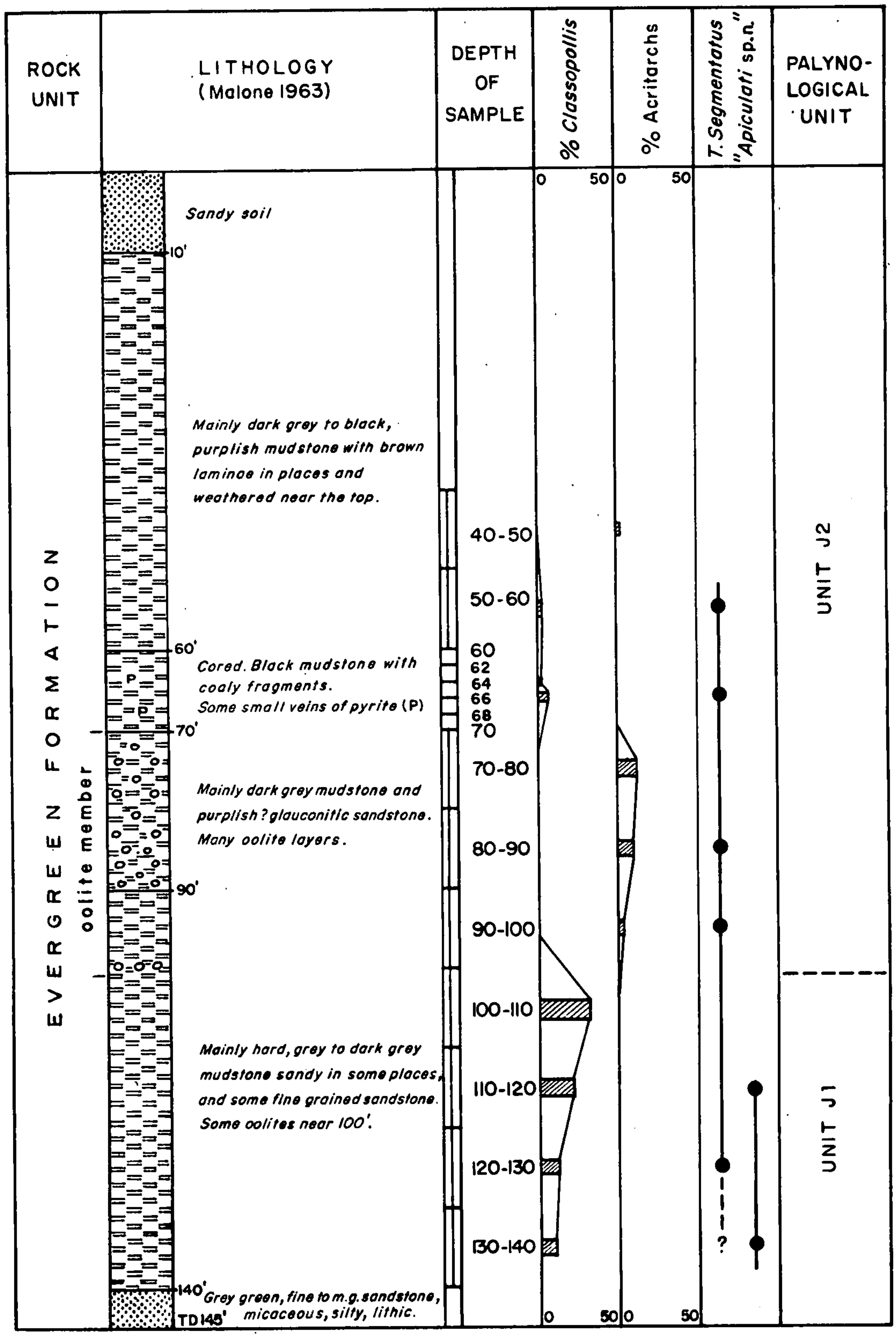
UNION/OIL DEVELOPMENT CORPORATION, 1962b - Union-Kern-A.O.G. Burunga No.1 Well Completion Report No.6 (unpubl).

UNION/OIL DEVELOPMENT CORPORATION, 1962c - Union-Kern-A.O.G. Yarril Creek No.1 Well Completion Report No.7 (unpubl.).

WATSON, D.M.S., 1958 - A new labyrinthodont (Paracyclotosaurus) from the upper Trias of New South Wales. Brit.Mus.(Nat.His.) Bull. 3 (7), 233-262.

WHITEHOUSE, F.W., 1955 - The geology of the Queensland portion of the Great Artesian Basin. Appendix G. in Artesian Water Supplies in Queensland Dep. Co-ord. Gen. Public Works, Qld Parl. Pap.A, 56-1955.

TABLE 1: PALYNOLOGICAL FEATURES OF B.M.R. No. 29 (TAROOM)



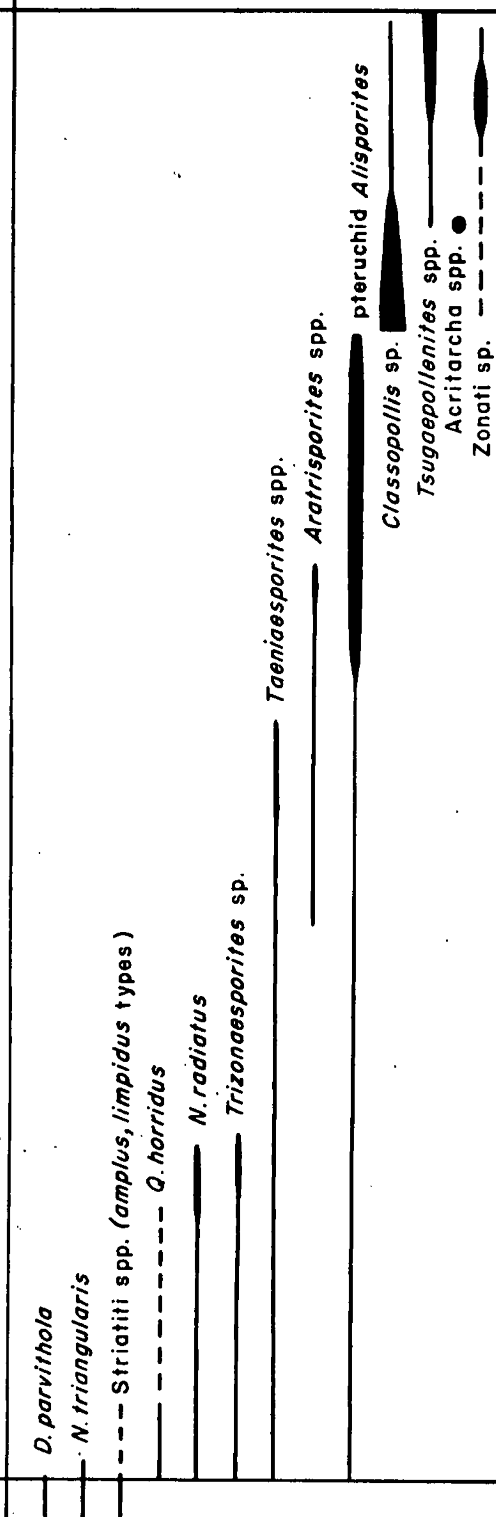
To accompany Record No. 1964/91.

Bureau of Mineral Resources, Geology and Geophysics. June 1964. M(S) 32. EJ

TABLE 2: SUMMARY OF EARLY MESOZOIC PALYNOLOGICAL UNITS IN BOWEN-SURAT BASIN

LITH.	FORMATION	AGE	UNIT	SAMPLE
	Injune Ck. Bds.	JURASSIC	? J4	SP161, SP195
	Hutton Sst.	JURASSIC	J3	SP203
	Hutton Sst. / Evergreen (oolite) Formation	JURASSIC	J2	SP211, SP221, SP241
	Evergreen (oolite) Formation	JURASSIC	J1	BMR29, T735
	Precipice Sst.	JURASSIC	J1	T653, T285
	Moolayember Formation	M.-U. TRIASSIC	Tr 3	BMR19, SP60, T232, T286, SP134, T227
	Clematis Sandstone	M.-U. TRIASSIC / LOWER TRIASSIC	Tr 3 / Tr 2	
	Rewan Formation	LOWER TRIASSIC	Tr 2	BMR21, BMR18
	Rewan Formation	LOWER TRIASSIC	Tr I	Warrinilla No.I., BMR23, Burunga No.I., Warrinilla A.A.O.7
	Coal Measures	PERM.	P 4	

KEY FORMS



Not to scale.

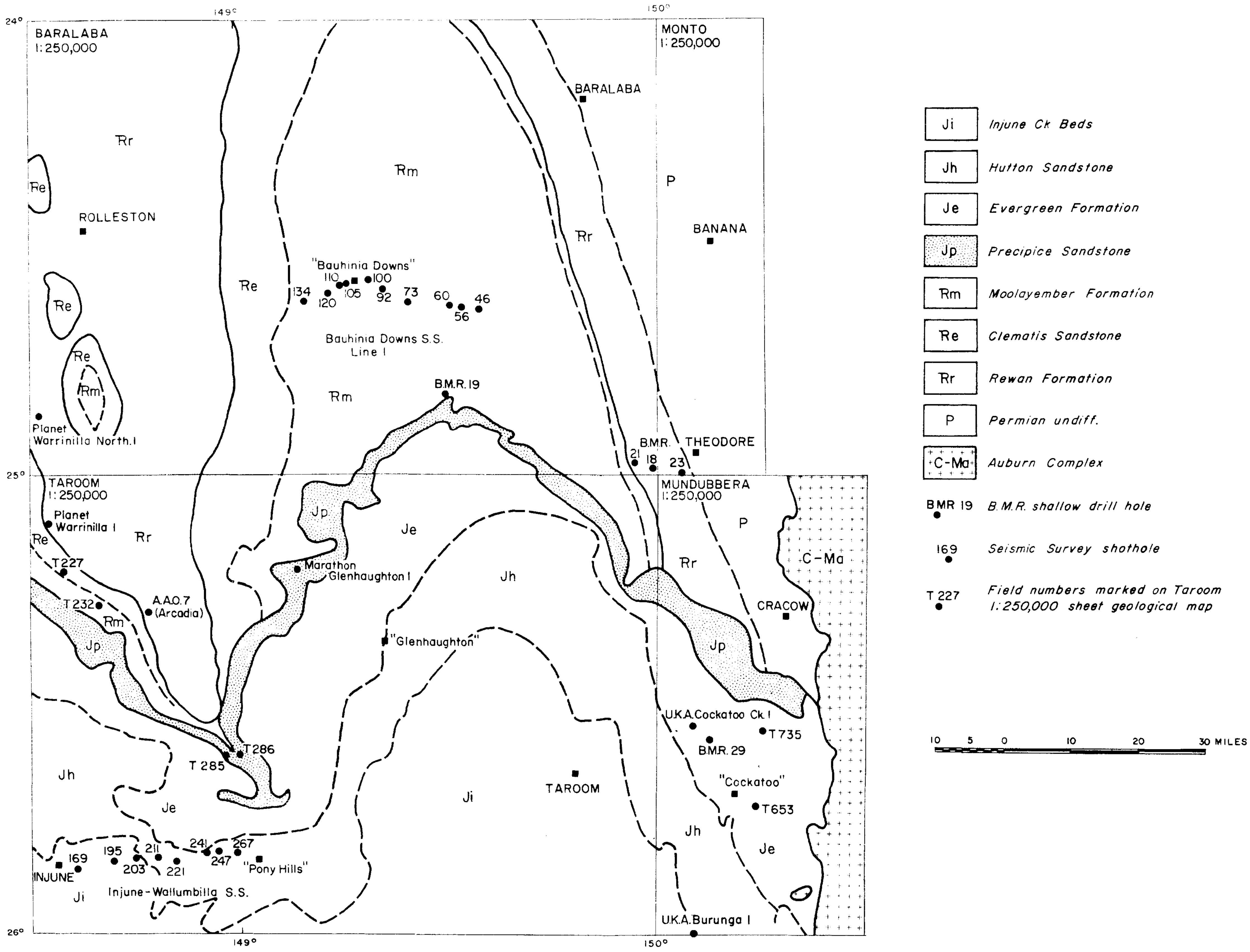
To accompany Record No. 1964/91.

Bureau of Mineral Resources, Geology and Geophysics. June 1964. M(S) 33. EJ

Figure 1

SKETCH SAMPLE LOCATION MAP

BARALABA, MONTO, TAROOM AND MUNDUBBERA AREAS



Bureau of Mineral Resources, Geology and Geophysics. June 1964 To accompany Record No 1964/91

Q/A/67 JK