THE FOSSIL COLLECTOR

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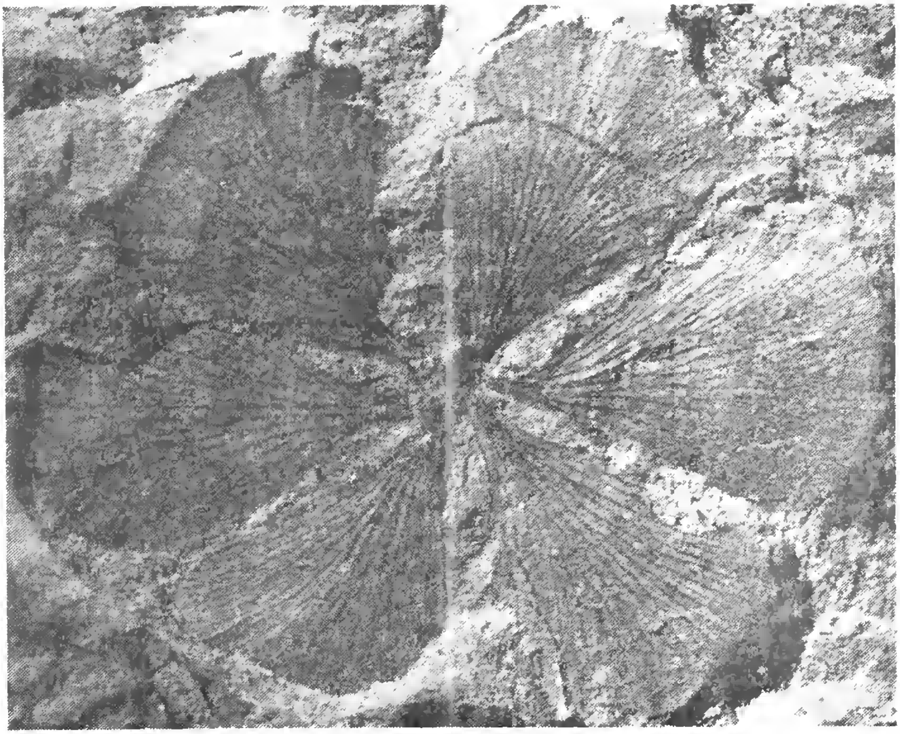

Sphenophyllum, a small herb from the Permian of Western Australia, x 3.
(Refer article, page 14)

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EDITORIAL

Thanks to information received from Queensland member Alan Rix and an item in the Newsletter of the Riversleigh Society, we note that the Queensland Government have finally gazetted (March, 1992) the Riversleigh National Park on 82,000 hectares resumed from the lessees of Riversleigh Station northwest of Mt Isa. The new park, first proposed by the National Parks Association of Queensland in 1951, includes the now world famous Riversleigh fossil sites. The proposal has not been without opposition, as is evidenced by correspondence published in the Brisbane, Courier

Mail over the last few months. Whether the fossil sites would have been better protected by declaration of a specific scientific reserve rather than the very much larger National Park, is open to conjecture.

Anyone interested in graptolites should obtain a copy of the current issue of Alcheringa (volume 16, numbers 1 & 2, 1992), the Journal of the Association of Australasian Palaeontologists, as it contains a paper by A.H.M. VandenBerg & R.A. Cooper "The Ordovician graptolite sequence of Australasia". This paper not only illustrates a large number of species but also includes: a table correlating Australian Ordovician graptolite zones with other important overseas sequences; comprehensive range charts; and as an appendix, an up to date checklist of Australasian Ordovician graptolite species.

Material for the next issue should be submitted by 15th August, 1992, unless otherwise agreed.

Frank Holmes

FINANCES

Income and expenditure for the Financial Year, 1st March, 1991 to 29th February, 1992 (previous year's income and expenditure shown in brackets).

INCOME		
Subscriptions		
current	780.50	(967.50)
advance	696.65	(981.28)
Donations	27.09	(32.30)
Advertising	-	(8.00)
Bank interest	45.86	(141.20)
Sale of Bulletins	130.10	(141.90)
Miscellaneous	5.00	(2.50)
Overpayments	7.50	(-)
	$1,692.70	(2,274.68)

EXPENDITURE		
Postage	809.07	(562.51)
Printing	656.85	(517.98)
Photocopies, photo's & bromides	221.05	(147.10)
Stationery	120.85	(76.44)
Sundries	126.75	(96.97)
State Rep. expenses	56.69	(28.22)
Subscriptions	-	(30.00)
State/Fed. tax	3.56	(5.85)
Miscellaneous	1.42	(2.55)
WP purchase (50%)	-	(555.00)
Refunds	7.50	(-)
	$2,019.74	(2,022.62)

Balance at 29th February, 1992

Brought forward from	1990/1991	$2,157.73
Add income	1991/1992	$1,692.70
		$3,850.43
Less expenditure	1991/1992	$2,019.74
		$1,830.69

When the above figures are adjusted to include 1991/92 subscriptions paid in 1988/89 1989/90 and 1990/91 ($962.12) and to exclude 1992/93 and 1993/94 subscriptions paid in advance ($701.09), expenditure for the Financial Year 1991/1992 exceeded income by $66.01 compared with a surplus of $4.20 for the previous year.

After deducting total advance subscriptions of $762.25 from the balance in hand at 29th February, 1992, we are left with a nett reserve of $1,068.44 ($1,134.45).

Assets are valued at approximately $920.00 (these include part ownership of a Word Processor [50%], stationery, staplers and back issues of Bulletins). At 29th February, 1992, there were no liabilities.

SALVAGE OF A DIPROTODON FROM NORTHWESTERN AUSTRALIA

A. Baynes*, R. D. Guthrie and G. W. Kendrick***

*Dept of Earth and Planetary Sciences, Western Australian Museum, Perth.
**Biology and Wildlife Dept . University of Alaska at Fairbanks, Alaska.

In October 1991, an officer of the W.A, Agriculture Protection Board found large fossil mammal bones in a creek bed in the north-west of W.A., while checking a noxious weed infestation site that he had last visited some two years earlier. The bones were embedded in sediments now forming a level floor to the creek, which previously had been buried beneath half a metre of gravel. He reported his find to Peter Kendrick of the Karratha office of the W.A. Department of Conservation and Land Management, who accompanied him back to the site early in November. Peter Kendrick identified the bones as probably those of a Diprotodon, collected some surface specimens of small bones and mollusc shells and reported the find to the W. A. Museum.

This report posed something of a dilemma: the curator responsible for vertebrate palaeontology was away on field work in Antarctica, and the W. A. Museum had a zero budget for field work in the current financial year. On the other hand, the cyclone season was just beginning in north-western Australia, and the gravel overlay which had presumably been removed from the site by the last cyclone could easily be redeposited by the next one. The specimen might also be lost to the Museum because its whereabouts were becoming fairly widely known locally. A volunteer party consisting of the authors was therefore assembled and launched on invisible finance. Guthrie, who happened to be on sabbatical in Perth at the time, added expertise in plaster jacketing and experience in recovering remains of large mammals, and Kendrick expertise in fossil molluscs and Quaternary stratigraphy to Bayne's experience of collecting fossil mammals (almost entirely small species!). Time and other commitments permitted us to devote just eight days between 26th November and 3rd December to the enterprise. It was not a propitious choice of dates from the weather point of view - 42.5°C was the lowest maximum we experienced during the five days on the site and 46.7°C the highest, and none of us was acclimatised to heat. Without enormous local support in the form of sunshades and a generator and rock hammer provided by the Karratha office of Cockburn Engineering, and a small army of acclimatised local volunteers organised and ably led by Peter Kendrick, we could not have succeeded.

The Diprotodon bones were exposed at the surface of a hard calcareous alluvium containing fossil crab claws and shells of mollusc species (Telescopium telescopium and Terebralia palustris) characteristic of mangrove habitats plus calcareous nodules and water-worn pebbles of rocks derived from the Pilbara block. These clasts coarsened upward towards the surface of the sediments. The top of the bed was estimated to lie some 2-3 m. above present sea-level, indicating that the sediments dated from the high sea-level stand of a Pleistocene interglacial. The degree of weathering of the mollusc shells suggested that the deposit could pre-date the last Interglacial. This point needs further study.

The bones were spread along about 180 m. of the creek bed, with the long axis of the distribution approximately aligned with the direction of the present channel. The first item at the upstream end was a fragment of one of the proximal long bones, probably part of the head of a femur. This was followed by the left shoulder blade and then a more concentrated scatter of ribs, distal long bones, teeth and a partial skull consisting of the premaxillae with upper incisors, some of the palate with a few molars and part of the basicranium. Close to the downstream end of the scatter was the largest group of bones consisting of the pelvis, several vertebrae and ribs, most of the left front limb and both lower jaws. Although the bones lay predominantly at the top of the bed, some penetrated to a depth of over 0.5 m. and were positioned more or less vertically.

Most of the bones visible at the surface were excavated during the field work. Many had cracked or fractured during settlement of the matrix and were recovered in fragments. Unfortunately, the material remains almost entirely unprepared, with the largest items still contained in plaster jackets, so we are only able to provide two alternative preliminary interpretations of the taphonomy. We consider that the bones represent one mature individual of Diprotodon. Under hypothesis one the animal probably died in or beside a riverbed a short distance upstream of the site some months at least before its remains were incorporated into the sediments. The carcase, which lay on probably its left side, was scavenged and many of the skeletal elements were scattered. However, the pelvis, some vertebrae with attached ribs, the left forelimb and the lower jaws remained attached to the hide on the underside of the carcase. Very substantial rainfall, probably from a tropical cyclone, occurred in the river catchment. River flow increased to flood levels and transported coarse channel sediments and the Diprotodon bones downstream until

SALVAGE OF A DIPROTODON (Cont.)

they reached the river delta. Here they settled into depressions at and a little above the intertidal zone, either because they were trapped by the mangrove roots or, more likely, because water speed diminished. The large group of bones attached to the hide was carried the greatest seaward distance because the hide acted like a sail and dragged the heavy bones along. Under hypothesis two, the Diprotodon made its own way into the sea or mangrove, became mired at the site where the pelvis was found, drowned and the detached bones were later redistributed landward by a storm surge, probably caused by a tropical cyclone.

The specimen is particularly important both because it is the first articulated Diprotodon from Western Australia, and being in marine sediments can potentially be dated relatively accurately.

The F.C.A.A. wishes to thank the Association of Australasion Palaeontologists for permission to reprint the above abstract of a talk given at the A.A.P. Conference and General Meeting, Perth, Western Australia, 16-17 March, 1992.

FIRST RECORD OF FOSSIL SIRENIANS IN SOUTHERN AUSTRALIA

Neville Pledge, South Australian Museum, Adelaide.

The diverse early Pliocene Sunlands Local fauna from the Loxton Sands of the Waikerie area in the Murray Basin in South Australia continues to yield new species of vertebrates. A new specimen found late in 1991 proves to be the anterior portion of the right mandible of a sirenian. This is only the second specimen recorded from Australia, and is the older of the two. It is too incomplete to be compared closely with contemporary species from Europe and the Americas, or with the Queensland specimen, which is a different bone. It is probably referrable to Dugong, and if so provides the first fossil record of the genus.

Modern Dugong occurs from Mozambique to the Persian Gulf and southern Queensland to southern Japan, inhabiting warm shallow coastal waters. The fossil extends this latitude range considerably, and adds further evidence for a warmer climate phase and eustatic sea level rise at the end of the Miocene and into the Early Pliocene.

The F.C.A.A. wishes to thank the Association of Australasion Palaeontologists for permission to reprint the above abstract of a talk given at the A.A.P. Conference and General Meeting, Perth, Western Australia, 16-17 March, 1992.

NEWLY DESCRIBED MAASTRICHTIAN BIVALVES FROM NORTHWESTERN AUSTRALIA

George Kendrick, Western Australian Museum, Perth.
Thomas A. Darragh, Museum of Victoria, Melbourne.

The Miria Formation from the northern part of the Carnarvon Basin in Western Australia appears to be the only significant source of latest Cretaceous (Late Maastrichtian) macro-fossils on the Australian mainland. Interest in its fauna arises from this unique aspect and from the fact that it provides new information about life in the oceans right up to the great global extinction event of 65 million years ago at the Cretaceous-Tertiary boundary.

The Miria Formation is a thin (0.6 - 2.1 m) friable calcarenite and calcisiltite which winds around the ridges and gullies of the Giralia Range along a distance of about 80 km. southeast of Exmouth Gulf. The Range is a much-dissected and rather large anticlinal fold structure composed of gently dipping marine sediments, mostly various kinds of limestone, of Cretaceous to Miocene age. Unfortunately the Cretaceous-Tertiary boundary is represented by a disconformity. Miria contacts are both disconformable; below, via a thin, phosphatic nodule bed with the inoceramid-rich Korojon Calcarenite and above, with the Late Palaeocene Boongerooda Greensand.

The Giralia Range is very susceptible to erosion, much fossil material being released into gullies after rain and eventually into lag deposits, all of mixed origins. Up to four formations ranging in age from Campanian to Thanetian may contribute specimens to this aggregate and care is needed in determining the source and age of any particular specimen not obtained in situ. Study of sections with undisturbed strata is essential to understand the origin of the reworked fossils lying around in gullies, etc. Miria Formation material can usually be recognised by the abundance and diversity of ammonites, especially pieces of Eubaculites spp., however, these may also be found reworked into the base of the Boongerooda Greensand. Access to the area is difficult and is only by arrangement with station managers.

Preservation of Miria fossils varies greatly, from excellent to poor. Groups with primary-calcitic shells, such as the oysters, scallops, barnacles, annelids and brachiopods, are accasionally found in very good condition. Those which in life had an aragonitic shell mineralogy, such as the ammonites and most bivalves and gastropods have lost through dissolution their entire original

NEWLY DESCRIBED MAASTRICHTIAN BIVALVES (Cont.)

shells and remain as phosphatic moulds, either with or without shell replacement by secondary calcite. This calcite replacement may or may not turn out a good replica of the original. Since fossils from the outset are not common in the formation, much effort is required to obtain good specimens of most of the aragonitic groups.

For numbers and diversity, molluscs, principally broken heteromorph ammonites, are by far the most prominent macro-group in the Miria; also present, though much less common or rare, are sponges, bryo-

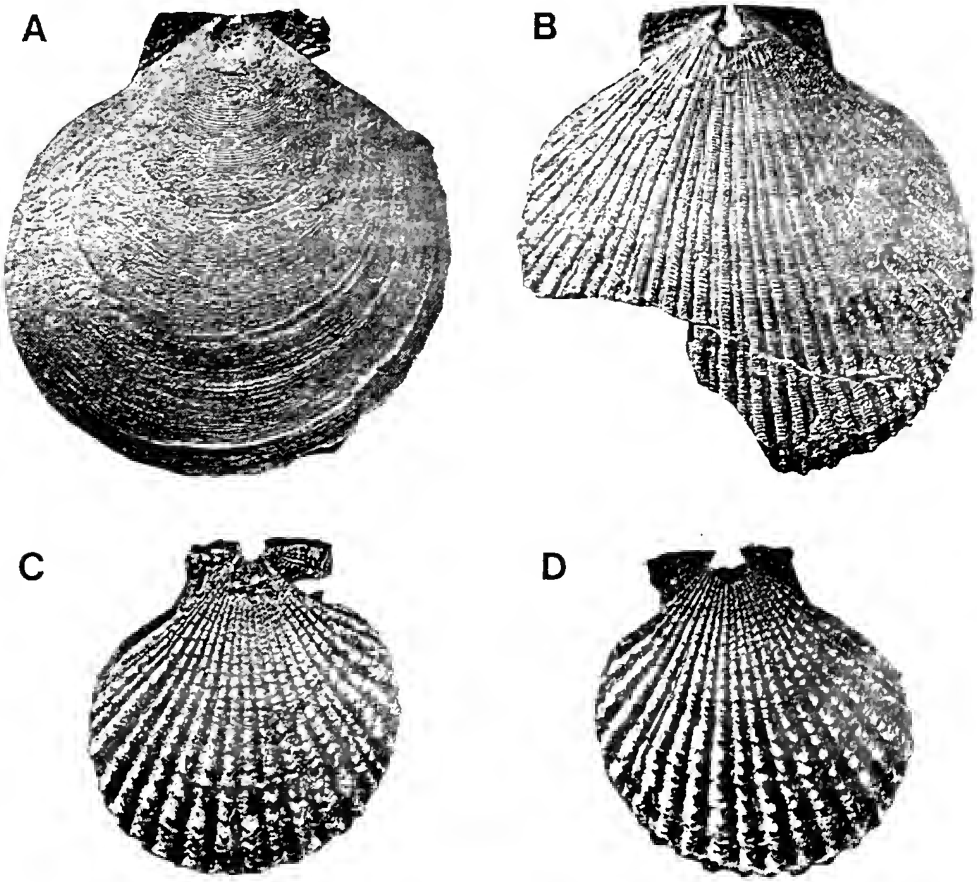

FIGURE 1.
Giraliapecten oboloides Darragh and Kendrick: A, right valve and B, left valve x 1.5 [note contrasting sculpture]. Chlamys (Microchlamys) propesalebrosa Darragh and Kendrick: C, right valve and D, left valve x 1.8. Both specimens from the Miria Formation (Maastrichtian), Carnarvon Basin, Western Australia.

zoans, corals, brachiopods, annelids, cirripedes, echinoids and vertebrates (sharks and several kinds of reptile). Western Australia's first dinosaur bone was found recently at Giralia, apparently reworked from the Miria into the base of the Boongerooda Greensand (Palaeocene). Published studies on Miria Formation fossils are: Glenister et al. (1956) - nautiloid; Edgell (1957) - foraminifers; Belford (1958) - foraminifers; Skwarko (1963) - bivalve; McGowran (1968) - foraminifers; Buckeridge (1983) - cirripede; Henderson and McNamara (1985a,b) - ammonites; Darragh (1986) - bivalve; McNamara (1987) - echinoid and Kemp (1991) - shark.

In addition a monograph by T. A. Darragh and G.W. Kendrick (1991) entitled "Maastrichtian Bivalvia (excluding Inoceramidae) from the Miria Formation, Carnarvon Basin, north Western Australia" has recently been published. The following remarks and figures are taken from the above work.

Thirty bivalve species are described and figured in this work, of which six are associated definitely or with qualification to a previously described species and seven are named as new. Seventeen species are left in open nomenclature, pending the collection of better preserved material. Genera recognised in the assemblage are:

Chlamys	- five species		Atreta	- one species
Pseudolimea	- two species		Entolium	- " "
Limea	- " "		Neithea	- " "
Spondylus	- " "		Trigonia	- " "
Giraliapecton	- " "	(A new genus)	Linotrigonia	- " "
Grammatodon	- one species		Panopea	- " "
Plagiostoma	- " "		Pholadomya	- " "
Pycnodonte	- " "			

Seven species remain for the present without confirmed generic identities and some of these may eventually be seen to represent new genera.

From its lithology and fossil content, the Miria Formation is considered to have formed in the middle of the continental shelf, in moderately energised water of depths from 50 to 100 m. It is of coarser texture and has a more diverse fossil assemblage than other chalks of the Perth and Carnarvon Basins (e.g., Gingin Chalk, Toolonga Calcilulite), which apparently formed on the outer shelf in depths greater than 100 m.

Miria bivalves include a small group of infaunal species, for example, of the genera Grammatodon, Trigonia, Linotrigonia and Panopea; some byssate-epifaunal forms of the Mytilidae and Limidae; several attached - epifaunal forms of the genera Atreta, Spondylus

NEWLY DESCRIBED MAASTRICHTIAN BIVALVES (Cont.)

and Pycnodonte, and a numerically large group of byssate - swimming pectinaceans of genera, for example, Entolium, Chlamys, Neithea and the new genus Giraliapecten.

Of the 30 Miria species examined in the paper, five are either confirmed or suspected of being wide-ranging to cosmopolitan species of the Late Cretaceous. Foremost of these is the well-known oyster Pycnodonte vesiculare (Lamarck) - the species Pycnodonta ginginensis Etheridge from the Gingin Chalk is placed in the synonymy of this species.

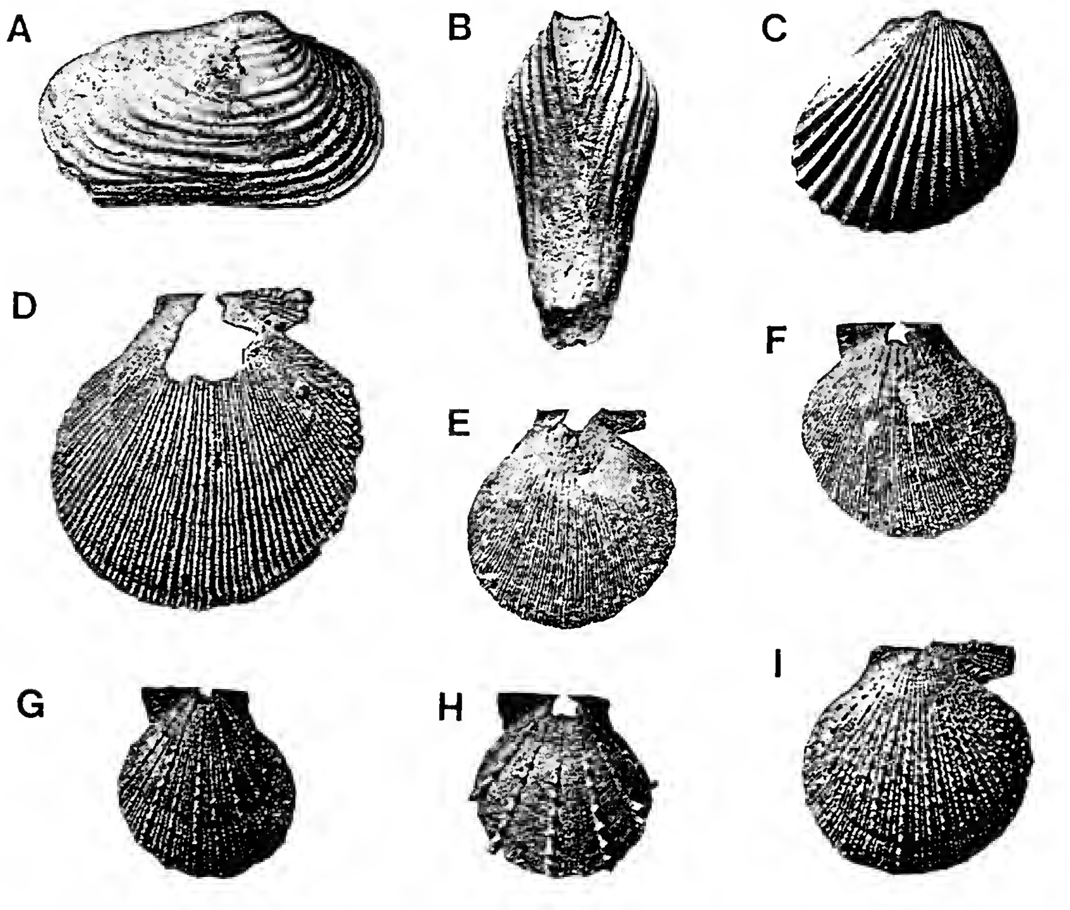

FIGURE 2.
Panopea stenopleura Darragh and Kendrick: A, right valve and B, ventral aspect. Pseudolimea flabellulina Darragh and Kendrick: C, left valve x 1.9. Chlamys (s.l.) cracenticostata Darragh and Kendrick: D, E & I, right valves and F, G & H, left valves x 1.7 [series shows some of the sculptural variations in the species]. All from the Miria Formation (Maastrichtian), Carnarvon Basin, Western Australia.

The largest group comprises 16 species, all endemic to northwestern Australia but representing widespread to cosmopolitan genera of the Late Cretaceous, e.g., Grammatodon, Pseudolimea, Limea, Plagiostoma, Chlamys, Spondylus, Trigonia, Linotrigonia and Panopea. There are five species of up to four endemic genera, of which one, Giraliapecten, is created for two local species. Four poorly preserved and mostly rare species have not been assigned to genera.

Of the 20 genera/subgenera recognised in this study of the Miria bivalves, up to four genera may prove to be endemic to the Carnarvon Basin. This suggests a generic-level endemism of about 20%, consistent with a biogeographic subprovince in northwestern Australia during the Late Maastrichtian. This aspect, plus a species endemism of about 70% confirms what is known of Australia's isolation from other land masses except Antarctica throughout the Late Cretaceous. Weddelian (southern-polar) elements in the assemblage include the bivalve Panopea stenopleura and species of the ammonite genera Neograhamites, Gunnarites and Maorites.

Among Southern Hemisphere bivalve assemblages of the Late Cretaceous, that of the Miria Formation is notable for the high diversity (nine species of at least four genera) of the scallop family Pectinidae. If we add to these the nine species of pectinids from the Coniacian-Santonian Coolyeena Group of the Perth Basin, we have up to 15 species of this family (not counting scallops of other families) from the Western Australian Late Cretaceous. This may reflect the proximity of the Australian margin of the Indian Ocean to the Tethyan Realm of that time. However, no rudists (a major Tethyan group) are known from the Miria and affinities in that direction are limited. The oceanic climate at the time of deposition appears to have been temperate.

Prominent among the Miria pectinids is the new-genus, new-species Giraliapecten oboloides (Fig.1A & B), with transverse-lamellose sculpture on the right valve and scaled radial ribs on the left valve. This kind of bizarre sculptural discrepancy is known otherwise only from some unrelated, modern deep-water scallops of the genus Cyclopecten, family Propeamussiidae.

The paper records the first Australian record of a species of Nipponectes (subgenus of Chlamys), known hitherto only from the Campanian of Japan. This group has recently been recognised in the Cenomanian of South India. Included also are figures of the three species, all rare, of the genus Ctenioplеurium Feldtmann, still known only from the Gingin Chalk (Santonian).

NEWLY DESCRIBED MAASTRICHTIAN BIVALVES (Cont.)

For those with a strong interest in fossil oysters ("the epicure's delight, the systematist's despair"), there is an analysis of extreme, atypical morphological diversity in Pycnodonte vesiculare, the forms being interpreted as "an ecophenotypic response to an energetic, somewhat unfavourable environment ....". This same

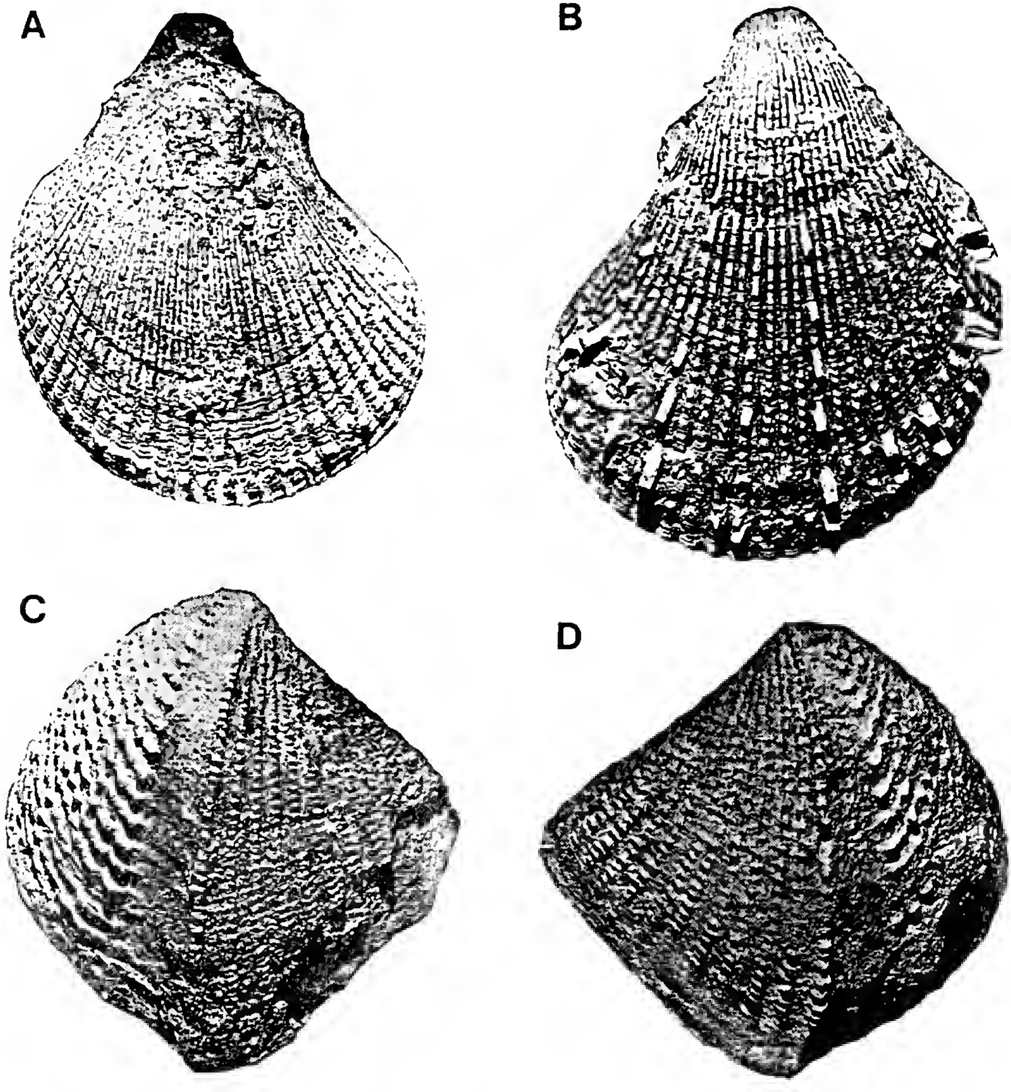

FIGURE 3.
Spondylus schekkermanae Darragh and Kendrick: A, left valve and B, right valve x 1. Trigonia miriana Skwarko: C, left valve and D, right valve x 1.5. Both specimens from the Miria Formation, (Maastrichtian), Carnarvon Basin, Western Australia.

species in its more typical form is present in the overlying Boongerooda Greensand, apparently one of the survivors of the great extinction event of the Cretaceous-Tertiary boundary. Another possible "survivor" is Trigonia miriana (Fig.3C & D), which the authors suggest may be ancestral to the Tertiary-Recent Australian lineages of Eotrigonia and Neotrigonia.

Further studies by the authors on the Inoceramidae and gastropods of the Miria Fm., are in progress.

Copies of the authors' monograph "Maastrichtian Bivalvia (excluding Inoceramidae) from the Miria Formation, Carnarvon Basin, north western Australia. **Records of the Western Australian Museum Supplement 36**, 102p. (including 26 figs)", are available from the W.A. Museum for $10 per copy.

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PERMIAN FLORA RESEARCH IN WESTERN AUSTRALIA.

The following report is adapted from an article titled "The remaking of Australia" published in the "West Australian", Monday, March 2nd, 1992. The F.C.A.A. wishes to thank the West Australian Newspaper for permission to use the article and Carmelo Amalfi and Dr. Stephen McLoughlin for their assistance.

Western Australia has been almost a vacant field for the study of fossil plants until now. Few studies have been carried out and those that were completed during the 1960's are now largely out of date, yet fossil plants tell us of past climates, ancient landscapes and of environments carpeted with plants long extinct.

Dr. Stephen McLoughlin arrived in W.A., last year to piece together the scattered plant remnants buried beneath rock sediments deposited in basins millions of years ago. His work is funded by the Australian Research Council as part of a three-year post-doctoral fellowship and focuses on the Permian Age of 290 to 245 million years ago.

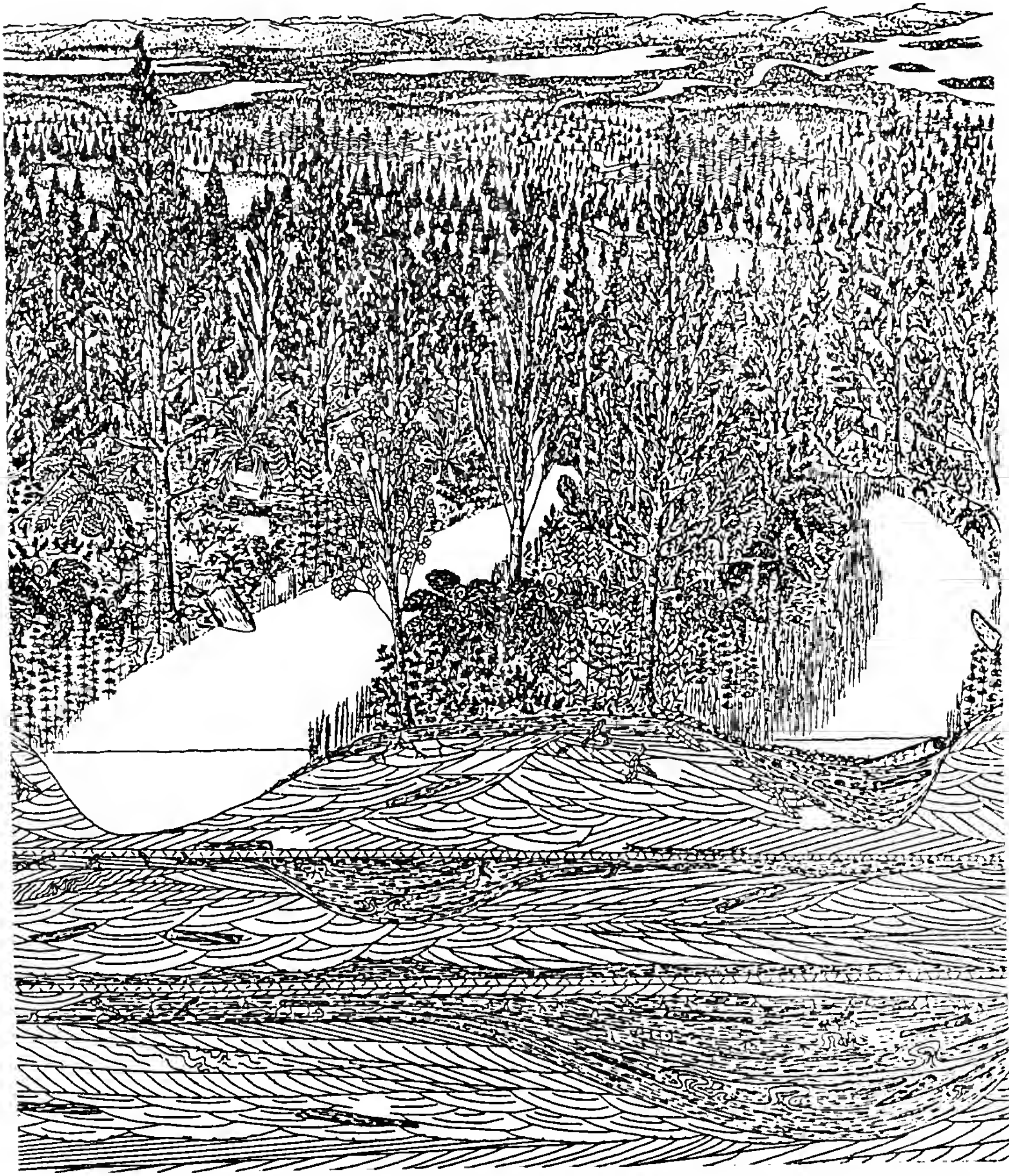
At that time, the climate was warming in W.A., and in other parts of the great southern Gondwana continent after having survived the rigours of an ice age.

The seas retreated from the Perth basin but much of the Canning and Carnarvon basins remained flooded until the middle of the Permian.

Though the climate warmed up it was still cold for most of the period, with alpine glaciers on higher ground. Vast, cold-climate, coal-forming swamps reminiscent of modern Siberia occupied regions in drainage basins where most of Australia's existing coal and gas were formed.

According to Dr. McLoughlin, who has studied fossil plants in central Queensland's coal mines, the landscape was characterised by Glossopteris plants which evolved from the floral remnants that made it through the ice age. As the plants appeared just after a major glaciation they were of low diversity, unlike modern bushland where you will find many species within a given hectare.

The plants which took over the barren landscapes after the ice-caps retreated, are similar throughout the great southern continent and are today preserved as fragments, making it difficult to reconstruct a whole organism.



Reconstruction of Australia's Permian landscape about 270 million years ago.

PERMIAN FLORA RESEARCH IN WESTERN AUSTRALIA (Cont.)

The study of fossil plants is complex. Rarely is there a complete plant or "connecting link" between different organs, such as leaf and stem or fruit and seeds.

Many ecological factors can be tied into the plant remains. Sometimes fossilised plants are found eaten away by prehistoric insects or fungi that were nibbling or sucking juices from leaves or rotting wood. It is also difficult to tell whether branches were broken off during storms or whether neat cuts in the leaves may have been due to caterpillar attack.

Dr. McLoughlin stated that the work is further complicated by the fact that the Glossopterids are an extinct group and have no modern analogues for comparisons.

The pronounced distribution of the Permian Glossopteris flora across the now disparate southern continents was immediately noted by pioneering geologists. Its range became a key factor used to argue in favour of the concept of continental drift.

Fossil plants, especially their spores and pollen, remain an important tool for geologists today, as they can be used to correlate sedimentary rocks.

Of the associated scrambling herb Sphenophyllum (see cover photo) found in the coals at Irwin River, one close relative includes the horsetails which once grew alongside giant clubmosses in the coal swamps of Europe during the Carboniferous Period (362 to 290 million years ago). However, as Dr. McLoughlin points out, the Permian coal swamps of Australia should not be confused with those found in the northern hemisphere in the preceding geological period.

Left: New species of Nothofargus (the Antarctic Beech) x 1.4. Right: New species of Cyprus Pine x 4. Both from the Eocene of Kojonup, Western Australia.

The W.A. coal deposits were products of the cold, swampy bogs in which horsetails grew in great profusion like rushes that line some modern wetlands.

By the Jurassic (208 - 145 million years) and Cretaceous (145 -65 million years) the ancestors of our modern flora are beginning to appear. By the Eocene epoch (55 to 38 million years) many modern plant forms such as the banksias and Antarctic beech had evolved and can be found in scattered outcrops at Kojonup.

Dr. McLoughlin also advised that some plants from the Triassic age (245 to 208 million years) occurred just south of the Kimberley region but, like the Jurassic plants occurring near Mingenew, are not currently being studied.

Plant fossils of Cretaceous age, found near Bullsbrook, Gingin, Shay Gap and Broome, existed alongside the dinosaurs whose well preserved tracks were discovered by the W.A. Museum last year.

Dr. McLoughlin has been busy collecting specimens. Seven trips were launched last year to take photographs and record descriptions of several thousand specimens. He is now working to get some of these published and plans further papers next year as he progresses up, or down the geological record.

TWO GEOLOGY EXHIBITS OPEN AT THE CINCINNATI MUSEUM OF NATURAL HISTORY

Alan Goldstein, Louisville Museum, Louisville, Kentucky, U.S.A.

In Bulletin 25 (May, 1988) under the heading "Cincinnati prepares for a new ice age" we wrote about the plans of the Cincinnati Museum of Natural History to reconstruct a Pleistocene environment in the old Union Railroad Terminal. In this note Alan Goldstein describes the successful conclusion to this ambitious project.

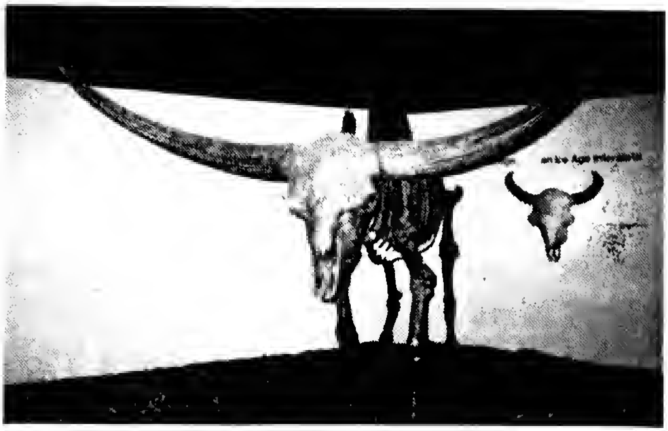
Geology exhibits in the United States are widespread. Large exhibits (excluding the display case type) are fewer in number. The Cincinnati Museum of Natural History has recently opened two simultaneously: One on the Pleistocene of the Ohio Valley; the second a Kentucky cavern.

"Cincinnati: The Pleistocene Legacy" is an exhibit that is larger than many museums! At 1858 square metres (20,000 sq. ft.). It is the most comprehensive Pleistocene reconstruction ever developed in North America. The entry area (this exhibit can be entered from either end) consists of a mix of hand's on activities with computers, microscopes, fossils, and fibreglass fossil skeletal casts.

TWO GEOLOGY EXHIBITS OPEN AT CINCINNATI (Cont.)

Family of Smilodon or saber-tooth cat. The background window provides visitors a glimpse of the exhibit from the interpretive area.

Dire wolf with morraine in background. Can you tell where the rocky floor ends and the mural begins?



Bison latifrons, life-size fibreglass skeletal cast (North American bison skull on wall for comparison).

The main portion of the exhibit is a walk-through diarama, recreating the Cincinnati region 19,000 year ago. Following the interpretive area, a visitor walks on glacial outwash, through a meandering glacial cave (complete with a melt-water stream which flows throughout the exhibit). In the age of robotic animal recreations, the overwhelming detail makes it easy to forget that this exhibit is essentially static! Fibreglass reconstructions of animals and plants are made in exacting detail. Trees, mosses and lichens are lifelike. Mammals include the musk ox, bison, dire wolf, and families of the giant beaver Casteroides and sabertooth cat Smilodon. Birds can also be found by sharp-eyed visitors. Depth is added to the diarama with an immense mural covering 371 sq. metres (4,000 sq. ft.) that took two years to complete! The blend from foreground to background is phenomenal! The path is denoted with cemented glacial gravel, but it is likely that ropes will have to be erected to keep visitors from wandering too far and damaging the exhibit. The exhibit ends with a mastodon sinking into a mud bog, what is today called Big Bone Lick (a state park in Kentucky a few miles away).

The Kentucky cavern is a second large (743 sq. metre/8,000 sq.ft) exhibit. The main part of this exhibit consists of a cave recreated with painstaking detail. It contains a plethora of cave speleothems (formations) and speleogens (water-sculpted features), a dome-pit with a 7.3 metre (24 ft.) waterfall and realistic passages. The cave consists of multiple levels, with different trails for regular and handicapped visitors. For children and adventurous adults, there is a maze of small crawlways and narrow passages.

The rendition of this cave is accurate because sections were cast from latex moulds from a real cave. These moulds were then cast out of fibreglass reinforced concrete. Air conditioning and a chilled cave stream add to the ambience. The only thing it lacks is the mud and the wet-to-the-touch passages of a real cave.

A living colony of bats is being developed by collecting females that are pregnant from buildings around the city. While the mothers are likely to return to their old nurseries after they raise their young in the museum cave, it is hoped that the offspring will imprint in the exhibit room and over the years, the colony will grow larger. Access to the outside to feed is provided via a 30 metre (100 ft.) conduit. The colony is separated from the rest of the cave by a large plexiglass window.

The entry area to the cave exhibit contains illustrations with

TWO GEOLOGY EXHIBITS OPEN AT CINCINNATI (Cont.)

flip-up answers, and other hand's on activities, much like the Pleistocene exhibit.

If you travel to the U.S.A., try to visit the Cincinnati Museum of Natural History. IT IS WELL WORTH THE TIME!

IN THE NEWS

SIOUX'S DINOSAUR SUE IS SEIZED

The skeleton of a Tyrannosaurus rex, said to be the largest and best preserved yet found, has been seized by the FBI. The Tyrannosaurus, known as Sue, was found on a ranch on the Cheyenne River Sioux reservation in South Dakota in 1990.

The rights to recover the skeleton were bought from a member of the tribe for $US5,000 by a private excavation company. However, local US attorney Kevin Schieffer stated the deal was illegal, and sent in the FBI to recover the evidence.

Mr Schieffer argues that the legal status of the Indian reservation means that all antiquities found on it belong in trust to the Federal Bureau of Indian Affairs, and permission is needed to sell them. Experts say the bones could be sold to a museum for several million dollars.

It took 30 FBI experts three days to move Sue, labelling and packing each bone in a plaster cast and crate. Several trucks then moved the bones to the South Dakota School of Mines and Technology in Rapid City. During the move, the laboratories of the Black Hills Institute of Geological Research in Hill City, which excavated the skeleton, were sealed off by the FBI.

It was Cheyenne River Sioux tribal leaders who first called attention to the deal. They said Mr Maurice Williams, a tribal member, had no right to sell the bones, and they wanted them back as an asset for the tribe. Under the terms of the treaty setting up the reservation, they should have the rights over fossil finds.

Daily Telegraph report in the **Herald-Sun**, Melbourne, May 20, 1992.

COMATULIDS - THE FORGOTTEN FOSSILS

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The following article gives a brief outline of the historical study of comatulids, their overall classification, general morphology and fossil record. Illustrations are provided as a general quide to the recognition of comatulid specimens in the field and in existing collections. Historical information is based on A. H. Clark's "Monograph of the existing crinoids" and the "Treatise on Invertebrate Paleontology".

Introduction

Comatulids, or feather stars as they are commonly known, are in their adult stage, small free swimming crinoids with feathery arms springing from a central flat topped plate known as a centrodorsal. The central stem or stalk of the sessile crinoids (sea-lilies) degenerated during evolution to the comatulids and only the centrodorsal, which represents 3 or 4 fused columnal plates, remains. At the same time the cirri or rootlets on this greatly reduced stem developed into strong grasping structures often with hooked tips (Fig. 1). While comatulids are recorded as fossils from many parts of the world, what we understand of their overall anatomy and life style is based principally on our knowledge of extant forms which live in the oceans today, primarily in Indo-Pacific waters. They are generally unable to tolerate a wide variation in pressure and live predominently on the continental shelves from the intertidal zone to a depth of around 200 metres, although a minority of forms are found on the continental slopes. While their maximum diversity is in shallow tropical zones, they are known in large numbers, but few species, from temperate and polar regions.

Comatulids are suspension feeders using podia (tube feet) located along the pinnules and arms to trap planktonic organisms or detritus; this is passed down the ambulacral groove and across the disc to the mouth.

Swimming and crawling are performed by use of the arms & cirri; swimming by raising and lowering one set of arms alternately with certain others; and crawling by lifting the body from the substrate and moving about on the cirri.

Historical Outline

In his Monograph of the existing crinoids (volume 1, part 1, 1915), A. H. Clark wrote:

"The common comatulids of the coasts of Europe (Antedon

COMATULIDS - THE FORGOTTEN FOSSILS (Cont.)

> *petasus, A. bifida, A. mediterranea, and A. adriatica) were undoubtedly known, at least to fishermen, long before any record of them appears in literature; so also it is probable that numerous specimens of the large species from the Orient had reached Europe and found their way into the cabinets of collectors soon after the establishment of regular trade between Europe and the East, though they had not aroused sufficient interest to lead to a definite announcement of the fact."*

The first conclusive reference to a comatulid was made by Fabius Columna in 1592 who described at some length the common Mediterranean species Antedon mediterranea. Apparently the remarks of Columna aroused considerable interest as they were incorporated in many of the succeeding works on zoology.

Although fossil crinoids were widely known, especially the detached columnals, it was not until 1699 and again in 1703 that Edward Llhuyd pointed out the connection between fossil crinoids and the recent sea stars, suggesting that Decampeda cornubiensium Llhuyd (now referred to as Antedon bifida) was the type of sea star to which they were most closely related.

In 1733, Henry Linck published in a single volume all the facts which had been discovered about the sea stars at that time. He differentiated the comatulids from the asteroids (star fish) and ophiuroids (brittle stars) placing them in a separate genus in the class "Stellae Crinitae".

However, in 1758 Linné placed the comatulids, starfish and brittle stars in a single genus Asterias, throwing the study of the group into utter chaos.

Referring purely to the Linnean system of nomenclature, it was de Fréminville (1811) who took the first step in recognising the comatulids as a group distinct from other sea stars by erecting the genus Antedon for the common west European species, A.bifida.

A year later (1812), Lamarck suggested the vernacular name "Comatule" for the comatulids but did not latinise or formerly describe the genus (Comatula) until 1816. However, he failed to recognise the affinities of the comatulids also placing them with the starfish as other post-Linnean authors had done.

During the remainder of the nineteenth century a vast amount of literature was produced on the crinoids including numerous attempts at the classification of this diverse and complex group.

One of these classifications, Austin and Austin, 1842, separated the crinoids into two orders, one named Cionacineti for those with a jointed, flexible column and the other Liberidae for crinoids that lacked a stem or were capable of free motion. This latter group included Marsupites and Comatula thus placing the living stalkless crinoids with fossil relatives.

The major nineteenth and early twentieth century contributions to the knowledge of the comatulids were made by Lamarck (1816) in Histoire naturelle des animaux sans vertebres; J. Müller (1849) in Uber die Gattung Comatula; P.H. Carpenter (1888) in his report on the Comatulae collected during the voyageof HMS Challenger; and A. H. Clark (1915-1967) in his monumental work "A Monograph of the Existing Crinoids - The Comatulids". However, as the title states, this latter work deals purely with extant species, although it is essential to the understanding of the anatomy of these creatures and consequently the interpretation of fossil remains.

Only the Treatise on Invertebrate Paleontology, Part T, Echinodermata 2 (3), published in 1978, provides any comprehensive listing of fossil comatulids. As we shall see, genera known to occur in the fossil record amount to a mere

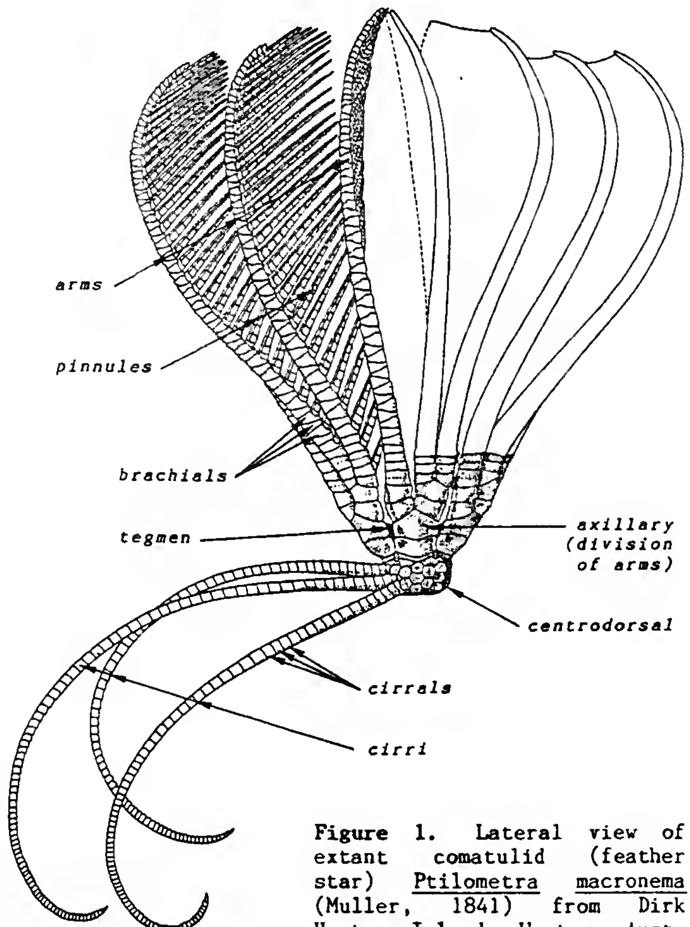

Figure 1. Lateral view of extant comatulid (feather star) Ptilometra macronema (Muller, 1841) from Dirk Hartog Island, Western Australia [after Clark, 1915].

COMATULIDS - THE FORGOTTEN FOSSILS (Cont.)

21%of the total recorded up to the 1970's.

Classification

The phylum Echinodermata embraces an extremely diverse group of marine invertebrates, the majority of which had become extinct by the end of the Permian some 250 million years ago.

Of the nineteen classes in the phylum, as listed in the Treatise on Invertebrate Paleontology, only four contain extant genera: Crinoidea (sea lilies and feather stars); Stelleroida (starfish and brittle stars); Echinoidea (sea urchins, heart urchins and sand dollars); and Holothuroidea (sea cucumbers).

The class Crinoidea is divided into five subclasses, with only the Articulata, which includes the order Comatulida, represented by extant forms.

The following classification, to the level of order, indicates the extent of the fossil record of the comatulids:

Phylum	**Echinodermata**
Subphylum	**Crinozoa** Matsumoto, 1929. [Early Cambrian to Recent]
Class	**Crinoidea** Miller, 1821. [Middle Cambrian to Recent]
Subclass	**Articulata** Zittel, 1879 [Early Triassic to Recent]
Order	**Comatulida** A. H. Clark, 1908. [Early Jurassic to Recent]

When the Treatise was published in 1978, the order Comatulida contained 169 genera (from 23 families) out of a total of 256 listed in the subclass Articulata. Only 36 of these comatulid genera had a known fossil record.

General Fossil Record

Among the oldest fossil comatulids recorded in the Treatise are a specimen of a centrodorsal, Antedon morierei, and a radial circlet, A caraboeufi from the Early Jurassic (Pliensbachian) of France. Both described by de Loriol in the late nineteenth century, they have since been tentatively assigned to the genus Palaeocomaster (see Treatise T877). Recently a new species Palaeocomaster styriacus Kristan-Tollmann, 1988, has been described from three centrodorsals (less than 2mm in diameter) and isolated fragments of theca and brachials. These latter specimens are from the lowermost alpine Liassic (? Hettangian) of Austria, and stated to be the oldest comatulids so far recorded. Other specimens from this genus are known from the Middle and Late Jurassic of England and France.

While Mesozoic comatulids are well documented from throughout Europe, from Portugal in the west to Poland in the east as well as from Yugoslavia and Sweden; outside Europe the record of described material is extremely poor, reference in the Treatise being made only to Algeria, Colombia, Lebanon and the USA (Texas).

The Tertiary record is little better, with Europe again contributing the major source of described species, mainly from the Early Paleocene and the Miocene, with Eocene and Oligocene material recorded only from Italy and Germany respectively.

Non European species are noted as occurring in the Paleocene (Tunisia); Eocene (USA - N. & S. Carolina and Louisiana); Miocene (Algeria, Argentina and Indonesia); and Pliocene (Indonesia).

Based purely on the recorded stratigraphic and geological distribution, one could be forgiven in believing that the apparent abundance of fossil comatulids found in Europe and the paucity of material from the remainder of the world, has some evolutionary

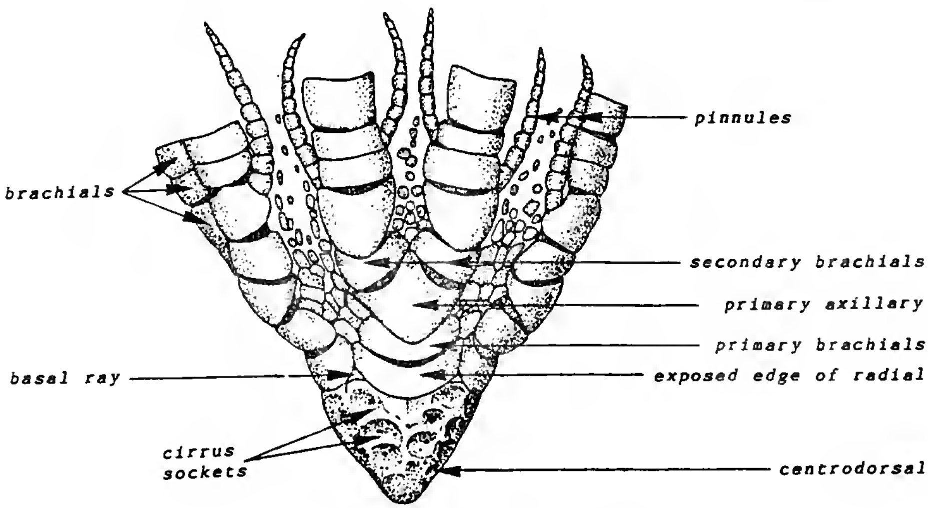

Figure 2. Lateral view of crown and centrodorsal of Notocrinus virilis Mortensen, a Recent comatulid from the Antarctic region, x 4. Note the conical centrodorsal and the cirrus sockets in columns (normally 10). Drawing after Mortensen, 1918.

COMATULIDS - THE FORGOTTEN FOSSILS (Cont.)

or even palaeoenvironmental significance.

However, as with so many other groups of fossil invertebrates that appear to have significant gaps in the non European record, it is not because they did not exist, or that there is a scarcity of material to be found, merely a lack of systematic collecting in the past and an apparent lack of interest or even general awareness of this particular group of crinoids.

It is interesting to note that A. H. Clark (1915) considered the small importance previously given to the crinoids as recent animals in comparison with other echinoderms, arose from three causes: firstly, the extraordinary completeness of the palaeontological record; secondly, the small number of species then known; and lastly, the paucity or absence of accessible species along the shores of countries where the greatest interest in zoology was taken.

Today the position is somewhat reversed. Thanks to Clark and his monumental 4,336 page monograph, we now know an enormous amount about recent forms, yet our knowledge of fossil comatulids has advanced little since the early part of this century.

The Australian Fossil Record

Currently the only fossil comatulid described from Australia is Antedon protomacronema Chapman, 1913, based on an isolated centrodorsal found in a bore sample from the Mallee region of Victoria at a depth of about 130m. The specimen measures a mere 1.15mm high and 1.7mm wide (smaller than a match head). Another centrodorsal, several brachials and a cirral from a larger species were also recorded from Mallee bores but not figured. Chapman

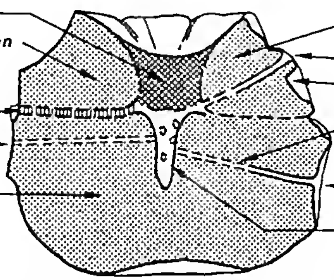

Figure 3. Section through centrodorsal and radial pentagon showing centrodorsal cavity, central plug and axial canal etc., x 3.5 [based on actual specimen].

also notes brachials occurring in "the Janjukian series, having a Mount Gambier facies" and at Batesford near Geelong, Victoria, as well as a comparatively large form, with few cirrus sockets and a low centrodorsal, from Torquay, Victoria and Mount Gambier, South Australia, however, they were never described. Later in 1926, Chapman lists Antedon sp. as occurring at Neumerella, near Orbost, Victoria.

H. L. Clark (1946) considered A. protomacronema Chapman to be more likely related to the family Ptilometridae than to the Antedonidae. [Note: the generic name Antedon is now restricted to extant species]

References in Australian paleontological and geological papers to the occurrence of comatulids, or indeed any other fossils not referred to by specific names, are almost impossible to check, as such items are rarely if ever, indexed.

Probably the only significant reference to the presence of fossil comatulids in Australia is contained in Geological Survey of South Australia Bulletin 36, Stratigraphy of the Murray Basin in South Australia by N. H. Ludbrook (1961). In this Bulletin, Ludbrook notes that the smooth surface of a granite inlier in Section 156, Hundred of Younghusband, is thinly covered with a few feet of coarse rubbly crinoidal calcareous sandstone. Considered an island at the beginning of the transgression, the granite was submerged to shallow depth at the end of the deposition of the Mannum Formation (Early Miocene), thus probably providing optimum conditions for the establishment of a crinoid colony. Associated with the comatulids are echinoids, brachiopods and bivalves as well as a large range of foraminifera.

The comatulids at this location are known from one articulated specimen, various forms of centrodorsals, some with radial pentagons attached, and a diverse range of brachials, pinnulars and cirrals representing several species.

Comatulids are now known to occur in the following locations:

South Australia

- : Mannum Formation (Early Miocene); Murray River cliffs, Murray Bridge to Bow Hill.
- : Gambier Limestone (Late Oligocene/Early Miocene); Mt Gambier district.
- : Port Willunga Formation (Oligocene/Early Miocene); Wool Bay, Yorke Peninsula.
- : Kingscote Limestone (Late Eocene); Kingscote, Kangaroo Island.

COMATULIDS - THE FORGOTTEN FOSSILS (Cont.)

Victoria

: Gippsland Limestone (Early/Middle Miocene); Merriman Creek, near Rosedale; Mississippi Creek, near Lakes Entrance; Neumerella, near Orbost.

: Batesford Limestone (Early Miocene); Batesford, near Geelong.

: Puebla Formation ? (Early Miocene); Torquay.

: formation uncertain (? Early Miocene): Mallee Bores, near Murrayville.

: Jan Juc Formation, Point Addis Limestone Member (Late Oligocene); Point Addis.

Western Australia

: unnamed sediments (Quaternary); Jandakot.

: Pirie Calcarenite (Late Palaeocene); Giralia Station, north west W.A.

: Miria Marl (Late Cretaceous); Giralia Station, north west W.A.

Cont...

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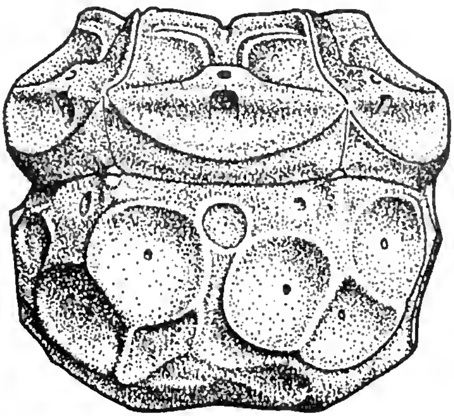

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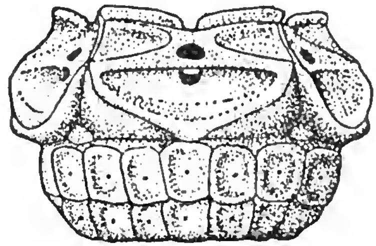

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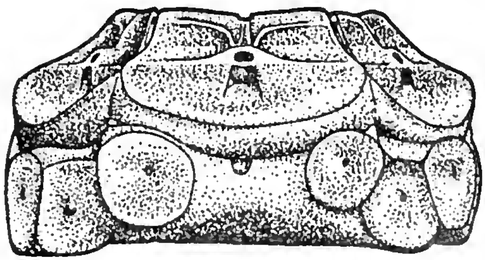

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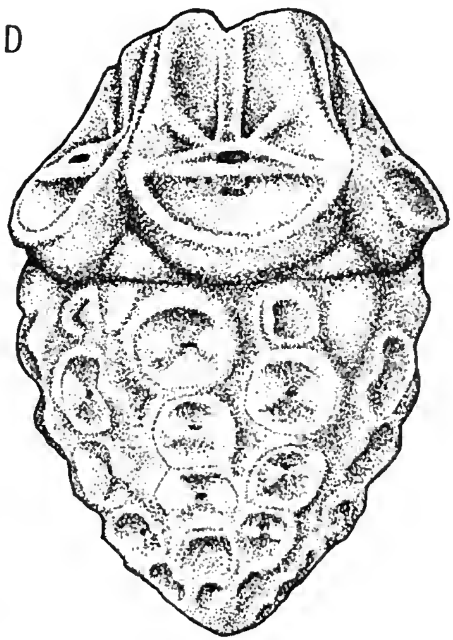

Figure 4. Lateral views of typical centrodorsals with attached radial pentagon. A & B, showing random cirrus sockets [drawings based on Early Miocene specimens from Australia, A x 5.7, B x 4.5]; C, Ptilometra australis (Wilton), showing horizontal rows of cirrus sockets, Recent, Australia, x 8.5; D, Amphorometra brydonei Gislen, showing vertical columns of cirrus sockets, Late Cretaceous, England, x 12 [C, after Clark 1921; D, after Rasmussen 1961].

No doubt our knowledge of the distribution of comatulids through Late Cretaceous and Tertiary strata in Australia will expand quite considerably as more people become aware of their existence.

As with virtually all fossils, taxonomy must by necessity be based on the animals' hard parts. In the case of the comatulids it is the centrodorsal and the radials on which genera and species are determined, as these creatures are rarely found preserved with their arms and cirri attached. In fact the only articulated specimens figured in the Treatise are either Mesozoic (mainly Jurassic) or Recent.

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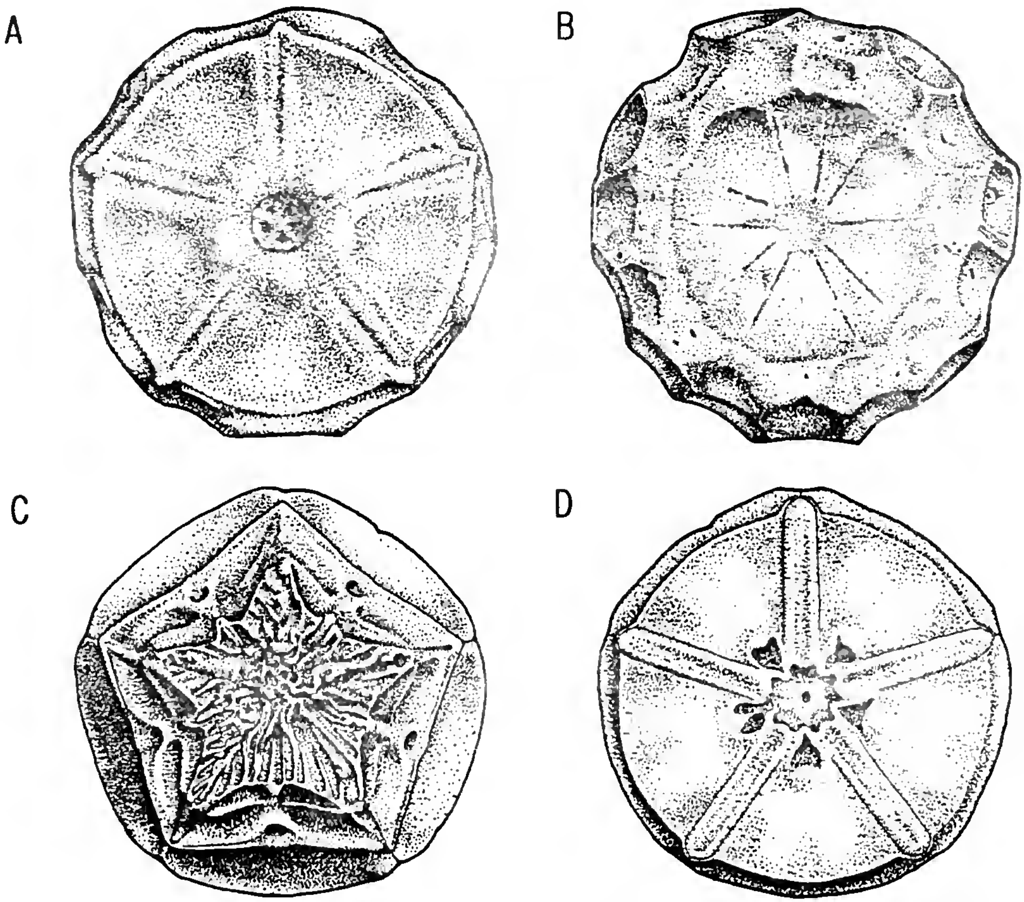


Figure 5. A, ventral (adoral) surface of a centrodorsal showing five radial depressions, centrodorsal cavity and interradial furrows, x 5; B, dorsal (aboral) surface showing a central concave depression. C, ventral (adoral) surface of a radial pentagon with calcified central plug; D, dorsal (aboral) surface showing interradial basal rays. Drawings based on Early Miocene specimens from Australia, x 5.

COMATULIDS - THE FORGOTTEN FOSSILS (Cont.)

Unfortunately, two important diagnostic features used to differentiate species of Recent comatulids, the division of the arms and the structure of the soft parts, in particular the tegmen, are rarely, if ever found in the fossil record. Consequently taxonomic links between recent and fossil forms are difficult to establish below the level of family.

It is not the purpose of this article to attempt any classification or description of Australian fossil comatulids; simply to illustrate typical specimens, so that specimens can be recognised in the field and in existing collections.

Acknowledgements

The author is grateful to Dr Peter Jell, Queensland Museum, for reading the article and suggesting improvements and to the Museum of Victoria (Natural History Library) for access to literature on the subject.

Glossary

The following glossary of morphological terms is restricted to the primary elements of the comatulid skeleton likely to be found in Late Cretaceous and Tertiary marine sediments and to general terms used in this article.

aboral - directed away from mouth.
adoral - directed towards mouth.
ambulacra - shallow grooves running along ventral (adoral) surface of the pinnules and arms and traversing the disc to converge at the mouth; serve to convey food to mouth.
ambulacral grooves - see ambulacra.
arms - series of brachials (ossicles) extending upwards or outwards from the radials irrespective of the number of divisions. Term restricted in use by some authors (Clark) to undivided distal branches.
axial canal - longitudinal passageway for axial cord which penetrates cirrals, thecal plates (centrodorsal and radials), brachials and pinnules. Usually but not always located centrally.
axillary - brachial supporting two arm branches (Fig.1).
basal ray - any of five calcareous rodlike structures of secondary origin developed in the basal grooves between the radial pentagon and centrodorsal in an interradial position and usually connected with the rosette (Fig.6B).
basals - any plate or circlet next proximal to radials, each basal typically in interradial position.
brachial - calcareous segments or ossicles of which the arms are composed. May be axillary or non axillary.
central canal - see axial canal
central cavity - see centrodorsal cavity
central plug - a more or less spongy calcareous deposit on adoral surface of radial pentagon.
centrodorsal - the stellate, discoidal, button-like, conical, cup-shaped or collumnar central plate, from which all other structures appear to radiate. Its sides generally bear varying numbers of cirrus sockets, which mark the place of attachment

of the cirri. These cirrus sockets may be arranged in definite alternating horizontal rows, in vertical columns (Fig.4C) or closely crowded and quite without any precise arrangement (see Fig.4A & B).

centrodorsal cavity - depression on adoral surface of centrodorsal containing chambered organ and accessory structures.

cirral - single cirrus segment.

cirrus (pl. cirri) - slender unbranched jointed appendage of practically uniform thickness arising from the centrodorsal and used for attaching the comatulid to the sea floor etc. (Fig.1).

cirrus socket - a shallow pit or facet each with a small central perforation, situated on the side of the centrodorsal to which a cirrus is attached (Fig.2 & 3).

column - series of segments (ossicles) composing stem of sessile crinoids; excludes cirri and anchorage structures (holdfasts). In comatulids the stem is discarded in early life when the animal becomes free swimming.

disc - the tegminal covering of the ventral surface of the body between the arm bases. It is traversed by the ambulacral grooves which converge on the mouth and in one of the areas bounded by these grooves, rises into an anal tube.

distal - direction or position away from polar or central axis.

dorsal - direction or side away from the mouth normally downward and outward. Mainly used to describe the underside of the centrodorsal or radial pentagon. (see also aboral, the preferred term).

dorsal star - stellate hollow around aboral pole of centrodorsal in some comatulids, often fused with depression.

facet - surface in ossicles (cirral, brachial or pinnular) and radials that functions for connection with adjoined skeletal element.

fossa (pl.fossae) - elongate depression or articular face of ossicle for attachment of muscles or ligaments; less localised than pit.

ligament pit - usually a steep sided small depression in aboral ligament fossa adjoining centre of transverse ridge.

ossicle - any single calcareous segment of crinoid skeleton pinnular plate forming part of aboral skeleton of pinnule.

pinnule - slender unbifurcated branchlet of arm.

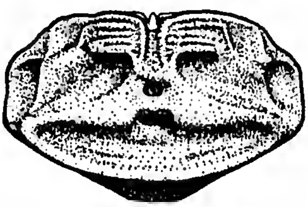
primary axillary - (primaxillary, primaxil) - proximal (first) axillary of arm.

primary brachial (primibrachial,primibrach) - proximal brachials (ossicles) of arm following the radials up to and including the first axillary (primaxil). Where the arm does not divide, all brachials are regarded as primibrachs.

proximal - direction or position toward polar or central axis.

radial pentagon - subpentagonal ring formed of mutually adherent radials after removal of all other structures (Fig.6A & B).

A



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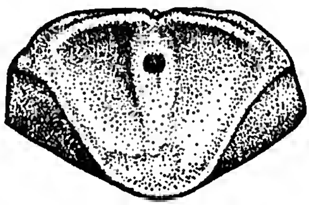

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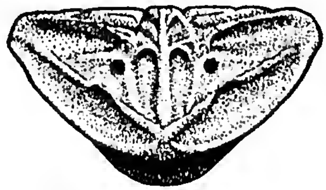

Figure 6. A, proximal surface of a typical first primary brachial (primibrach) showing muscular articulation; B, distal surface. C, distal surface of a typical primary axillary (primaxil) showing dual muscular articulation; proximal surface (not illustrated) similar to distal surface of first primibrach. Drawings based on Early Miocene specimens from Australia, x 6.

COMATULIDS - THE FORGOTTEN FOSSILS (Cont.)

radial pit - radially disposed depression in ventral (adoral) surface of centrodorsal in some comatulids.

radials - the plates from which the arms arise, normally five in number although two extant genera have ten. They usually appear externally as narrow oblong or more or less crescentric plates protruding beyond the edge of the centrodorsal (Fig.6A & B); although in many genera they barely reach the edge of the centrodorsal, and in others may be entirely concealed by it.

ray - radial plate, together with all structures borne by it.

rosette - a delicate calcareous plate formed of metamorphosed basals, centrally located just below the dorsal surface of the radial pentagon.

stem (stalk) - see column.

tegmen - adoral part of theca (see disk).

theca - crinoidal skeleton exclusive of stem, holdfasts and free arms.

ventral - adoral side of theca and rays. Mainly used to describe the upper surface of the centrodorsal or radial pentagon (see also adoral, the preferred term).

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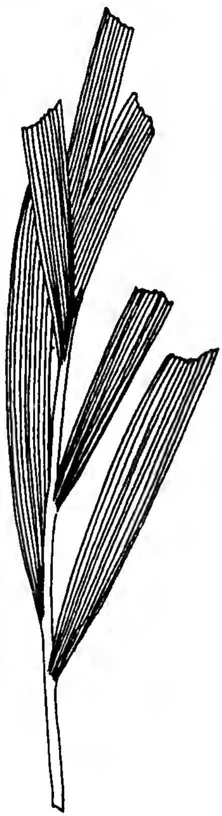
A JURASSIC PLANT FROM CHINA

C.M. Chidley and V.C.P. Lam.

A number of fossil plant specimens recently received from the Peoples Republic of China warranted a closer examination, on the basis that knowledge gained in recent years, seems to indicate that these specimens were wrongly identified, even though the identification was consistent with scientific information available at the time the specimens were first found. The specimens were labelled "Podozamites from the Jurassic strata of Fungchung, Jiangxi Province, Peoples Republic of China"; the scientific name being written in English, while the locality information was translated from Chinese by my wife.

1

2



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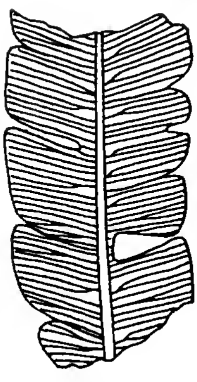

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The specimens consist of a number of rarely complete, black carbonaceous isolated 'leaves' in gray shale, measuring up to 8 cm in length (Fig.2), with three complete foliage spurs up to 5 cm in length on one of the specimens (Fig.3). The spiral phyllotaxy of the 'leaves' indicates that the specimens have an affinity with the conifers, not the cycads as suggested by the name Podozamites. Closer examination of one specimen revealed 5mm to 6mm cone scales (Fig.1), consistent with conifer identification. It is naturally impossible to state definitely that the scales belong to the foliage on the specimen, but the close association is, in itself, identical to the type of association found with conifer foliage of Jurassic age at the Talbragar River Fossil Fish Beds, near Gulgong, New South Wales. It is for this reason that I believe that the fossil specimens represent a species of Agathis.

A JURASSIC PLANT FROM CHINA (Cont.)

Another 'leaf', associated with the specimen (Fig.4), appeared to be consistent with Taeniopteris, further enhancing the similarity between the Fungchung deposit and the Talbragar River deposit, but a closer examination suggests that the affinities may lay closer to that of the British/European Mesozoic, rather than the Australian. The 'leaf' appears strikingly similar to Wielandiella nilssoni, but further information from China may reveal its true scientific name and affinities in the future.

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IN THE NEWS

A FISHY LEAD TO THE AGE OF ROCKS

Using a shark's tooth or some other fossil fragment to identify the age of rocks in resource exploration has become so accepted that world scientists are now getting together to improve their knowledge of the fish of different eras.

Australian scientists are taking a major role in the five year international research effort sponsored by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and the International Union of Geological Sciences, which involves some 200 world scientists.

Dr Sue Turner, of the Queensland Museum, stated that the identification of fish fossils had been used in the search for resources in Australia's Canning, Amadeus and Georgina basins. The technique had also been used to age rocks in oil exploration in Alaska and Siberia.

By improving their ability to identify the different varieties of fish which inhabited the seas and waterways in past ages, scientists can use fragments as small as a tooth or a single fish scale to assess more accurately the age of rocks - a vital clue in the exploration of resources.

The microscopic size of fish fossils means that scientists can obtain evidence from exploration cores rather than undertake special searches.

According to Dr Turner, the identification of fossils is one of the most useful dating techniques, and as fish are often the only fossils to be found at a site, it is possible to date rocks that no one else can date. Even quite small fragments such as spine fragments, teeth or even a single scale can be used. Considering an ancient shark had thousands of scales, every time a shark died it left thousands of clues for future scientists.

Dr Turner, who is funded by the Australian Research Council, has been working with scientists including Dr Gavin Young of the Bureau of Mineral Resources and Dr John Long of the Western Australian Museum.

The international research effort will study beds of fish fossils in various areas of the world.

A FISHY LEAD TO THE AGE OF ROCKS (Cont.)

Scientists have noted strong similarities between fish fossils from specific ages found at divergent sites. For instance, some fossils found in the western McDonnell Ranges in the Northern Territory tie in with others found in Antarctica and in Bolivia, South America.

This is seen by many scientists as supporting the still controversial theory of Australian Sam Carey that the Earth, back in the era when the continental plates were linked, was approximately half its present size.

From **Oil & Gas Gazette** news, John Feary ed., February, 1992.

BOOKS AND BOOK REVIEWS

BMR FOSSILS COME OUT FOR AN AIRING IN NEW CATALOGUE SERIES

Bryozoa hot on the lophophores of the Brachiopods: As the principal Commonwealth Government geoscience agency, BMR is custodian of the national collection of fossils - the Commonwealth Palaeontological Collection (CPC) - which features specimens referred to or illustrated in scientific publications. This responsibility carries attendant obligations under the International Codes of Zoological and Botanical Nomenclature. BMR is fulfilling these obligations by compiling a series of catalogues of type, figured and cited specimens in the CPC, and by making the collection available for bona fide scientists to study.

The catalogues are published in BMR's Report series. The first of them - Report 298, issued a year ago - records the Brachiopods in the collection. The second one - Report 305, just released - is dedicated to the Bryozoa. Des Strusz is the compiler of both.

Each of these catalogues annotates taxonomic, bibliographical, locality, horizon, and age information for the published specimens, which are listed alphabetically by generic name. This information is complemented by a set of indexes, which list genera and subgenera, species and subspecies, and (in Report 305) specimens. All the data have been generated from the ORACLE database 'PALEO', which is replacing the traditional ledger or card-index type of collection cataloguing.

Report 298, comprising 289 A4 pages, costs $37.20 + postage & handling charges of $12 (in Australia) or $25 (overseas) and Report 305, with 73 pages, $30.00 + postage & handling charges of $5 (in Australia) or $15 (overseas).

BMR Sales Centre, GPO Box 378, Canberra, ACT 2601.

AUSTRALIA: EVOLUTION OF A CONTINENT - Second printing

This BMR publication recounting the story of Australia's changing environments during the past 600 million years, has almost sold out of its first printing of 2,000 copies. Stocks of this popular book, which was published early last year are being replenished by a second print run of a further 2,000 copies.

The purchase price remains unchanged at $29.50 per copy + postage & handling charges of $3 (in Australia) or $9 (overseas). Available from the BMR Sales Centre (see address above).