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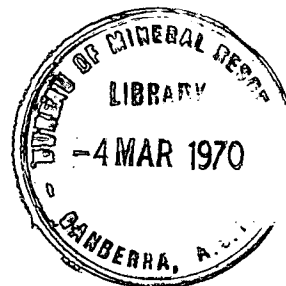
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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record No. 1969 / 130



A Correlation Chart for the Cretaceous System in Australia

by

S.K. Skwarko

*Paper Presented at Fourth ECAFE Symposium on the
Development of Petroleum Resources of Asia and the
Far East, Canberra, October - November 1969*

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 It may not be published in any form or used in a company prospectus or statement without the permission in writing of the Director, Bureau of Mineral Resources, Geology & Geophysics.



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A CORRELATION CHART FOR THE CRETACEOUS SYSTEM IN AUSTRALIA

by S.K. Skwarko*

INTRODUCTION

A correlation chart for the Tertiary rocks of the Australasian Region was prepared for the Eleventh Pacific Science Congress held in Tokyo in 1966, (Ludbrook, 1967), and charts for the Australian Carboniferous Permian, Triassic and Jurassic were produced for the First International Symposium on Gondwanaland held at Mar de Plata in Argentina in 1967 [Banks, Campbell, Dear, Dickins, de Jersey, Rattigan, Roberts and Williams (in press)]. The correlation chart for the Cretaceous System in Australia now presented supplements these.

The chart incorporates some of the latest information and ideas on the distribution, age, and correlation of individual units of Cretaceous age in the whole of the country. Possibly it is the first one ever produced for the whole of Australia and is an entity in itself.

I considered and rejected the idea of giving the accompanying notes the form of a brief and concise description of each sedimentary basin in turn. "The geological evolution of Australia and New Zealand" (Brown, Campbell & Crook, 1968) does this, and although some new information is certainly available since this book went to press, much of what could be said would be repetitive. The notes to accompany the chart are thus hardly more than a thinly veiled list of selected references for those interested in the detail of the Cretaceous rocks and fossils of all or part

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of Australia. It is hoped the reader will find in these all available data which may interest him. Many of the accumulated references deal purely with the stratigraphy, the rock types, and ages, and in this respect partly supplement the - "Bibliography of the Mesozoic palaeontology of Australia and Eastern New Guinea" (Skwarko, 1969b) recently published.

WESTERN AUSTRALIA

In Western Australia, sediments of Cretaceous age occur mainly in four basins aligned along or close to the margins of the Australian Continent. They are all shallow-water or moderately shallow-water deposits laid down in a variety of environments. Their thicknesses vary from place to place, from a few feet to a few thousand feet, and may occur entirely subsurface as in Eucla Basin or entirely in outcrops as in the Gibson Desert, or be of mixed occurrence as along the western coast of the State.

"The Geology of Western Australia", by McWhae, Playford, Lindner, Glenister and Balme (1958), includes the most recent complete discussion of all the established Cretaceous sedimentary units of this State and should be regarded as a basic reference. Much of what it includes has been supplemented in the past few years in a number of publications as well as in many unpublished company and State Survey reports. The following notes grouped for ease of reference according to sedimentary basins in the order set out in the accompanying correlation chart, give suggested references to post-1958 literature.

West Australian Petroleum Pty Limited (WAPET) has an active petroleum drilling programme in many parts of the State and the completion reports on some of their bores contain much recent information on the Cretaceous strata of Western Australia. Copies of the reports on the

Government subsidized drilling operations are held in the Bureau of Mineral Resources library in Canberra.

PERTH BASIN:

1. South Perth: Lowry (1965) summarises most of what is known of the Cretaceous rocks, their age and sequence in the area, and the bibliography contained in his report includes numerous references to unpublished reports. Some units have accumulated in non-marine environment (e.g. Yarragadee Formation, South Perth Formation, Osborne Formation), and are dated on spores and pollen (Balme, 1964; Edgell, 1964a) while others are dated on Foraminifera (Belford, 1958, 1960). In the last few years WAPET has drilled in the area (e.g. Cobar No. 1).
2. Gingin Area: The older Cretaceous sediments in this area are non-marine (Balme, 1957, 1964) and are known both from surface outcrop and from bores. The younger unit - Molecap Greensand, Gingin Chalk and probably Poison Hill Greensand - are marine as shown by their faunas, both large (Feldtmann, 1963) and small (Belford, 1958, 1960; Edgell, 1964b). Low (1965) describes auger drilling of the marine units.

CARNARVON BASIN:

The Cretaceous stratigraphy of the Carnarvon Basin was recently summarised by Condon (1968) and the reader is referred to his bulletin for exhaustive information - much of it very recent and not easily available elsewhere - on rock types, boundaries and definitions of individual units.

However, some of his conclusions regarding ages of formations are not supported by the most reliable fossil evidence and, in construction of the chart, the following additional references were consulted: Balme (1957, 1964); Belford (1958, 1960); Brunnschweiler (1957, 1966); Caye (1968); Cox (1961) and Skwarko (1966).

CANNING BASIN:

1. Canning and Fitzroy: Cretaceous sediments outcropping in this area were described in detail by Veevers and Wells (1961). Some of the stratigraphic units used in their bulletin (e.g. Parda Formation, AnketeII Formation, Frazier Sandstone) are no longer used by WAPET geologists currently working in the area as they "are based on minor variations of silt content, silicification, etc., so for simplicity should be replaced by Broome Sandstone" (pers. comm. W.H. Johnstone).

2. Dampier Peninsula: Brunnschweiler (1957, 1960) described and dated outcropping sediments on the Dampier Peninsula. Some of his conclusions have since been revised (Skwarko, 1969a). The names Leveque Sandstone and Melligo Quartzite, though included in the Broome Sandstone by the WAPET geologists, are retained in the chart as they represent marine horizons of different ages, each horizon containing a distinct macrofauna.

GREAT ARTESIAN BASIN:

Gibson Desert: Wells (1963, unpubl.) mapped and described Cretaceous sediments in the Gibson Desert. These were dated by macrofossils collected during the survey. The fossils are similar to some occurring in the eastern and southern portions of the Great Artesian Basin, and give evidence of the extension of this basin into Western Australia (Skwarko, 1967a).

NORTHERN TERRITORY

The Cretaceous sediments occur in two main areas in the Northern Territory.

In the north they are called Mullaman Beds and occur partly on islands north of Darwin where they are thick and unweathered. But mainly they occur on the mainland where they are almost entirely exposed and their original thickness considerably reduced by long periods of erosion following uplift.

In the south they are present in the subsurface of the Hay River area and form prominent flat-top outcrops in the Rumbalara area. Both the southern portion sediments and the youngest mainland Mullaman Beds were laid down in the westward extension of the Great Artesian Basin.

The most detailed and complete account of the stratigraphy and palaeontology of the Cretaceous sediments of the Northern Territory is by Skwarko (1966; and 1967b, unpubl.). The sediments outcropping on Bathurst Island, north of Darwin, were described in considerable detail by Daily (1956, unpubl.). Wright (1963) described the ammonites collected by Daily.

The Northern Territory is being mapped geologically, mostly on 1:250,000 scale, by geologists of the Bureau of Mineral Resources, but explanatory notes accompanying individual sheets contain only the minimum of information on the Cretaceous sediments.

QUEENSLAND

The Cretaceous sea which covered a large part of the Australian continent in Lower Cretaceous time extended over most of Queensland, and sediments which were laid down then still cover much of the State. This sea was and, to some extent still is referred to as the Great Artesian Basin, but lately with more detailed work continually adding to our knowledge, it has become both practical and fashionable to subdivide the Basin into a number of constituent sub-basins. In time these have acquired the status of sedimentary basins, and their names are listed on the correlation chart.

I have adopted the layout of the Queensland portion of the chart - with a few minor modifications by both R. Vine, B.M.R., as well as myself - from Hill, Playford and Woods (1968), who in turn mainly followed the work of the Bureau of Mineral Resources geologists. References to B.M.R. publications and other works will be found under the headings of the individual basins. They supplement the latest, but now partly out-dated, description of "The geology of Queensland" by Hill & Denmead (ed., 1960).

GREAT ARTESIAN BASIN:

1. Surat Basin: The Cretaceous stratigraphy of part of the Surat Basin is discussed by Day (1964). A more recent reference, mainly to nomenclature of individual lithological units of the area, is that of Vine, Day, Milligan, Casey, Galloway, and Exon (1967).
2. Eromanga Basin:
 - (a) Boulia area: the area to the south and east of Boulia was mapped by geologists of the Bureau of Mineral Resources, and the explanatory notes for Boulia, Springvale, Mackunda and Brighton Downs contain descriptions of Cretaceous stratigraphy in the area. (See also Casey, 1959).

(b) Richmond-Winton area: The reader is referred to Vine et al. (1967), for a summary of the rock units in this area, and to Day (1967) for a description of the fauna.

(c) Tambo area: Vine and Day (1965), Exon (1966) and Vine et al, (1967) all discuss Cretaceous strata outcropping in the Tambo area.

3. Carpentaria Basin: This basin is currently being mapped by geologists of the Bureau of Mineral Resources. Little is published on the area apart from Woods (1961) and Rade (1966).

4. Laura Basin: Even less has been hitherto published on the Cretaceous sediments of the Laura Basin, but the reader is referred to a paper by de Keyser (1963) and to explanatory notes by Lucas and de Keyser (1965) for a description of units, to Woods (1962) and Skwarko (1966) for some palaeontological determinations, and to de Keyser and Lucas (in press) when this is published.

5. Maryborough Basin: Hawthorne (1960) and then Ellis (1968) described in considerable detail the Cretaceous sediments outcropping in the Maryborough Basin. For recent revisions of the fauna occurring in the Maryborough Formation the reader is referred to Skwarko (1963), and Fleming (1966a and b).

6. Stanwell area: In the first description of the Neocomian marine fauna of the Stanwell area, Whitehouse (1946) listed references to previous literature dealing with both marine and non-marine strata. More recently Skwarko (1968) revised the marine fauna.

7. Styx Basin: A summary of the Cretaceous lithologies of the Styx Basin appears in Malone, Olgers & Kirkegaard (1969) who carried out geological mapping of the area at scale 1:250,000.

NEW SOUTH WALES

It is only in recent years that a great deal of interest has been shown in the Cretaceous rocks of New South Wales - mainly by petroleum exploration geologists - and as a result of this much more is known now about the individual areas of Cretaceous sedimentation in this State than was the case several years ago.

The Cretaceous rocks can be divided into two groups - those outcropping and subsurface in the northern part of the State, which represent the extension southwards of the sediments of the Great Artesian Basin (Crespin, 1956), and those which underlie the Murray Basin Tertiary sediments in the southern part of the State (Evans & Hawkins, 1967, unpubl.). Little more can be said about the Great Artesian Basin sediments in New South Wales.

MURRAY BASIN:

Both microfloral and microfaunal evidence is used in correlation between bores sunk in the Cretaceous sediments underlying the Murray Basin. Two areas of occurrence of these sediments are known, viz. the Ivanhoe area, and the south-western or Renmark area.

1. Ivanhoe area: in this area the sediments are Aptian in age and marine in origin. Their fossil content gives evidence of connection between the Murray Basin and the Great Artesian Basin in Aptian times.

2. South-western or Renmark area: here the lowest Aptian sandstone is overlain by marine Aptian and early Albian rocks, which are overlain in turn by the non-marine Albian sediments. Of these the marine sediments give evidence of connection between the Murray and the Great Artesian Basin in the Aptian and the early Albian times, while the non-marine sediments have aspects similar to those of the corresponding sediments in the Otway Basin (Evans & Hawkins, 1967, unpubl.).

VICTORIA

In Victoria the Cretaceous sediments are mainly subsurface but are widespread both onshore and offshore and represent a variety of basins of sedimentary deposition as shown by numerous bores recently drilled in the State. The Murray Basin sediments extend south from New South Wales into the Mallee Region of Victoria (Lawrence, 1966). Along the coast, starting from the east, there are the Gippsland Basin (Dettman, 1963; Dettman & Playford, 1968; Dettman & Playford, in press; Reynolds, 1967; Taylor, 1964; Traill, 1968); Bass Basin which is represented onshore at Torquay (Esso-Bass 3, unpubl. rept.); and Otway Basin (Bock and Glenie, 1965; Dettman, 1963; Leslie, 1966; Reynolds, Evans, Bryan and Hawkins, 1966; Reynolds, 1967; Taylor, 1964a, and b; McQueen, 1961, Sprigg & Woolley, 1963). The Victoria part of the correlation chart is mainly after D.J. Taylor (pers. comm.).

SOUTH AUSTRALIA

The general reference for the Cretaceous stratigraphy of South Australia is "The geology of South Australia" (Glaessner & Parkin eds. 1958), but a wealth of newer data is available both from a recent revision of the outcropping sediments and the fauna (Ludbrook, 1966) as well as from several bores sunk in recent years.

The subsurface Cretaceous sediments of the Otway Basin extend from Victoria into South Australia in the Gambier Embayment and the sequences are comparable on both sides of the border (Dettman, 1963). Part of the Murray Basin subsurface Cretaceous also extends into the State in the Renmark area (Evans and Hawkins, 1967; Ludbrook, 1961, 1966; Dettman, 1963) - an overlap from both New South Wales and Victoria. Finally the Great Artesian Basin and the Eucla Basin also find expression in this State, covering large surface areas as well as being present subsurface (Dettman, 1963; Freytag, 1966).

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