1973/80
Copy 3

Rest. CANCELLED (AIMM)

DEPARTMENT OF
MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD 1973/80

THE EROMANGA BASIN

By

R.R. VINE

THE EROMANGA BASIN

BY

R.R. VINE*

Contents

---

* Principal Executive Officer, Department of Minerals and Energy (formerly Supervising Geologist, Bureau of Mineral Resources, published by permission of the Director).

DEFINITION AND EXTENT

The Eromanga Basin is the central one of three main Jurassic-Cretaceous downwarps in Queensland and adjacent areas. The shape and extent of the basin are shown by structure contours of the base of the Jurassic-Cretaceous sequence (Fig. 1), as Cainozoic structural modification has not been sufficient to distort the shape significantly.

Most of the margins are clearly evident from the presence of older rocks either in outcrop or in subcrop below a veneer of Cainozoic deposits. To the north the Eromanga Basin merges with the Carpentaria Basin across the Euroka Arch - a broad zone with a generally thin Mesozoic cover, which has probably been a zone of relative stability during Jurassic and Cretaceous downwarping. In the southeast the Eromanga Basin merges with the Surat Basin across the Nebine Ridge and, farther south, across the Cunnamulla Platform - a gently-sloping area of relatively shallow basement with thin cover of late Jurassic and Cretaceous sediments. To the southwest is the Muloorinna Ridge, connecting the Mt Painter Block with the Peak-Denison Block. The northward continuation of shallow basement is the logical western margin of the Eromanga Basin, although Jurassic and Cretaceous sediments, similar to those east of the Muloorinna Ridge, extend farther west over the Arckaringa Basin.

Basement to the Eromanga Basin includes a variety of Precambrian and Palaeozoic igneous and metamorphic rocks and indurated sediments, together with little-disturbed sediments of the Lower Palaeozoic Georgina and Warburton Basins, the Devonian Adavale Basin, and the Permo-Triassic

Galilee and Cooper Basins (q.v.). Overlying Cainozoic rocks are generally thin, although they reach 200 m in local downwarps.

STRATIGRAPHY

The maximum thickness of Eromanga Basin sediments is little more than 2500 m, so that in relation to the great extent of the basin the sedimentary sequence is thin. Lateral thickness variations are mostly small. An outstanding feature of the basin is the very broad extent of individual rock units, so that sub-surface lithological corelation is generally fairly simple and reliable. In summary, the Eromanga Basin is filled by a thin and fairly uniform pile of sediments deposited on a stable craton which was being downwarped steadily and more or less uniformly during Jurassic and Cretaceous times.

Figure 2 summarizes the nomenclature throughout the basin and also serves to illustrate the extent of some units. In essence the Eromanga Basin sediments can be divided into two sequences. The lower one is of Jurassic and early Lower Cretaceous age, and is predominantly terrestrial in origin. It consists of an alternation of generally permeable sandstone units with more argillaceous and generally tight units. Sandstone units are mainly quartzose or sublabile, commonly medium to coarse-grained and non-calcareous, and include some of the main artesian aquifers of the Great Artesian Basin. The intervening argillaceous units are mainly interbedded argillaceous labile sandstone, siltstone, and mudstone, some of which is calcareous; sandstone beds are generally very fine to fine-grained.

Deposition of this lower sequence came to an end with a major marine transgression. In places the later units of the lower sequence were deposited in marginal marine conditions, particularly in South Australia (Wopfner et al., 1970). Elsewhere the transgression coincided fairly closely with the start of argillaceous deposition of the upper sequence - the Rolling Downs Group.

Marine beds of the Rolling Downs Group are predominantly mudstone and siltstone, with local development of very fine or fine-grained sandstone and thin very calcareous horizons (including a stratigraphically important marker - the Toolebuc Limestone). Sandstone beds in the Rolling Downs Group are mainly labile and commonly argillaceous; they are most common in units such as the Coreena Member and Mackunda and Winton Formations which were deposited in regressive or terrestrial conditions. Generally they are interbedded with either mudstone or siltstone.

STRUCTURE

The deepest part of the basin approximates the position of the Cooper Basin, indicating continued downwarping of a slightly unstable area. A further, but shallower, depression east of the Canaway Ridge corresponds to the Powell Depression of the Devonian Adavale Basin and was also the site of continuing subsidence during parts of Permian and Triassic times during development of the Galilee Basin. An extensive roughly circular depression to the northeast of the Muloorinna Ridge is partly due to subsidence of the Lake Eyre Basin in Cainozoic time.

For its size, the Eromanga Basin is little disturbed, and through a large part of the basin dips are very low - generally less than $\frac{1}{2}^{o}$. A notable feature is the presence of elongate faults and fault-induced monoclines, many of which are inherited from the older periods of basin formation. Two of the most notable are the Canaway Fault, flanking the long-standing Canaway Ridge, and the Cork Fault, flanking a western lobe of the Galilee Basin. There is also a prominent belt of domes, periclines, and anticlines extending from northeast South Australia into southwest Queensland. Many of these folds are the somewhat subdued expression of tighter folds in the underlying Cooper Basin sequence, which are themselves growth structures formed by draping over periodically uplifted basement blocks. Senior (in prep.) points out that there is a broad relationship between steepness of dips on the flanks of these folds and the amount of sedimentary cover.

Evidence of compressive folding is lacking, and the structural style is interpreted as resulting from relative vertical movements of adjacent basement blocks.

PETROLEUM

Some 20 000 waterbores have been drilled in the Eromanga Basin, but mainly in the shallower parts. Numerous hydrocarbon occurences have been recorded from the bores (see, for example, GSQ, 1960), but all are small. Early petroleum drilling was in the vicinity of such shows, and later to test anticlines evident at the surface or interpreted from seismic data; the results have been disappointing, probably because of the presence of widespread highly permeable aquifers which have been flushed by meteoric water over a long period - possibly much of Cainozoic time.

There are possibilities of stratigraphic traps shielded from flushing in areas of facies change, particularly close to the basin margins. However, remoteness makes it unlikely that small pools in such traps could be of commercial importance unless close to pipelines from the Cooper Basin fields. It must be expected that, lacking a major discovery, the majority of exploration is going to be incidental to investigation of deeper, more prospective, section.

BIBLIOGRAPHY*

CASEY, D.J., 1970 - Northern Eromanga Basin. Geol. Surv. Qld Rep. 41.

EXON, N.F., GALLOWAY, M.C., CASEY, D.J., and KIRKEGAARD, A.G., 1972 - Geology of the Tambo/Augathella area, Queensland. Bur. Miner. Resour. Aust. Rep. 143.

FORBES, B.G., 1966 - The geology of the Maree 1:250 000 Map area. Geol. Surv. S. Aust. Rep. Invest. 28.

FREYTAG, I.B., 1966 - Proposed rock units for marine Lower Cretaceous sediments in the Oodnadatta region of the Great Artesian Basin. Quart. geol. Notes geol. Surv. S. Aust., 18.

GSQ, 1960 - Occurrence of petroleum and natural gas in Queensland. Compiled at the Geological Survey of Queensland. Geol. Surv. Qld Publ. 299.

HIND, M.C. and HELBY, R.J., 1969 - The Great Artesian Basin in New South Wales. J. geol. Soc. Aust., 16(1) 481-97.

PARKIN, L.W., Ed., 1969 - Handbook of South Australian geology. Geol. Surv. S. Aust.

SENIOR, B.R., in prep. - Geology of the central part of the Eromanga Basin. Bur. Miner. Resour. Aust. Bull.

WOPFNER, H., FREYTAG, I.G., and HEATH, G.R., 1970 - Basal Jurassic-Cretaceous rocks of western Great Artesian Basin, South Australia: stratigraphy and environment. Bull. Amer. Ass. Petrol. Geol., 54, 383-416.

---

* The Explanatory Notes accompanying 1:250 000 Geological Sheets, available from Bureau of Mineral Resources, Canberra; Geological Survey of Queensland, Brisbane; Geological Survey of New South Wales, Sydney; and South Australian Department of Mines, Adelaide, contain comprehensive bibliographies.

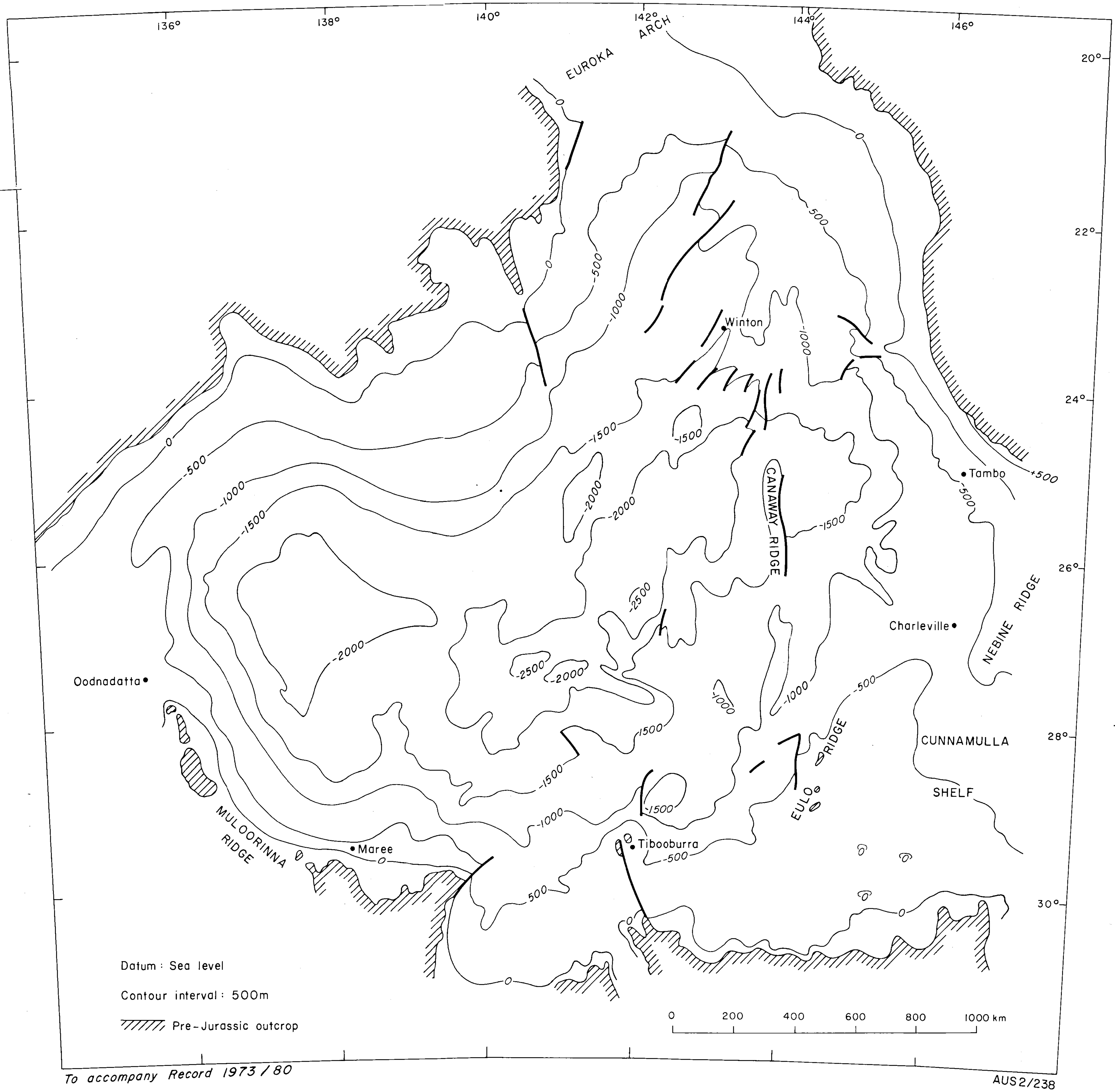

Fig. 1 Structure contours of base of Jurassic

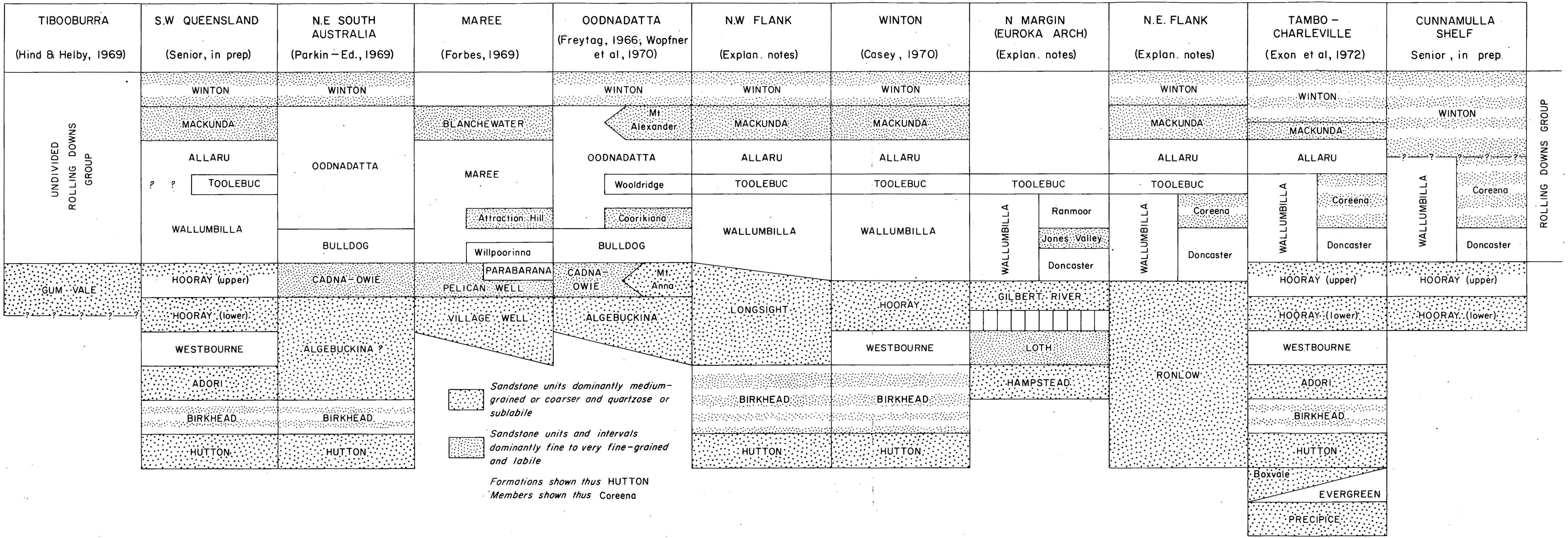

Fig. 2 Distribution of rock units & comparison of nomenclature