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PRECAMBRIAN FOSSILS IN AUSTRALIA

Notes on localities containing known and possible occurrences of stromatolites and microfossils

by

K.A. Plumb

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SUMMARY

Areas suitable for the collection of samples for the study of Precambrian fossils are described.

Stromatolites appear to be useful for Precambrian stratigraphic correlation and detailed study is warranted. Reasonably comprehensive assemblages have now been described from the Adelaide Geosyncline and Amadeus Basin. It is suggested that work by BMR should initially concentrate on the McArthur Basin, Victoria River Basin, and Pine Creek Geosyncline. This should be extended later to the Kimberley, Mount Isa, and Hamersley regions.

Most work on microfossils is concerned simply with finding and identifying specimens and their stratigraphic value is, as yet, unknown. They have been found in the Amadeus and Hamersley Basins, where further study is warranted. Suggested areas for possible new discoveries are in the McArthur Basin, Mount Isa and Pine Creek Geosynclines, and the Bangemall Basin.

INTRODUCTION

As a guide to future studies of Precambrian fossils by the BMR and the Baas Becking Geobiological Laboratory a brief literature review has been carried out to determine potential localities for the collection of samples for study. This report summarizes the results of this review.

Stromatolites and indeterminate microfossils are known from Precambrian rocks in Australia ranging in age from Archaean to the Cambrian. In addition many localities, yet to be studied in detail, have suitable rock types for the possible occurrence of microfossils.

Precambrian fossils are becoming increasingly significant in world stratigraphy and have been recently discussed by Glaessner (1966), Cloud & Semikhatov (1969), and Barghoorn (1971). During the last couple of decades Russian workers have erected a Precambrian stratigraphy based on stromatolites and this has been successfully tested on a world wide basis by Cloud & Semikhatov (1969), who present tables showing the evolutionary trends and age ranges of the various forms.

More recently the techniques have been applied in more detail to Australia by a group from the University of Adelaide (Glaessner, Preiss, & Walter, 1969; Walter, 1970; Preiss, 1971). Most attention was given to the Adelaidean sequences of the Adelaide Geosyncline and Amadeus Basin, resulting in several refinements in the correlation of the Adelaidean sequences. In addition Walter did some work on material from the McArthur, Hamersley, and Bangemall Basins.

Walter (1970), in a detailed discussion of the use of stromatolites, stresses that evolutionary trends can be recognized at both the macro and micro scale and the palaeontologist must personally study his material both in the field and in the laboratory to identify forms correctly. Material collected by field geologists is generally inadequate. Opinions that stromatolites are of little use stratigraphically (e.g. Robertson, 1960) have generally been based on inadequate study of material.

Considering the detail of work already carried out in the Adelaide Geosyncline and Amadeus Basin, maximum value can probably be obtained by BMR initially concentrating on sequences of different ages where stromatolites are known to be abundant. These are the McArthur Basin, the Victoria River Basin, and the Pine Creek Geosyncline. Later correlations can be attempted in the Kimberley, Mount Isa, and Hamersley regions.

Most work to date with microfossils in the Precambrian is concerned simply with finding the forms and proving their organic origin. Many examples are still of doubtful origin. Glaessner (1966) suggests that they may ultimately be of stratigraphic value, at least during the

Adelaidean and Carpentarian, but at this stage much effort, using all available facilities, will be needed to find, and identify as organic, sufficient specimens.

The only areas in Australia where microfossils have been positively identified are in the Adelaidean Bitter Springs Formation of the Amadeus Basin and in the Lower Proterozoic ironstone formations of the Hamersley Basin. Possible forms occur in the Archaean of the Yilgarn and Pilbara Blocks and in the Carpentarian Mount Isa Shale. The prime prospect for new discoveries would probably be the McArthur Group, particularly the HYC Pyritic Shale Member. Other areas with potential include the Mount Isa Geosyncline, Pine Creek Geosyncline, Bangemall Basin, and additional formations in the Hamersley Basin.

NOTES ON LOCALITIES

ARCHAEAN

Glaessner (1966) mentions probable micro-organisms, including blue-green algae, from the Archaean of South Africa, Canada and Australia, and stromatolites from South Africa and, probably, North America.

Barghoorn (1971) describes small bacteria-like bodies from the Fig Tree Formation (ca. 3 200 m.y. old) of the Barberton Mountain Land of South Africa. Black, grey and greenish cherts are interbedded with jaspers, ironstones, slates, shales and greywackes. Thin sections showed carbonaceous laminae but distinct bodies were not visible. Carbon replicas of etched and polished surfaces, 'shadowed' with metal, were examined by a transmission electron microscope. Various structures, between 0.2 - 0.3 microns diameter, and 0.5 - 9.0 microns long, were found. Later, cell-like spheres, 17 - 20 microns diameter, were resolved optically.

Close analogies exist between the geology of the Barberton Mountain Land and the Greenstone Belts of the Australian Archaean and the likelihood of finding suitable rocks seems good.

Yilgarn Block

Marshall, May, & Perret (1964) describe vague forms of possible organic origin within the opaline cement of fine-grained quartzites within Banded Iron Formation near Southern Cross. Brooks (1971) has noted carbonaceous matter and extractable organic compounds from a variety of

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Archaean rocks. Glikson (1970) notes intercalations of siliceous and carbonaceous meta-argillites from the lower part of the Coolgardie-Kurrawong succession.

Pilbara Block

La Berge (1967) describes clear chert spheroids of possible organic origin, about 20 - 35 microns diameter, from brillant red jaspers at Mount Goldsworthy.

Kimberleys

Dow & Gemuts (1969) record carbonaceous phyllite within the Ding Dong Downs Volcanics and pyritic-carbonaceous shale, overlying dolomite, within the Biscay Formation, of the Halls Creek Group, but metamorphism is probably too high for fossils to be preserved.

LOWER PROTEROZOIC

Glaessner (1966) notes several occurrences of Lower Proterozoic fossils, both micro and macro, from many countries, including Australia. Probably the most interesting area is the Gunflint Iron Formation (ca. 1 900 m.y.) of North America, where numerous micro-organisms are described from beds of black chert, 3 - 9 inches thick, and containing stromatolites, within the iron formation (Barghoorn, 1971; Hofmann, 1971). They show a variety of forms and range upwards from about 0.6 microns in size.

La Berge (1967) describes a number of spheroidal bodies of probable organic origin found in thin sections of Proterozoic iron formations from U.S.A., Canada, Australia and South Africa. The host rocks include chert, black chert, red jasper, granule-bearing silicate-iron formation, and greenalite iron formation, and the bodies are preserved as clear chert (visible under crossed nicols) or pigmented by a variety of substances such as carbon, hematite, greenalite, chlorite, carbonate etc. The bodies range in size from 5 to 40 microns diameter.

Stromatolites are common in the Lower Proterozoic and in Australia are well known from the Hamersley Basin and Pine Creek Geosyncline.

Glaessner (1966) also mentions Lower Proterozoic problematica. In Australia Robertson (1962) described peculiar forms from the Noltenius Formation of the Pine Creek Geosyncline, but Walter (1970) has shown them to be of inorganic origin, probably small sand volcanoes. Edgell (1964) described 'medusoids' from the Brockman Iron Formation in the Hamersley Basin. Walter (1970) has shown these also to be inorgwnnic, probably chert modules, as were the 'stromatolites' of the Brockman Iron Formation, named by Edgell Collenia brockmani n.sp., and Collenia cf. kona Twenhofel; Trendall & Blockley (1970) concur with Walter's conclusion.

Hamersley Basin

Microfossils: La Berge (1967) described spherical bodies, 12 - 25 microns in diameter, from the Dales Gorge Member of the Brockman Iron Formation. They consist of black carbonaceous material in a matrix of chert or stilpnomelane-bearing chert, and can be observed to 'fade' (by ?oxidation) into almost clear chert. They were found in only one locality, drill hole 61, footage 741, Wittenoom Gorge. The enclosing iron formation is thinly bedded and consists of chert, stilpnomelane, some magnetite, and a carbonate.

Trendall & Blockley (1970) record that La Berge's specimens probably come from beds equivalent to about 348.8 feet in the type section of BIF 13. They note similar carbonaceous bodies from the Marra Mamba Iron Formation at Kungarra Gorge. The Mount McRae Shale is recorded as containing some graphitic shale interbedded with chert and dolomite, while fresh sections of the Mount Sylvia Formation reveal carbonaceous shale and chert.

MacLeod (1966) notes beds of black chert within the Wittenoom Dolomite. The Roy Hill Shale Member of the Jeerinah Formation contains pyritic carbonaceous shale which is black when fresh but weathers white. The Warrie Member of the Jerrinah Formation contains shale, chert, mudstone, and thin-bedded dolomite.

Stromatolites: Stromatolites are abundant in several formations of the Hamersley Basin. Edgell (1964) described several forms and attempted stratigraphic correlations, but Walter (1970) showed that Edgell's identifications were wrong and that the 'stromatolites' of the Brockman Iron Formation are not of organic origin. Cloud & Semikhatov (1969) reidentified forms from the Tumbiana Pisolite of the Mount Jope Volcanics, Fortescue Group. Walter (1970) described forms from the Duck Creek Dolomite of the Wyloo Group and the Tumbiana Pisolite. Edgell's forms from the Wittenoom Dolomite have not been restudied yet.

Pine Creek Geosyncline

Microfossils: No microfossils have been recorded from the area yet, but there are several promising rock types. Metamorphism may be a problem locally but is generally only of low greenschist grade, certainly no worse than Mount Isa or the Archaean Greenstone Belts. Many favourable rocks are associated with mineralization, making them of interest to ore genesis, and providing fresh material from drill cores or mine or quarry workings.

Walpole et al. (1968) record pyritic-carbonaceous siltstone, carbonaceous siltstone, and pyritic siltstone, together with algal dolomite, from the Koolpin Formation of the South Alligator Group. The Golden Dyke Formation of the Goodparla Group, particularly the Craig Creek Member, contains carbonaceous-dolomitic shale, in places pyritic, pyritic-carbonaceous siltstone, and chert. The Acacia Gap Tongue of the Masson Formation, Goodparla Group, contains pyritic carbonaceous siltstone. Metamorphism of the Batchelor Group may be too high, but the Crater Formation contains pyritic-carbonaceous-dolomitic marl.

W.M.B. Roberts (pers. comm.) has unsuccessfully looked for organisms in the Golden Dyke Formation at Woodcutters but has not tried electron microscopy.

Stromatolites: Stromatolites are abundant in the Koolpin Formation of the South Alligator Group and in the Coomalie Dolomite and Celia Dolomite of the Batchelor Group. Detailed study and comparison with Hamersley Basin forms would provide a valuable indication of their stratigraphic value.

CARPENTARIAN

Stromatolites become very abundant within the Carpentarian, both in Australia and elsewhere, and show definite value for stratigraphic correlation in Russia (Glaessner, 1966). Stromatolites are abundant over a wide stratigraphic range in the McArthur Basin and the presence of probably stratigraphically equivalent rocks, with stromatolites, at Mount Isa and the Kimberley Basin allows their stratigraphic value to be tested. Their detailed study is highly desirable. Glaessner also mentions a number of occurrences of probable microfossils of various forms, including oncolites, and suggests that there may possibly be sufficient diversity of forms by the Carpentarian for them to assume stratigraphic value. Suitable host rocks for microfossils exist in Australia, but two Australian examples of micro-organisms so far recorded (Love and Zimmerman, 1961; Dunn, 1964) are now subject to considerable doubt.

McArthur Basin

Microfossils: Dunn (1964) described possible sponge spicules from the McArthur Group at Urapunga. I now believe these structures are volcanic shards and Dunn concurs with this view.

Large oncolites are visible in hand specimens of some McArthur Group rocks; they are particularly characteristic of the Reward Dolomite. There would seem to be a good chance of finding micro-organisms by detailed search.

The obvious choice is the H.Y.C. Pyritic Shale Member at McArthur River. Pyritic-bituminous shales are associated with the ore beds. Fresh material is readily available from drill core and there is obvious application to studies of ore genesis.

There is reasonable potential for other suitable rocks in the area, but exposure is a problem. The Batten Sub-Group is a favourable facies for cherts and black shales, but most of the outcrop of the Sub-Group is deeply weathered, leached, and silicified. Most of the 'cherts' recorded in the field are secondary; primary cherts have yet to be proven despite the apparently favourable sedimentary environment. The best potential for micro-organisms probably lies in the Yalco Formation and, possibly, the Looking Glass Formation. Fresh material may require drilling.

The Vaughton Siltstone in Arnhem Land is correlated with the Barney Creek Formation at McArthur River. Most of the unit is covered by soil, but black shale crops out near the Walker River. The shale has not been sectioned yet because of its fissility during collection. Access is poor but the unit should be kept in mind. The rest of the McArthur Group in Arnhem Land has similar potential to the Batten Sub-Group but is even more highly weathered.

The Wollogorang Formation of the Tawallah Group contains a distinctive marker bed of dolomitic shale containing pyrite pseudomorphs on Mount Young and Tanumbirini Sheet areas (Plumb & Paine, 1964; Paine, 1963). The pyrite may be considered significant but fresh exposure is scarce.

The Roper Group contains some possible microfossil beds, but the potential is not good. Black and grey shale is recorded from the Cobanbirini Formation in Tanumbirini Sheet area (Paine, 1963). In Urapunga Sheet area the Velkerri Formation contains laminated calcareous shale and the Mainoru Formation has fine-grained marls (Dunn, 1963).

Stromatolites: The McArthur Group contains abundant and varied stromatolites and detailed study is highly desirable. They occur in numerous laterally consistent beds throughout the 3 000 m Umbolooga Sub-Group. Exposures are good and superficial study during regional mapping suggests a variety of forms should be identified. Limited studies by Cloud & Semikhatov (1969) and Walter (1970) have only identified one form, Conophyton garganicum, but I confidently expect a comprehensive study would reveal many more forms. The study should extend into the Calvert Hills Sheet area to include the Karns Dolomite.

The Dook Creek Formation of the Mount Rigg Group contains abundant stromatolites in the Mount Marumba and Katherine Sheet areas (Roberts & Plumb, 1965; Randal, 1963) and we confidently correlate it with the McArthur Group. Cloud & Semikhatov (1969) have tentatively identified Conophyton f. indet. and Inzeria tjomusi Krylov, from which they query our correlation. Further work is obviously indicated.

The Wollogorang Formation of the Tawallah Group contains simple 'wavy' stromatolite forms in the Calvert Hills, Robinson River, Wallhallow, and Mount Young Sheet areas (Roberts et al., 1963; Yates, 1963, Plumb & Rhodes, 1964; Plumb & Paine, 1964). The best exposures are found in the Calvert Hills Sheet area.

The stratigraphically equivalent Katherine River Group in Arnhem Land contains stromatolites in the Cottee and McCaw Formations (Roberts & Plumb, 1965). The Cottee Formation contains particularly well developed dome-shaped colonies. Study is certainly warranted during any major project, but access is rather too difficult to be considered during any reconnaissance work.

In the Roper Group of the Urapunga Sheet area (Dunn, 1963) 'cone-in-cone' limestone has been recorded from the Kyalla Member; this could possibly be of organic origin.

Mount Isa Geosyncline

Microfossils: Love & Zimmerman (1961) described micro-organisms about 1 - 12 microns in size associated with pyrite in the Mount Isa Shale. There is now considerable doubt as to the organic origin of these bodies, even by Love himself (W.M.B. Roberts, pers. comm.).

Carter, Brooks, & Walker, (1961) record carbonaceous shale and slate from the Mount Isa Shale and its many stratigraphic equivalents. Many of these shales are associated with mineralization which makes them of interest to ore genesis studies and provides fresh specimens from drill core or workings. Metamorphism may be a problem. Units of the Western Geosynclinal Basin (Mount Isa Shale, Lawn Hill Formation, Surprise Creek Beds) are generally reasonably low grade. In the Eastern Geosynclinal Basin metamorphism is more intense, but carbonaceous slates are recorded from the Marimo Slate, Answer Slate, Hampden Slate Member of the Kuridale Formation, and the Corella Formation.

Stromatolites: Robertson (1960) described and abundantly illustrated the abundant stromatolites of the Paradise Creek Formation. Unfortunately his studies were only superficial and thus the identifications were wrong. They have been revised by Cloud & Semikhatov (1969) who recognize Eucapsiphora paradisa n.f. and a problematical form with affinities to Conophyton. Carter et al. (1961) also refer to stromatolites in the stratigraphically equivalent Ploughed Mountain Beds and problematical spheroidal structures in the Corella Formation. These forms should be studied further and compared with the stratigraphically equivalent McArthur Group.

Carter et al. (1961; page 131) refer to stromatolites at the top of the Judenan Beds but no locality is given. These may be relevant to comparisons with the Tawallah Group.

The Mount Isa Party have recently reported new stromatolite localities from the Marimo Slate (G.M. Derrick, pers. comm.) and from the Pilpah Sandstone (Wilson, September 1971 monthly report). This latter formation has been tentatively correlated with the Constance Sandstone/Mullera Formation by Carter et al. Stromatolite study may assist.

Kimberley Basin

Stromatolites: Well developed stromatolites are abundant in the Teronis Member of the Elgee Siltstone, Kimberley Group, in the Mount Ramsay, and, to a lesser degree, Lansdowne, Sheet areas (Roberts, Halligan, & Gemuts, 1965; Gellatly, Derrick & Plumb, 1965). Roberts and I have noticed a superficial similarity to those of the Cottee Formation of Arnhem Land, which is thought to be of similar age. Cloud & Semikhatov (1969) have identified Kussiella f. indet. Further study and comparison with the McArthur Basin is desirable.

ADELAIDEAN

As is to be expected the Adelaidean, throughout the world, has provided the most varied and best known collection of Precambrian fossils (Glaessner, 1966). Stromatolites have been used to subdivide the

Riphaean of Russia and this scheme has recently been applied, apparently successfully, to Australia by a group from Adelaide (Glaessner, Preiss, & Walter, 1969; Walter, 1970; Preiss, 1971). Figure 2 shows the correlations established by these studies (after Preiss, 1971). Of particular note is the refinement possible in establishing relationships between the Burra Group of the Adelaide Geosyncline and the Bitter Springs Formation of the Amadeus Basin. Microfossils are also well known. Schopf (1968) has described an abundant microflora from the Bitter Springs Formation. In a further reference Barghoorn (1971) recognizes three bacterium-like species, twenty blue-green algae, two possible fungi, and two problematica. Finally, the Adelaidean provides the first examples of definite, proven megafossils, including the well known Ediacara fauna of South Australia.

It would appear that at the present stage of our knowledge of Precambrian fossils in Australia the main Adelaidean assemblages, the Bangemall Basin, Amadeus Basin, and Adelaide Geosyncline, have been reasonably well studied, for the present, and attention should be focused on the older rocks. Ultimately, of course, there is still much more work to be done on the Adelaidean.

Adelaide Geosyncline

Microfossils: No microfossils have been recorded yet but some beds have possible potential. Thomson (1969) records minor black cherts in the Auburn Dolomite and black carbonaceous shale in the Bethel Shale Member of the Saddleworth Formation. The Skillogallee Dolomite is described as passing seawards into dark siltstone. The Tindelpina Shale Member of the Tapley Hill Formation is only moderately suitable lithologically, finely laminated dark shale and dolomite, but is well exposed in easily accessible road cuttings near Adelaide.

Stromatolites: Preiss (1971) has carried out extensive studies on the stromatolites and presumably the work is continuing. His results are summarized in Figure 2.

Amadeus Basin

Microfossils: Schopf (1968) has described an extensive microflora from dense, black, wavy, conchoidal-fracturing chert, associated with stromatolites, in the Bitter Springs Formation of the Ross River area. Further reference is made by Barghoorn (1971) who recognizes three bacterium-like species, twenty blue-green algae, two possible fungi, and two problematica. There is obviously still much more work to be done but Bitter Springs is probably adequately covered for the present

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and it would be initially more profitable to concentrate on less well known rocks. No other favourable formations are known in the basin.

Stromatolites: Cloud & Semikhatov (1969) identified some forms from the Bitter Springs Formation at Ross River; and Walter (1970) identified a number of forms (see Figure 2) from sections at Mount Gillen, Jay Creek, and Kanapota Gap. Forms were also identified from the Ringwood Member of the Pertatataka Formation and the presence of vague unidentified forms noted from the Julie Member. Some doubt was expressed whether structures in the Areyonga Formation were stromatolites or slumps. It should be noted that problematical structures, either slumps or stromatolites, occur in the stratigraphically equivalent Walsh Tillite of the Kimberleys; this would seem to strengthen the organic origin hypothesis. It would seem again that work on the Amadeus Basin is sufficient for the present and it would be more profitable to concentrate on other areas initially.

Bangemall Basin

Microfossils: No microfossils are known yet, but Daniels (1969) describes the Discovery Chert as consisting of thin-bedded black or grey chert, with disseminated pyrite, while near its base there is a thin, white-weathering, black carbonaceous shale. This unit would seem to be a prime objective if access is reasonable. Other possibilities include the Allawarra Formation, which contains black and maroon shale, locally pyritic, and the Coodardoo Formation, with minor alternating dark green and black shale. The Fords Creek Shale and Kurabuka Formation are faint possibilities if access is very easy.

Stromatolites: Stromatolites have long been known from the Bangemall Group. Walter (1970) has made a reconnaissance study and identified forms from the Devil Creek Formation and Irregully Formation (see Figure 2). Much more work obviously remains to be done.

Victoria River Basin

Microfossils: No microfossils are known from the area and the potential is not good. I. Sweet (pers. comm.) has mentioned dark grey to black shales in the Stubb Formation. There may be suitable cherts amongst the carbonate rocks of the Skull Creek Formation and Limbunya Group.

Stromatolites: The Victoria River Basin has been well known for many years for its abundant stromatolites. They are now mapped as belonging to the Hinde Dolomite, Tolmer Group; Skull Creek Formation, Bullita Group; and several formations in the Limbunya Group. Cloud & Semikhatov (1969) have identified Inzeria tjomusi Krylov from the Hinde Dolomite. No systematic work has been done on the other units. The area should have a high priority for study because of its abundant material and probable, but uncertain, age. Any such study should include the Bungle Bungle Dolomite of the East Kimberleys, which is part of the same basin and probably equivalent to the Limbunya Group (Sweet, pers. comm.).

East Kimberley Region

Microfossils: Several formations include rocks (Roberts, Halligan, & Gemuts, 1965; Dow & Gemuts, 1969) which may be suitable for microfossils, ranging in age from about 1 200 m.y. to the base of the Cambrian. Carbonaceous black cherty claystone has been recorded from the Matheson Formation of the Glidden Group (Specimen 6-31-96) and black fissile shale occurs in the Maddox Formation. Some black shales are found in the McAlly Shale and Yurabi Formation of the Louisa Downs Group. The Mount John Shale Member of the Wade Sandstone has some black shale and cherty siltstone, but access is poor. I. Sweet (pers. comm.) has mentioned some black shale in the Bungle Bungle Dolomite, but there is no record of it in Dow & Gemuts. The eastern outcrops of the Golden Gate Siltstone, Carr Boyd Group, consist of pyritic black shale but will probably be flooded by the Ord Dam.

Stromatolites: The Bungle Bungle Dolomite contains abundant stromatolites and should be included in any study of the Victoria River Basin. Dolomites within the Walsh Tillite locally contain problematical lamina structures which may be algal in origin. Similar problematica are recorded in the stratigraphically equivalent Areyonga Formation of the Amadeus Basin. Stromatolites occur in limestones of Subdivision H of the Egan Formation, Louisa Downs Group, overlying the tillites.

Macrofossils: Dow & Gemuts (1969) consider that structures in the Wade Creek Sandstone named by Sprigg (1949) Protonioba wadea are inorganic structures in chert. Dunnet (1965) has described possible 'jellyfish' from the late Adelaidean Ranford Formation. A.A. Öpik (pers. comm.) agrees that the latter are organic, but others, principally Trendall and others from G.S.W.A., consider they are inorganic. A large collection of material is available in the BMR museum for further work.

Arafura Basin

Trace fossils: Scolithus occurs in the late Adelaidean Buckingham Bay Sandstone of the Wessel Group (Plumb, 1965). Beds higher in the

Wessel Group have yielded a minimum glauconite age of 780 m.y. (McDougall, I., Dunn, P.R., Compston, W., Webb, A.W., Richard, J.R., & Bofinger, V.M., 1965). Opik (pers. comm.) does not accept the age and considers Scolithus is always Palaeozoic, but since glauconites yield, if anything, young ages, I accept an Adelaidean age. The best outcrops are only accessible by boat or helicopter.

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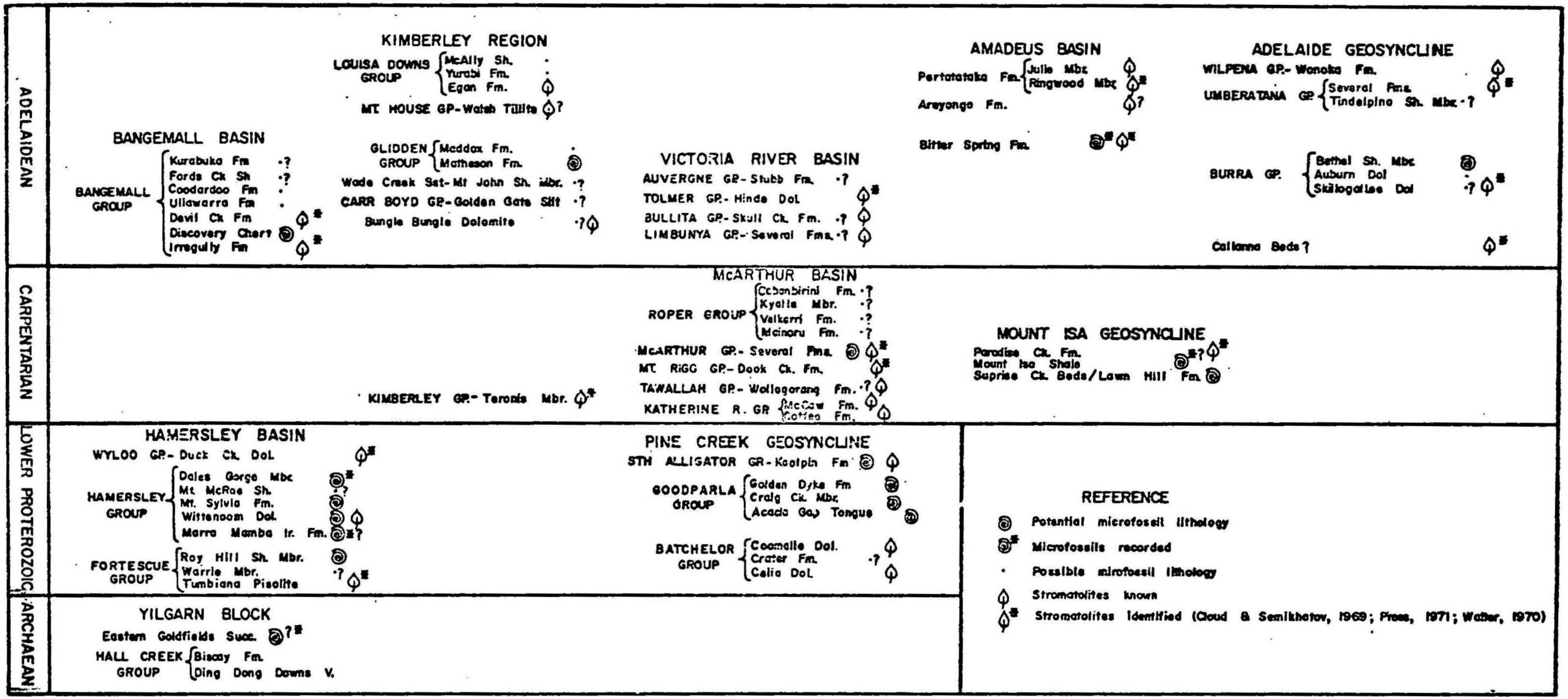

FIGURE 1: Table of Precambrian stratigraphic units containing known or potential fossil organisms. Units arranged according to approximate stratigraphic correlations. Listing of stratigraphic units not complete; units with no fossil potential not shown.

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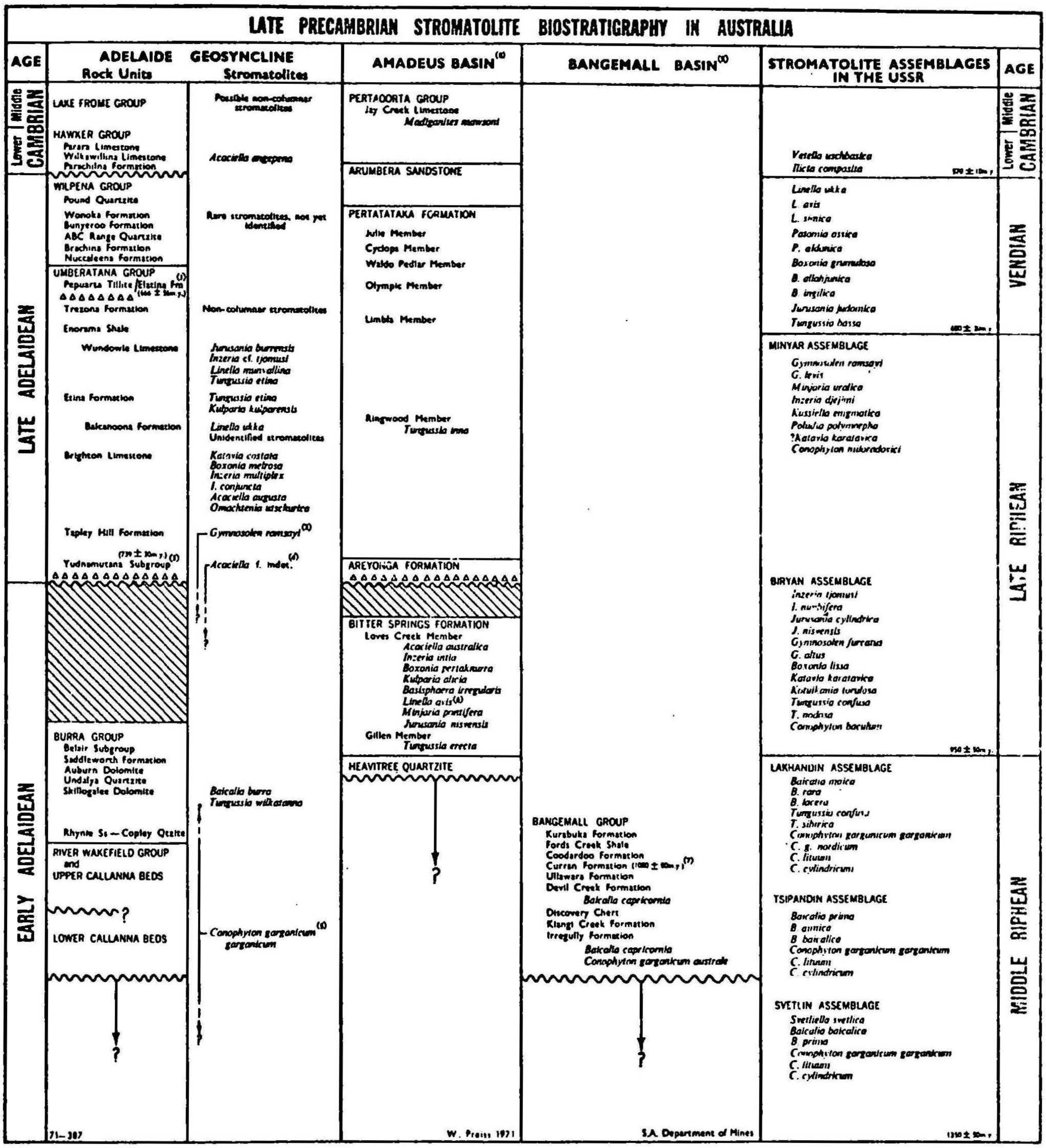
FIGURE 2: From PREISS. W., 1971; Quart. Geol. Notes. Geol. Surv. S. Aust., 38, 3-11



(1) These formations are correlated with the Egan Glacials of the Kimberley region, dated at 666 ± 56m.y. (2) *Gymnosolen ramsayi* is not younger than the Tapley Hill Formation; it occurs in boulders in a conglomerate interbedded in the latter. (3) The Yudnamutana Subgroup is correlated with the Moonlight Valley Tillite of the Kimberley region dated at 739 ± 30 m.y. (4) *Acaciella* f. indet. occurs in boulders in the Sturtian Tillite near the Enorama Diapir. (5) *Conophyton garganicum garganicum* in a diapiric raft is older than the upper Burra Group sediments intruded by the Paratoo Diapir. It may be derived from the Callanna Beds. (6) *Linella avis* does not occur in the Late Riphean of the USSR. (7) The Curran Formation was dated by the Rb/Sr method on shales. (8) Data for the Amadeus and Bangemall Basins are based on research by M.R. Walter.

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