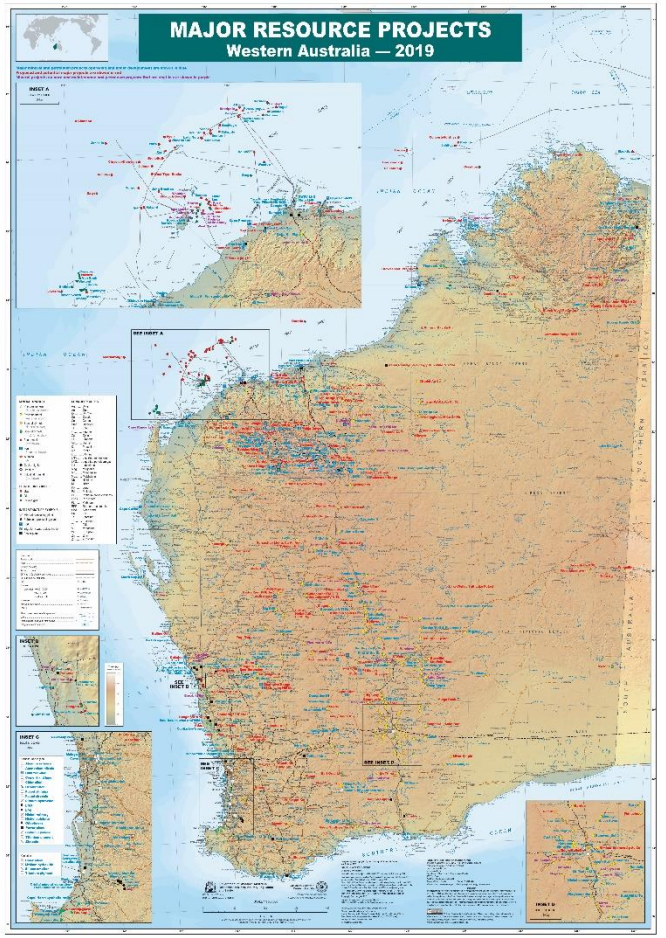
Microbialites:

an untapped resource

Heidi Allen
with contributions from **Kath Grey**,
Stanley Awramik, Peter Haines
& David Martin

Microbialites……the next big thing?

- Iron ore
- Gold
- Nickel
- Lithium



……microbialites?

Talk outline

- Introduction
  - WA's wealth of stromatolites
- GSWA microbialite studies
  - Neoproterozoic Centralian Superbasin
  - Paleoproterozoic Turee Creek and Wyloo Groups
- New toolkit
  - Bulletin 147

What are microbialites?

‘organosedimentary deposits that have accreted as a result of a benthic microbial community trapping and binding detrital sediment and/or forming the locus of mineral precipitation’ (Burne and Moore, 1987)

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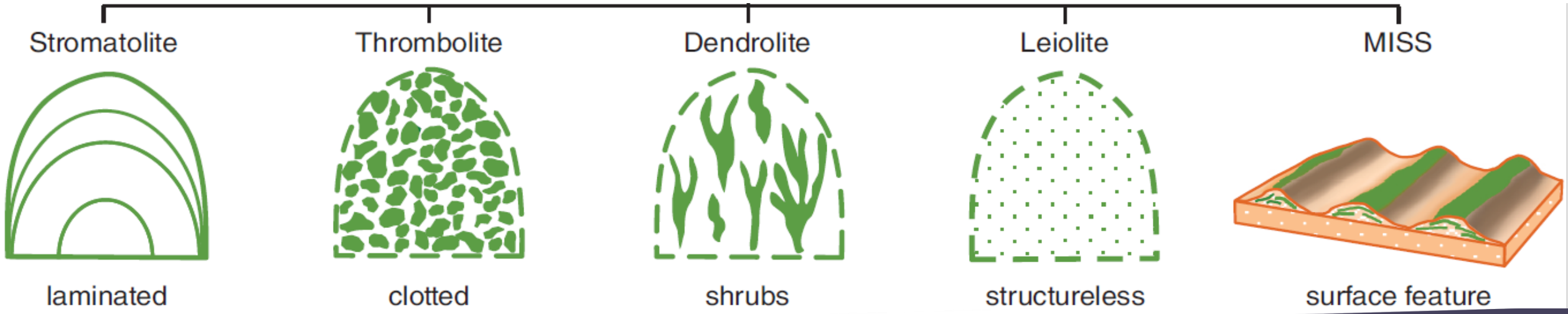

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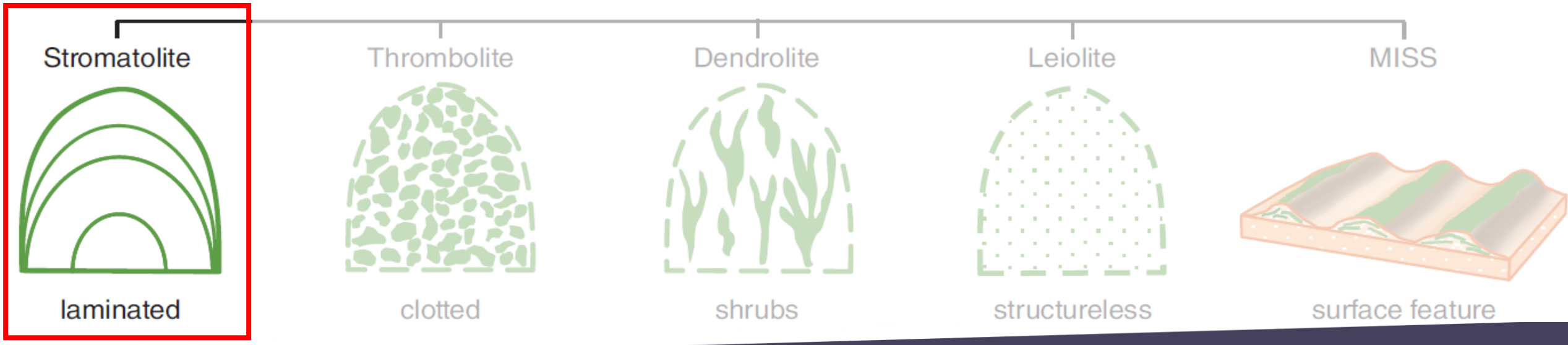


Megastructure

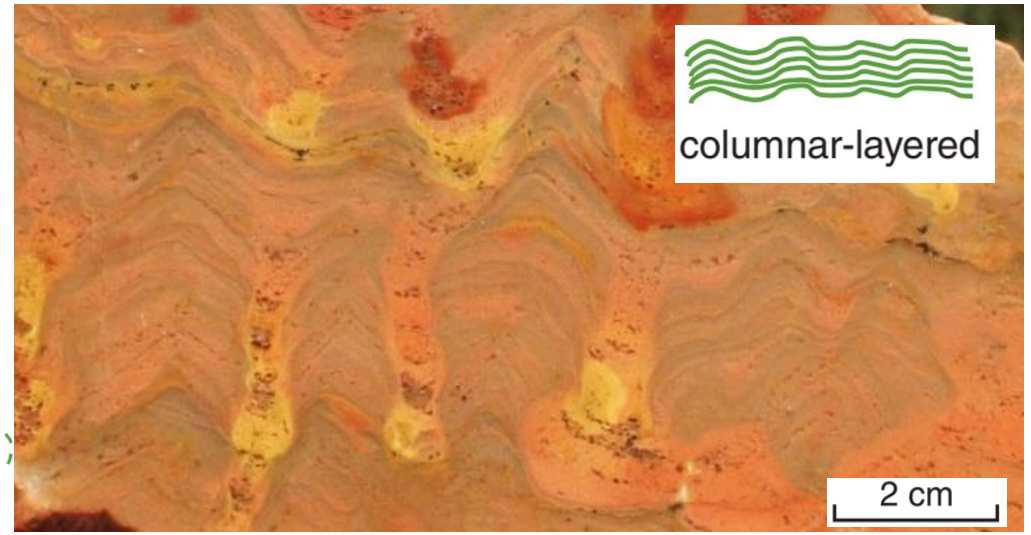
Microbialite buildup (bed or reef)

Macrostructure

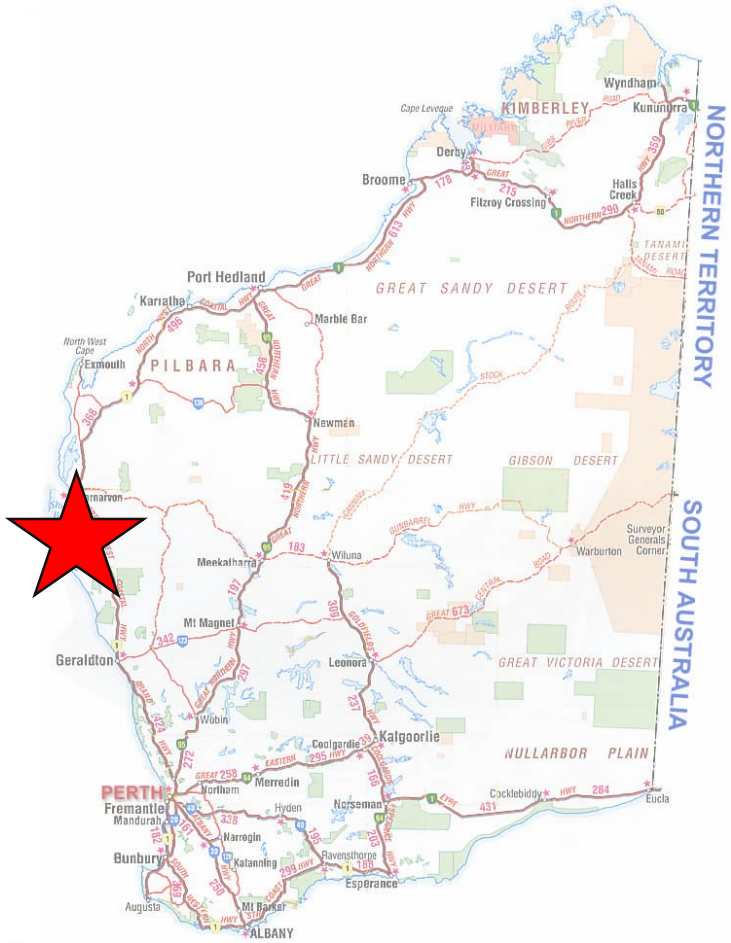
Bioherms and biostromes

Head (or stromatoid: individual, coenoplase, calyptra)

Microbialite shape



WA's wealth of microbialites



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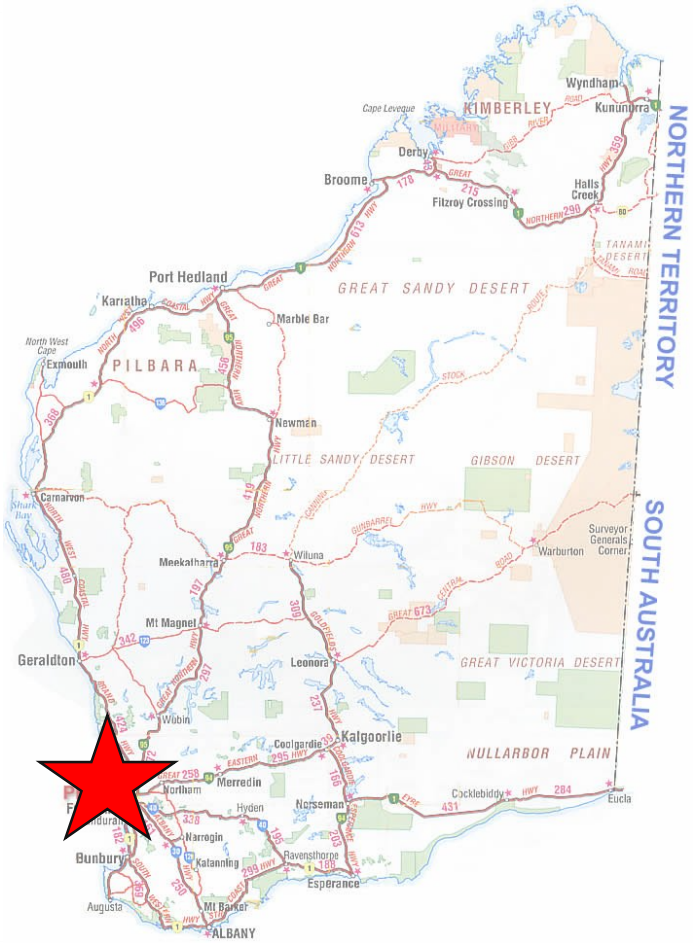

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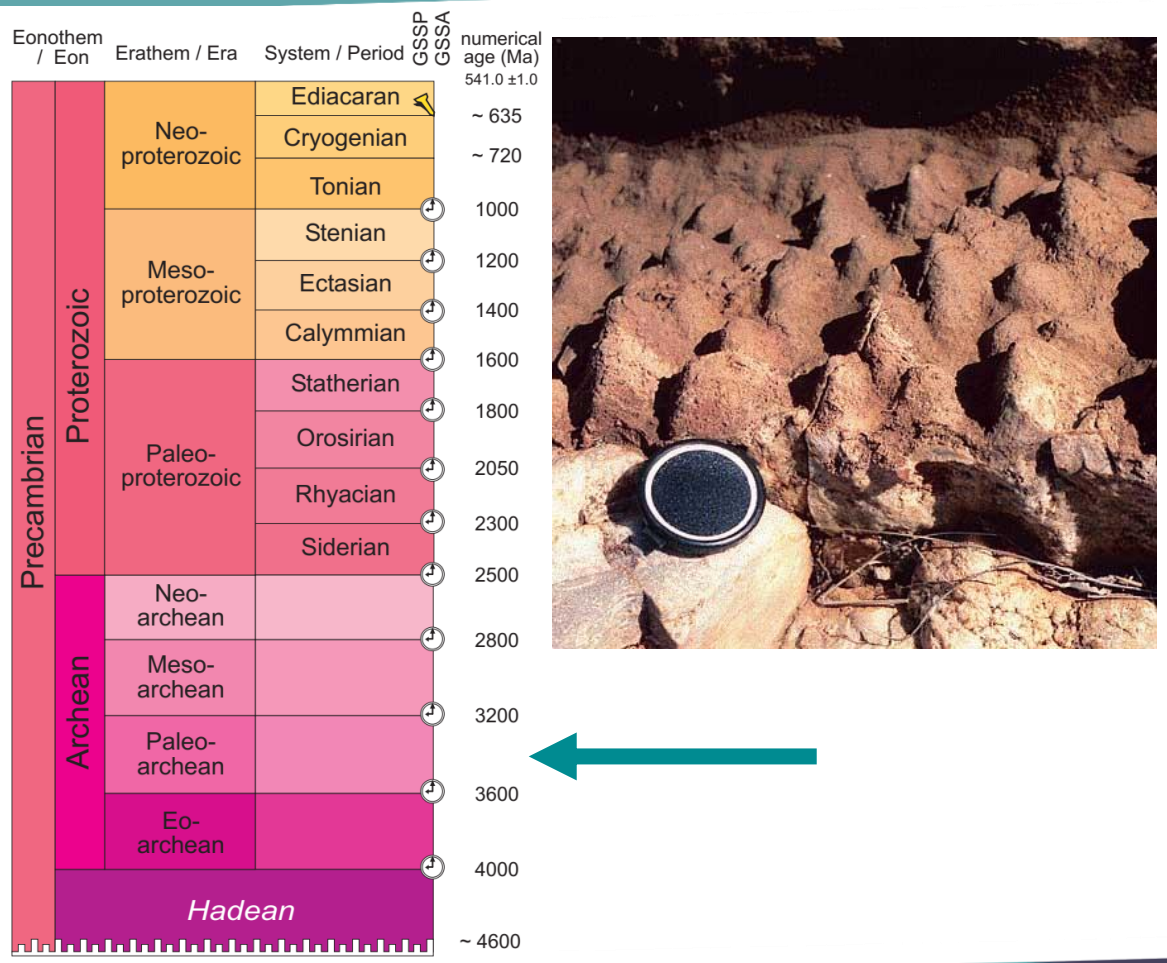
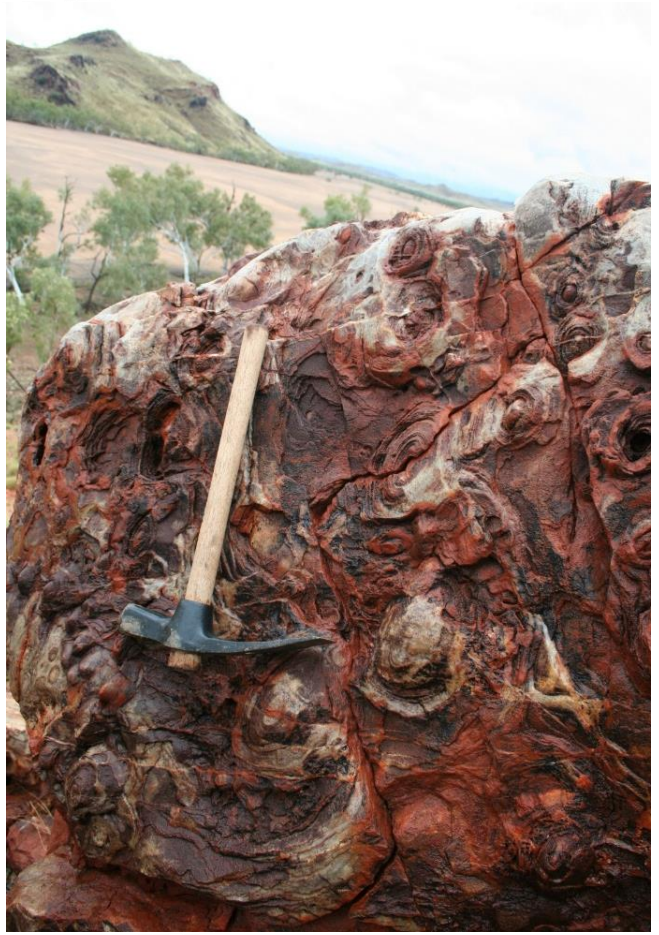
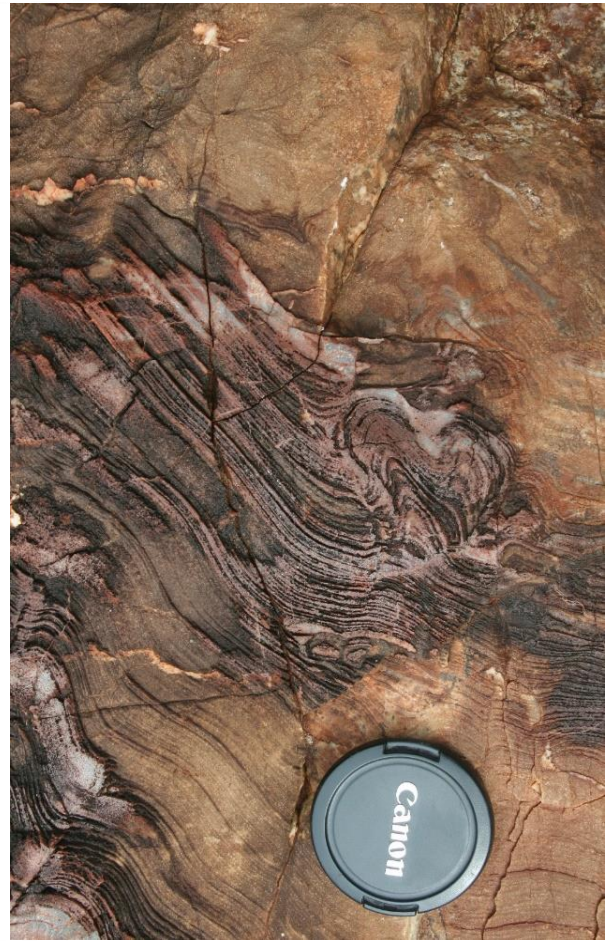
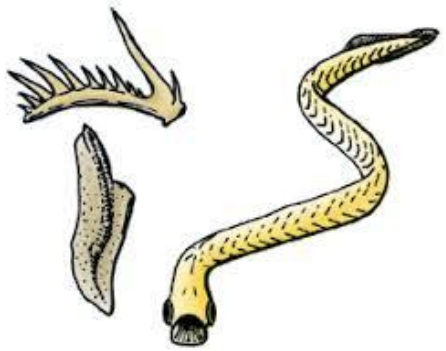


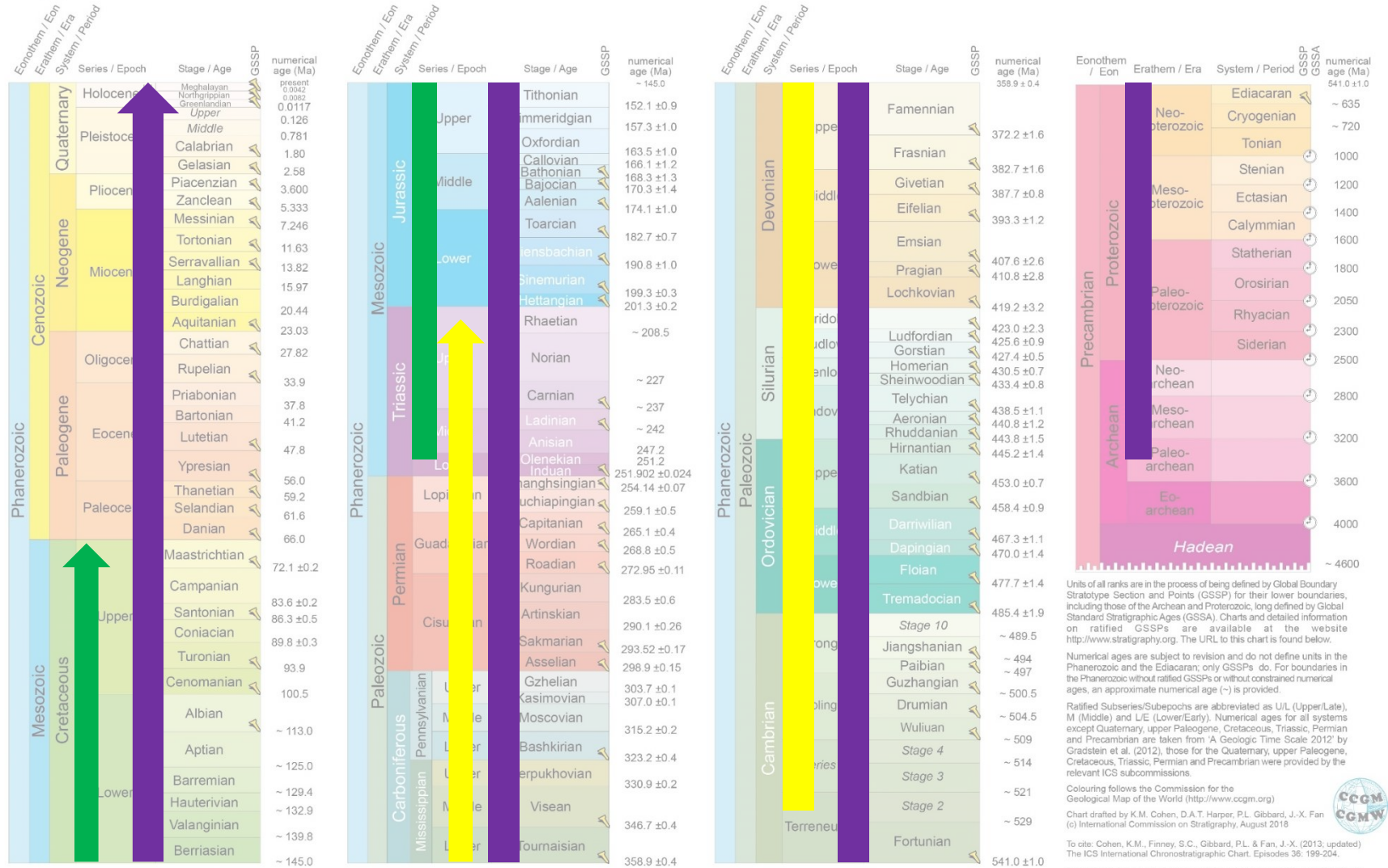






INTERNATIONAL CHRONOSTRATIGRAPHIC CHART

IUGS www.stratigraphy.org International Commission on Stratigraphy v 2018/08



Units of all ranks are in the process of being defined by Global Boundary Stratotype Section and Points (GSSP) for their lower boundaries, including those of the Archean and Proterozoic, long defined by Global Standard Stratigraphic Ages (GSSA). Charts and detailed information on ratified GSSPs are available at the website http://www.stratigraphy.org. The URL to this chart is found below.

Numerical ages are subject to revision and do not define units in the Phanerozoic and the Ediacaran; only GSSPs do. For boundaries in the Phanerozoic without ratified GSSPs or without constrained numerical ages, an approximate numerical age (~) is provided.

Ratified Subseries/Subepochs are abbreviated as U/L (Upper/Late), M (Middle) and L/E (Lower/Early). Numerical ages for all systems except Quaternary, upper Paleogene, Cretaceous, Triassic, Permian and Precambrian are taken from 'A Geologic Time Scale 2012' by Gradstein et al. (2012), those for the Quaternary, upper Paleogene, Cretaceous, Triassic, Permian and Precambrian were provided by the relevant ICS subcommissions.

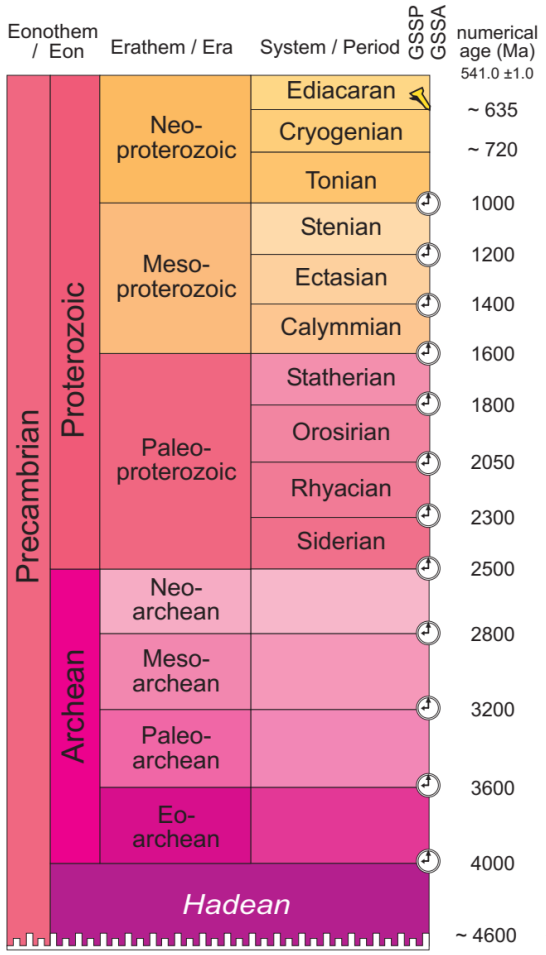
Colouring follows the Commission for the Geological Map of the World (http://www.ccgm.org)

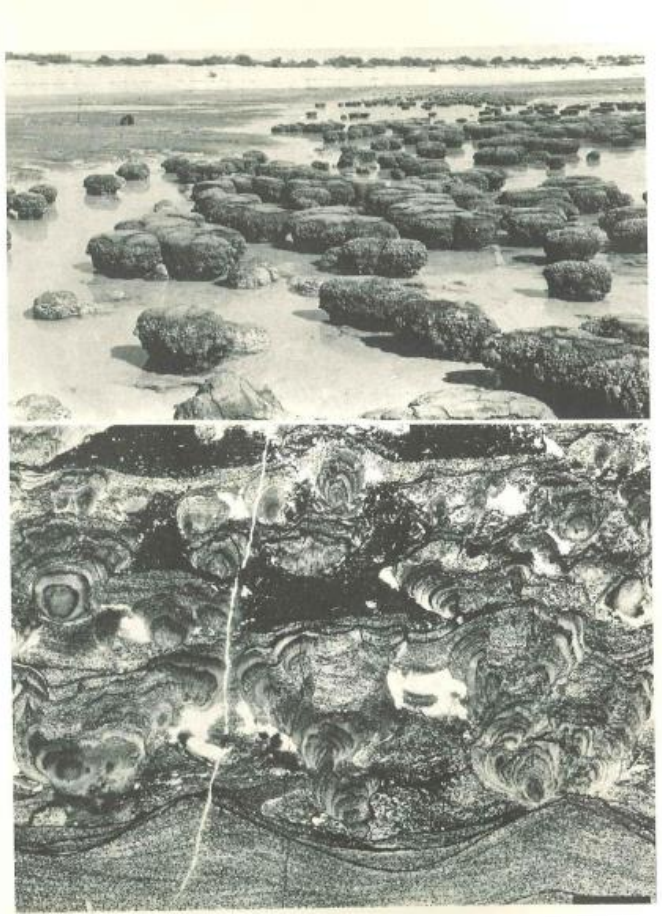
Chart drafted by K.M. Cohen, D.A.T. Harper, P.L. Gibbard, J.-X. Fan (c) International Commission on Stratigraphy, August 2018

To cite: Cohen, K.M., Finney, S.C., Gibbard, P.L. & Fan, J.-X. (2013, updated) The ICS International Chronostratigraphic Chart. Episodes 36: 199-204.

URL: http://www.stratigraphy.org/ICSchart/ChronostratChart2018-08.pdf

Early microbialite research





SPECIAL PAPERS IN PALAEONTOLOGY NO. 11

STROMATOLITES AND THE BIOSTRATIGRAPHY OF THE AUSTRALIAN PRECAMBRIAN AND CAMBRIAN

BY

M. R. WALTER

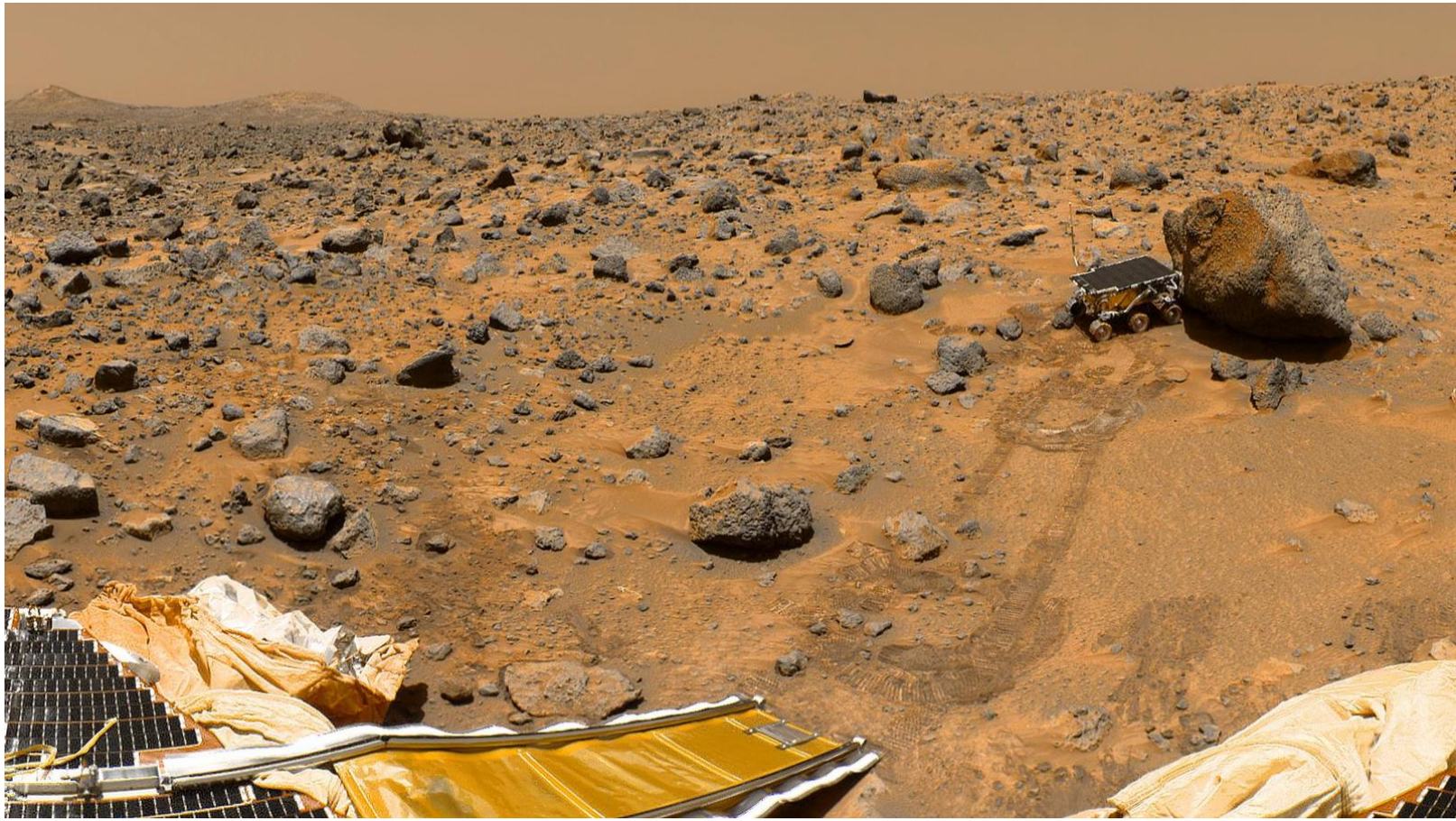
With 34 plates and 55 text-figures

The Centre for Precambrian Research, University of Adelaide, South Australia, provided a grant towards the cost of publishing this Special Paper

THE PALAEONTOLOGICAL ASSOCIATION
LONDON
DECEMBER 1972

A changing focus

- Biogenicity of older (and older) structures
- Early life
- Extraterrestrial life
- Modern biological studies of microbialites

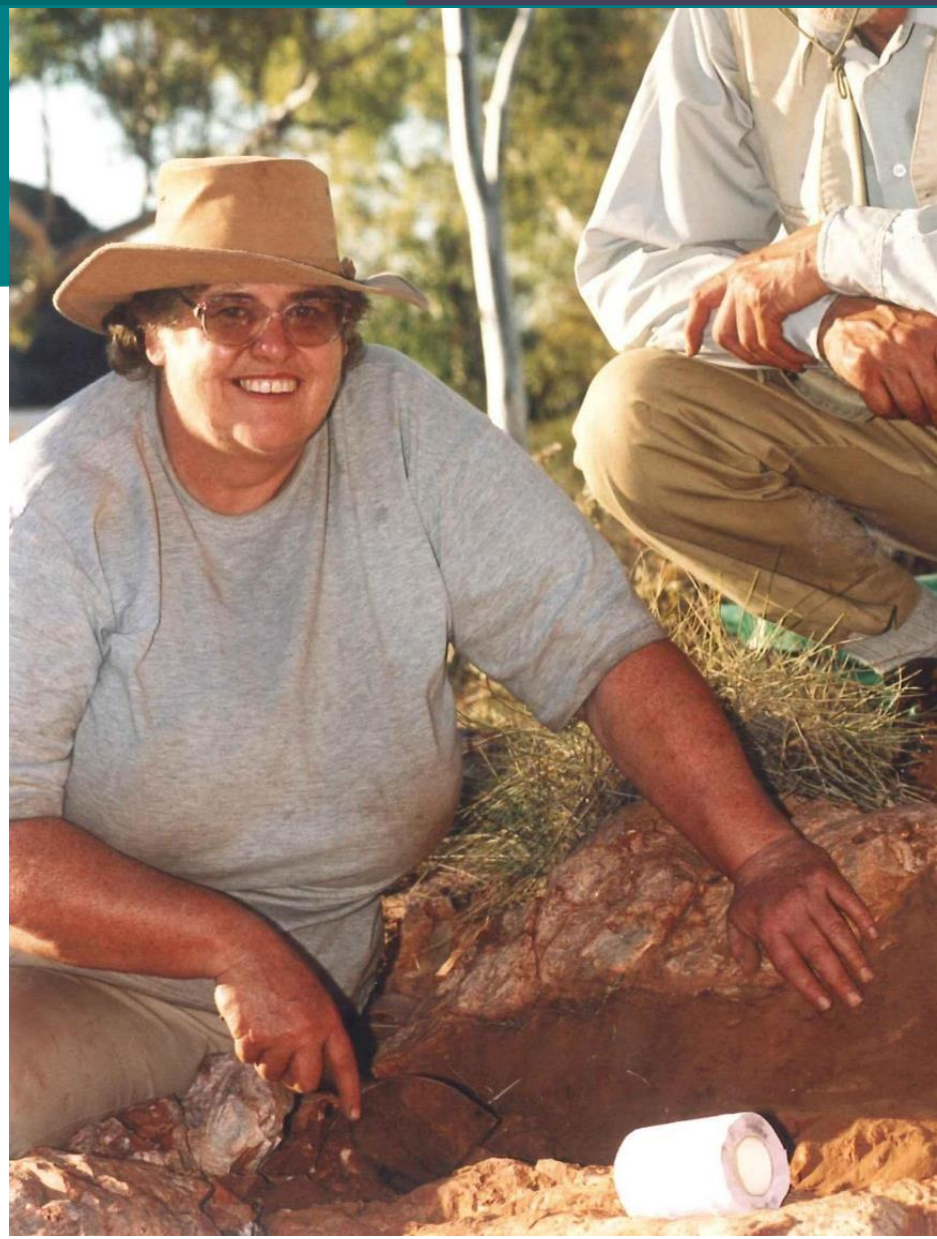


https://www.jpl.nasa.gov/news

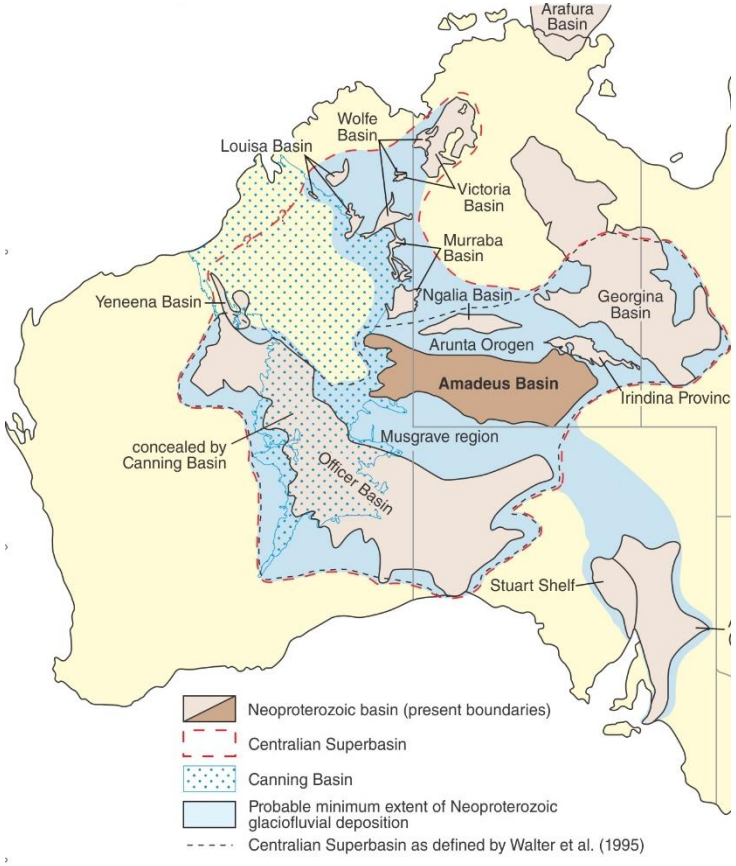
GSWA microbialite work

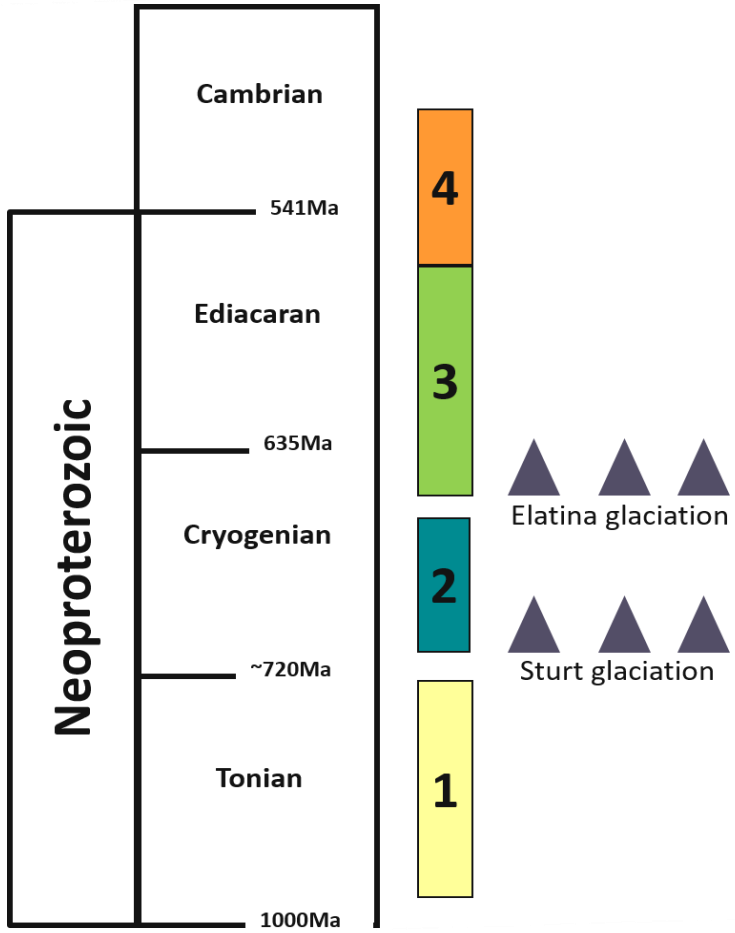
- 100s of microbialite localities documented in WA and Australia-wide
- Systematic description

→ Biostratigraphic application



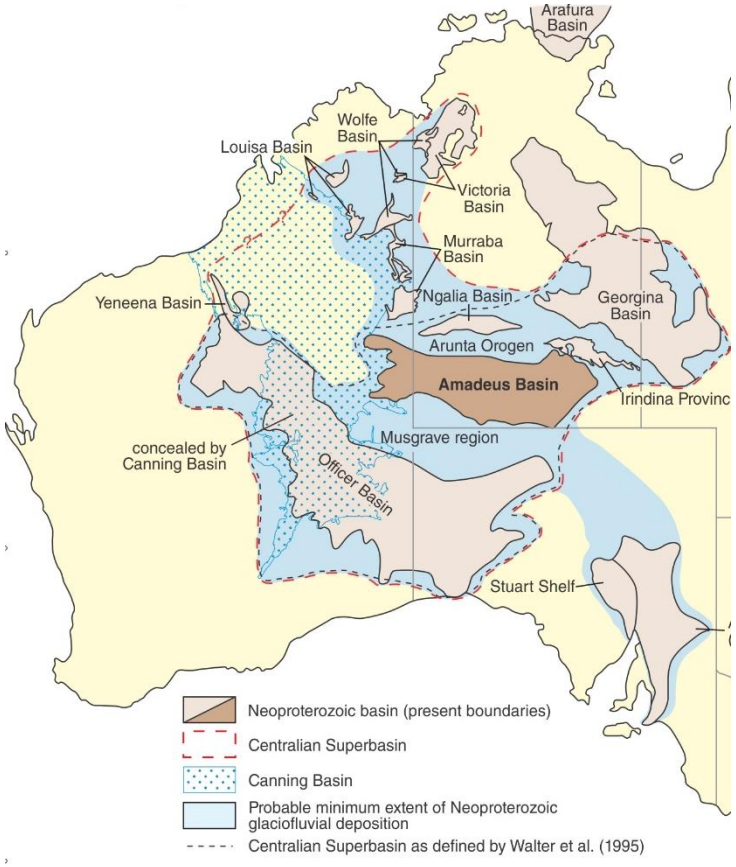
Amadeus Basin

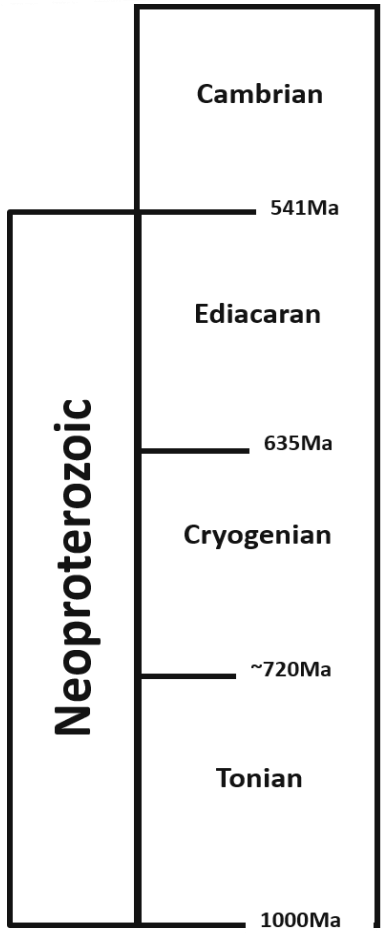




Tonian Aa Assemblage

Amadeus Basin





4

3 ← *Tungussia julia* Assemblage

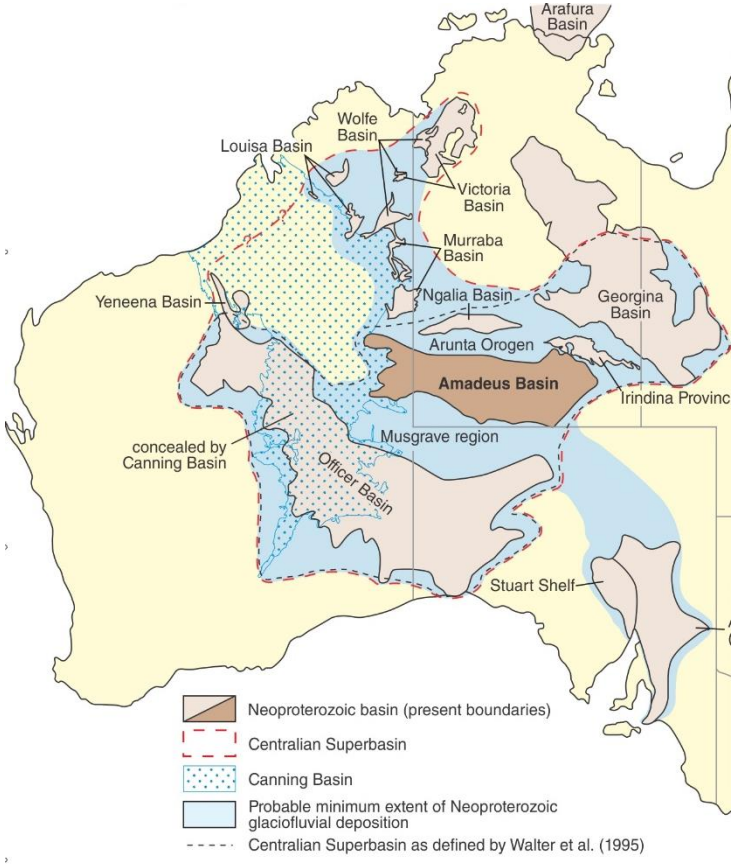
2 ← *Atilanya fennensis* Assemblage

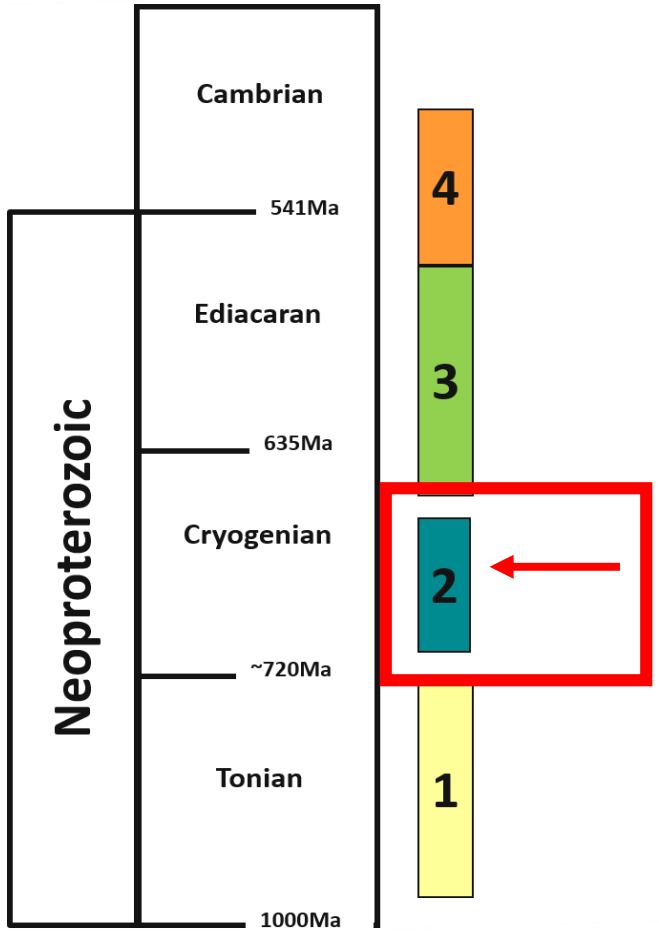
1 ← *Baicalia burra* Assemblage

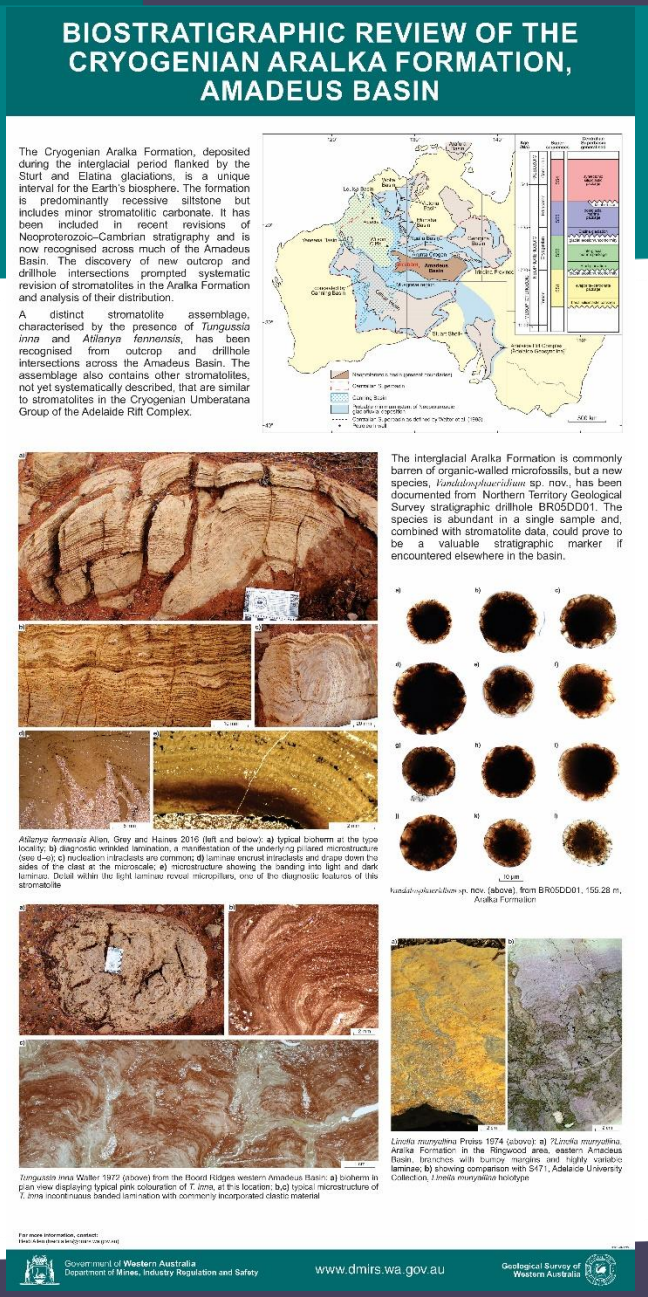
← *Acaciella australica* Assemblage

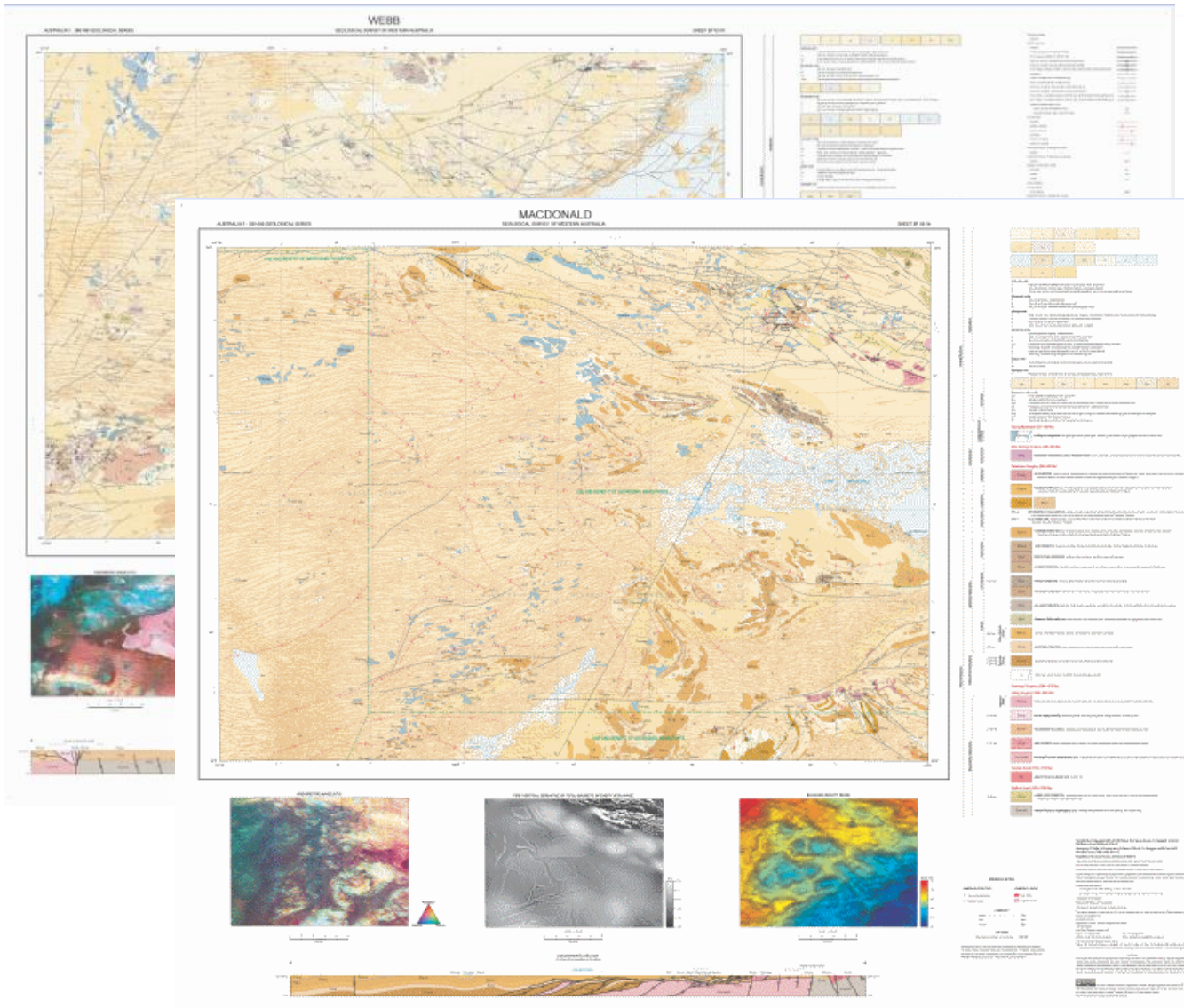
← *Tungussia erecta*

Amadeus Basin





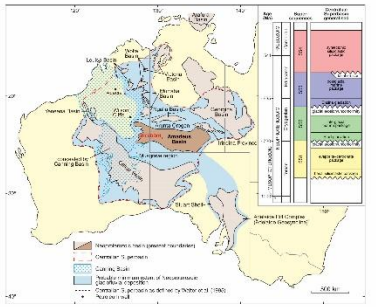


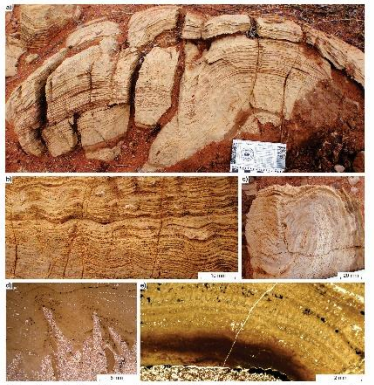


BIOSTRATIGRAPHIC REVIEW OF THE CRYOGENIAN ARALKA FORMATION, AMADEUS BASIN

The Cryogenian Aralka Formation, deposited during the interglacial period flanked by the Sturt and Elatina glaciations, is a unique interval for the Earth's biosphere. The formation is predominantly recessive siltstone but includes minor stromatolitic carbonate. It has been included in recent revisions of Neoproterozoic–Cambrian stratigraphy and is now recognised across much of the Amadeus Basin. The discovery of new outcrop and drillhole intersections prompted systematic revision of stromatolites in the Aralka Formation and analysis of their distribution.

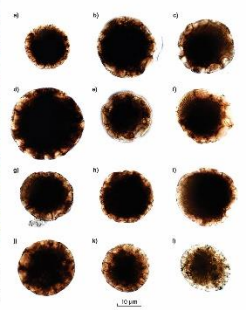
A distinct stromatolite assemblage, characterised by the presence of *Tungussia inna* and *Atilanya fennansis*, has been recognised from outcrop and drillhole intersections across the Amadeus Basin. The assemblage also contains other stromatolites, not yet systematically described, that are similar to stromatolites in the Cryogenian Umberatana Group of the Adelaide Rift Complex.



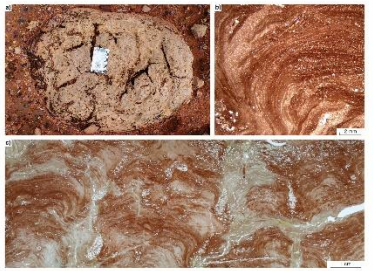


Atilanya fennensis Allen, Grey and Haines 2016 (left and below): **a)** typical bioherm at the type locality; **b)** diagnostic wrinkled lamination, a manifestation of the underlying pillared microstructure (see d–e); **c)** nucleation intraclasts are common; **d)** laminae encrust intraclasts and drape down the sides of the clast at the microscale; **e)** microstructure showing the banding into light and dark laminae. Detail within the light laminae reveal micropillars, one of the diagnostic features of this stromatolite

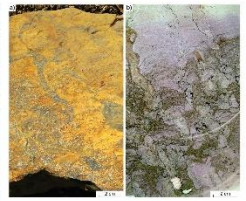
The interglacial Aralka Formation is commonly barren of organic-walled microfossils, but a new species, *Vandalosphaeridium* sp. nov., has been documented from Northern Territory Geological Survey stratigraphic drillhole BR05DD01. The species is abundant in a single sample and, combined with stromatolite data, could prove to be a valuable stratigraphic marker if encountered elsewhere in the basin.



Vandalosphaeridium sp. nov. (above), from BR05DD01, 155.28 m, Aralka Formation



Tungussia inna Walter 1972 (above) from the Boord Ridges western Amadeus Basin: **a)** bioherm in plan view displaying typical pink colouration of *T. inna*, at this location; **b,c)** typical microstructure of *T. inna* incontinuous banded lamination with commonly incorporated clastic material



Linella munyalina Preiss 1974 (above): **a)** *?Linella munyalina*, Aralka Formation in the Ringwood area, eastern Amadeus Basin, branches with bumpy margins and highly variable laminae; **b)** showing comparison with S471, Adelaide University Collection, *Linella munyalina* holotype

For more information, contact:

Government of Western Australia
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www.dmirs.wa.gov.au
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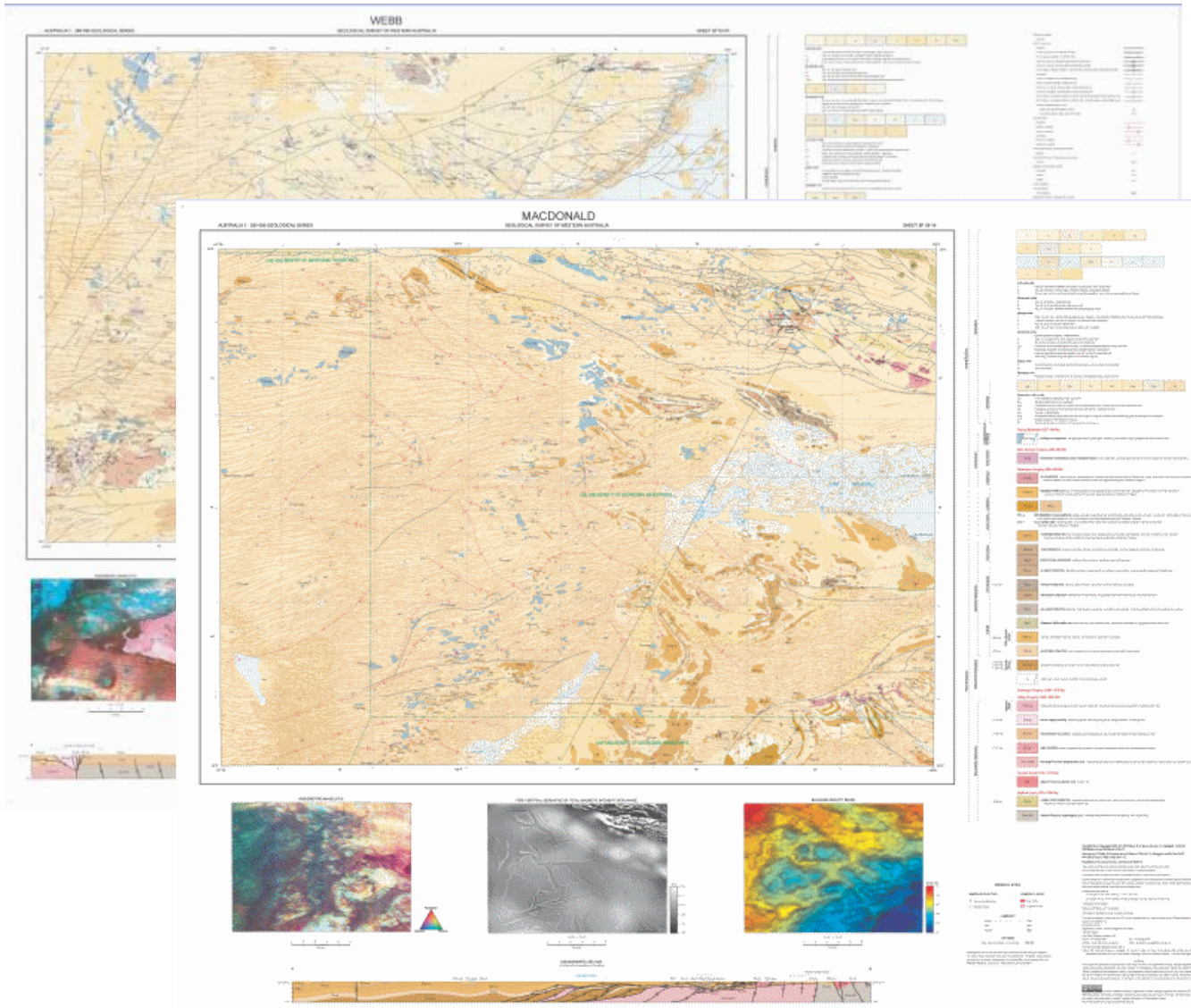

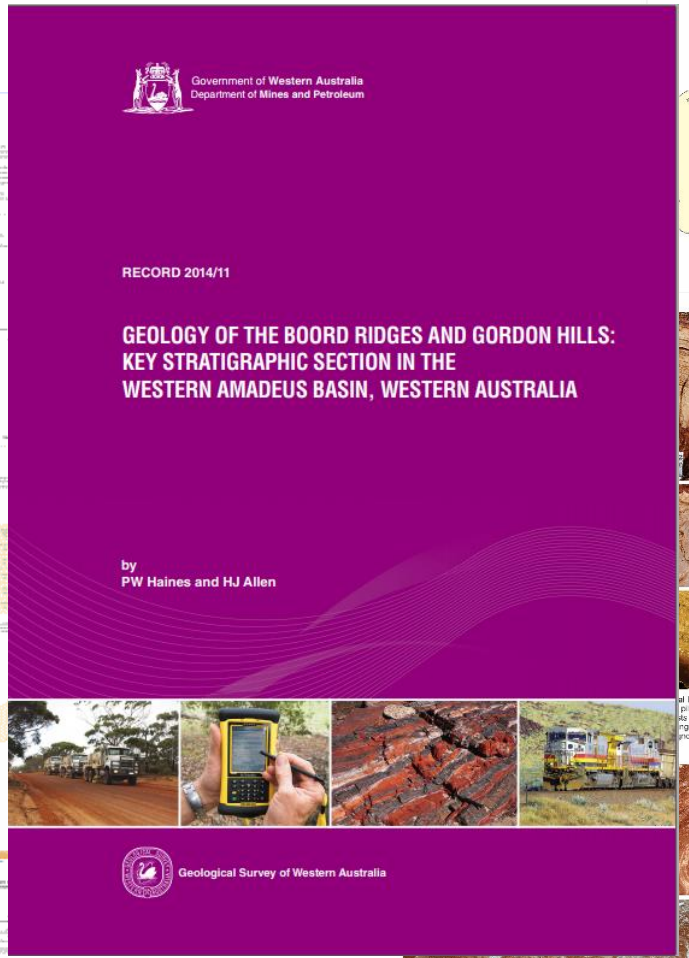

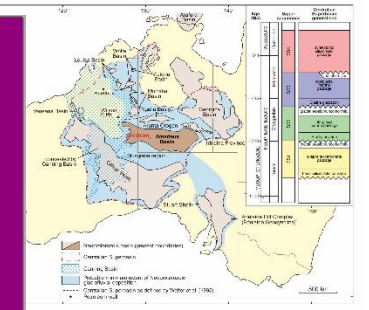

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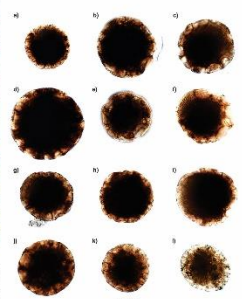

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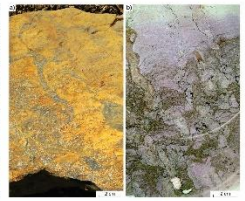

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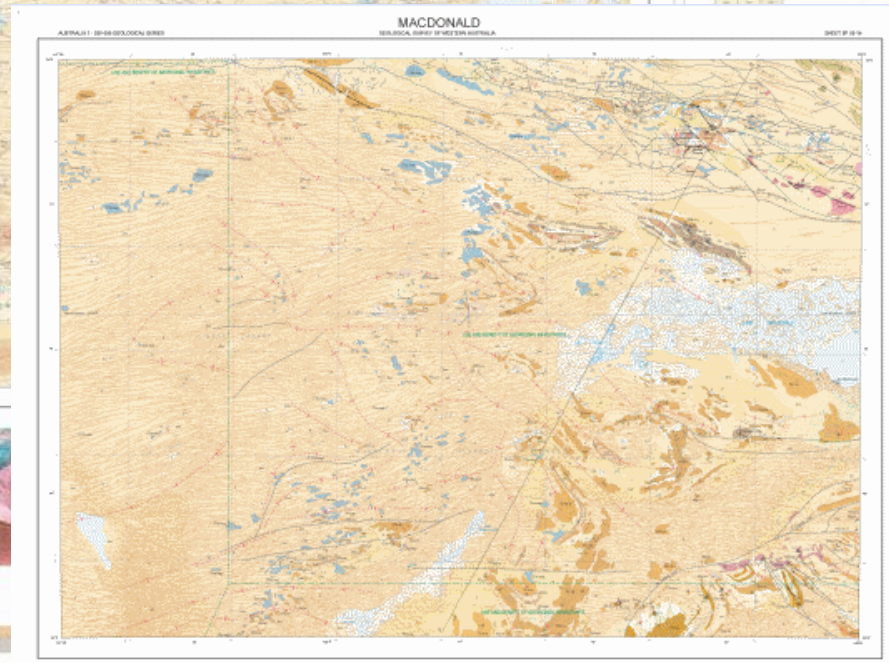
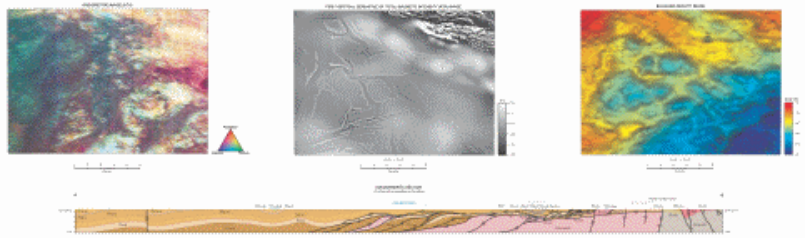
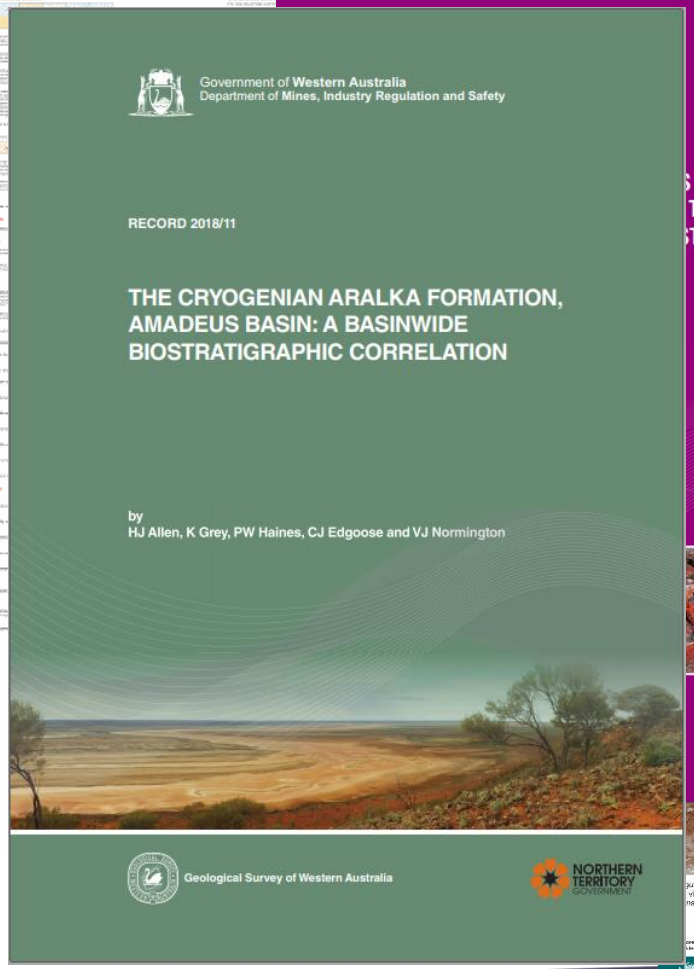
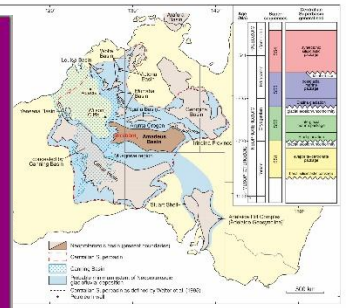
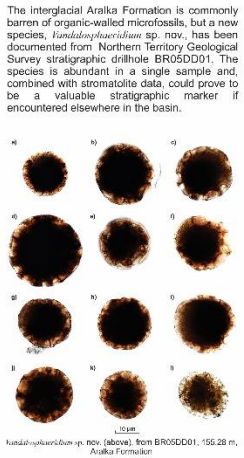
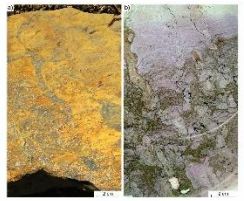












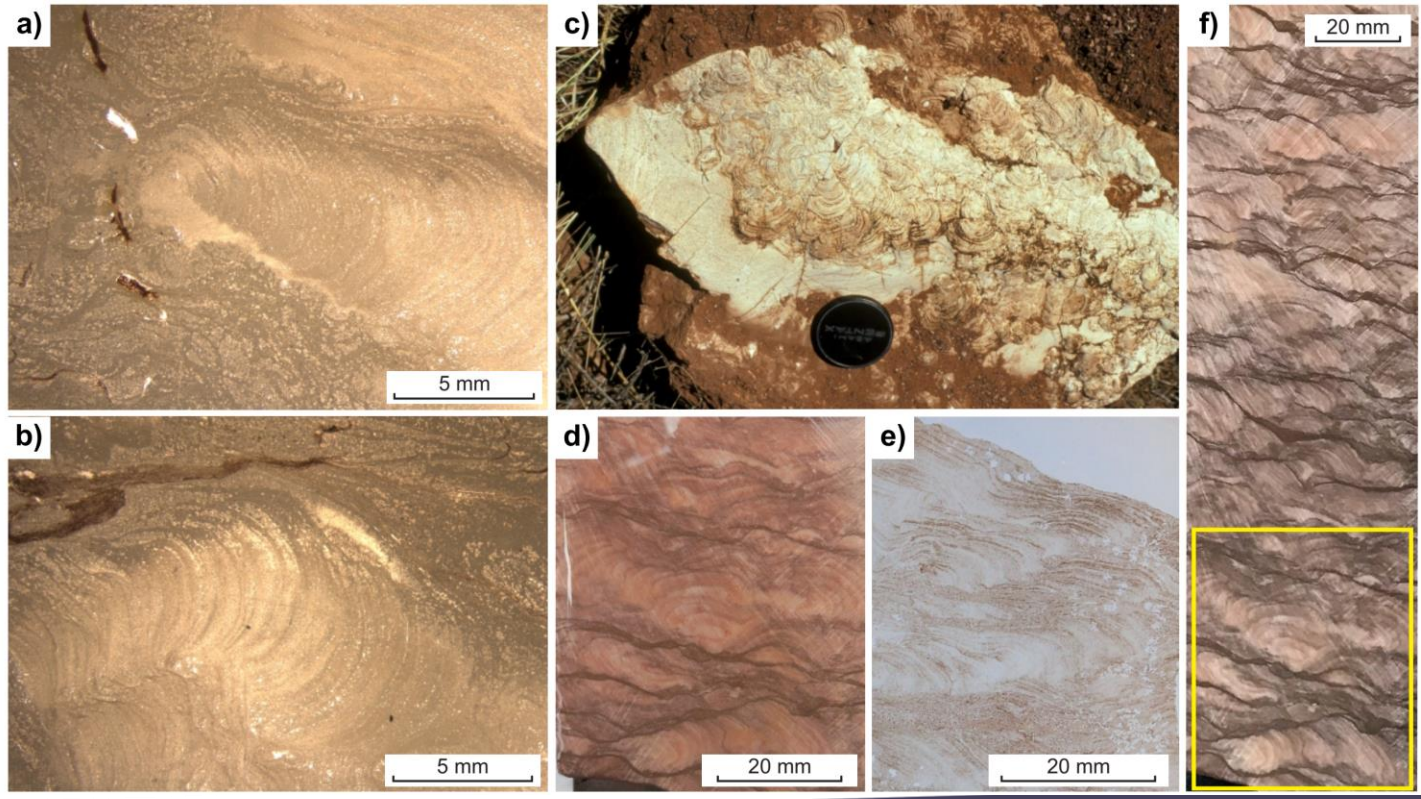
Officer Basin

- Paleontology Report 2018/1
- New stromatolite work will revise and refine older biostratigraphic schemes

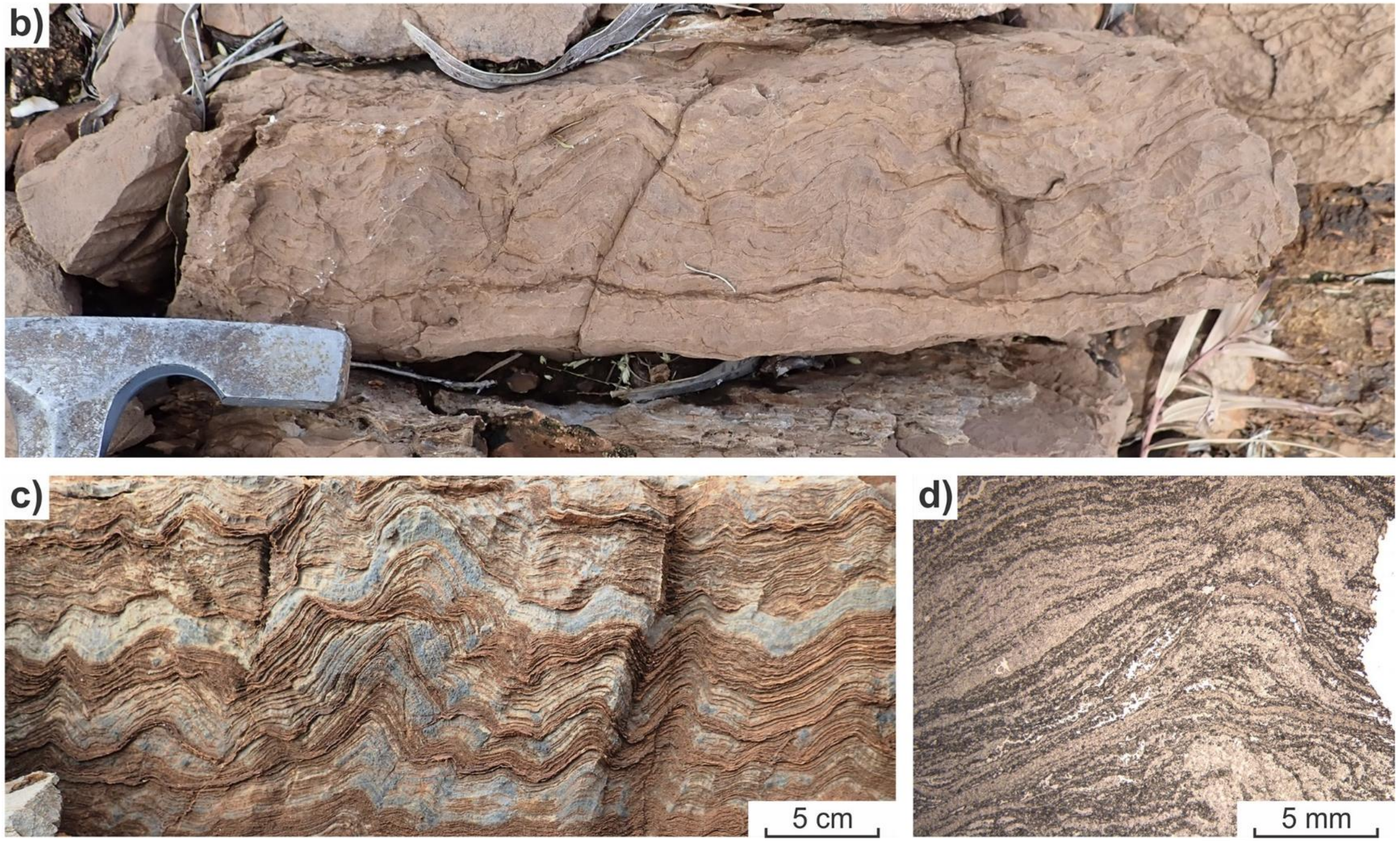
A stromatolite assemblage, including *Eleonora boondawarica* Grey and Walter, 1994 and *Acaciella savoryensis* Grey and Walter, 1994, from mineral drillhole AusQuest Table Hill 07THD003

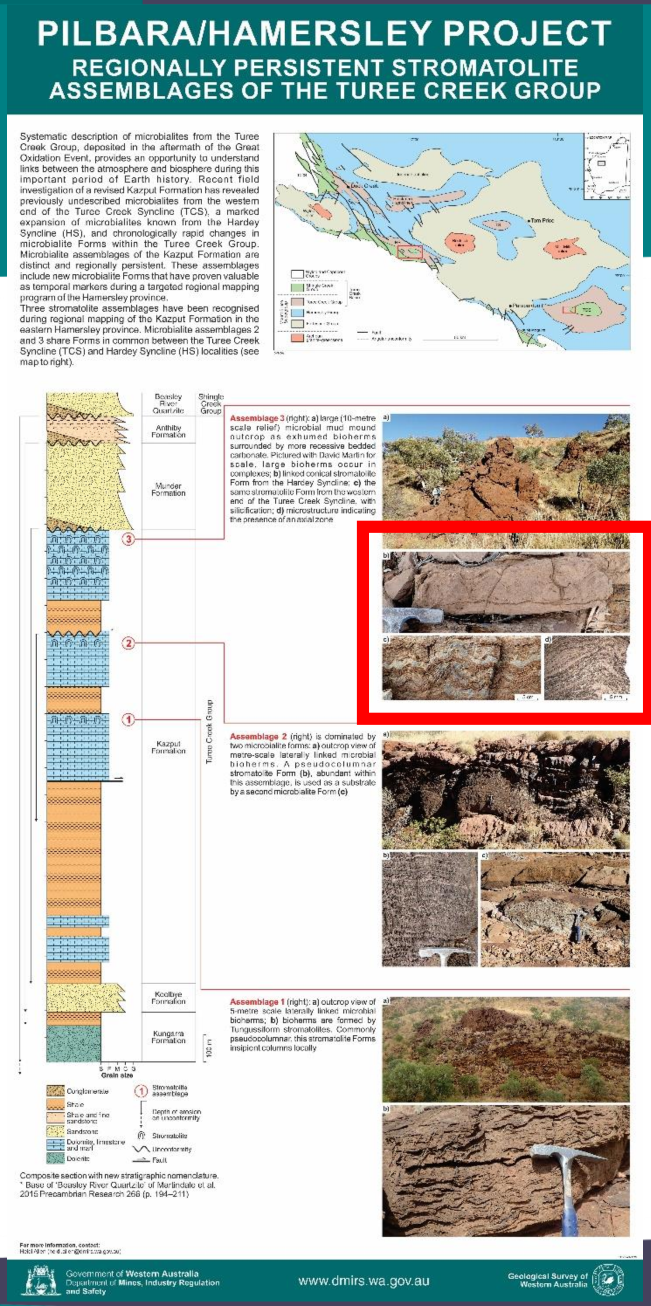
by

HJ Allen and PW Haines



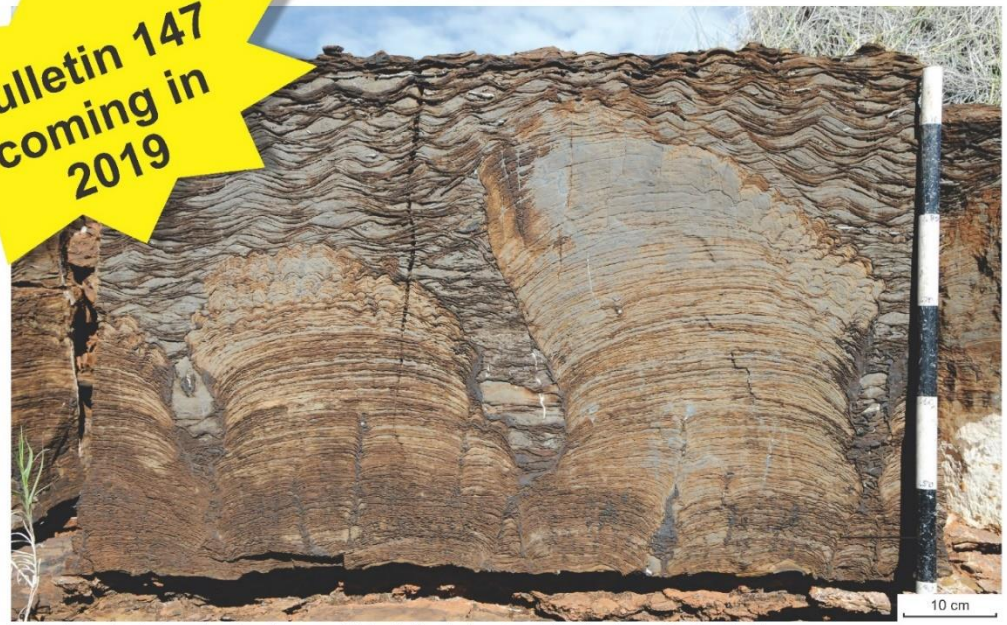
Hamersley province





HANDBOOK FOR THE STUDY AND DESCRIPTION OF MICROBIALITES

Bulletin 147 coming in 2019

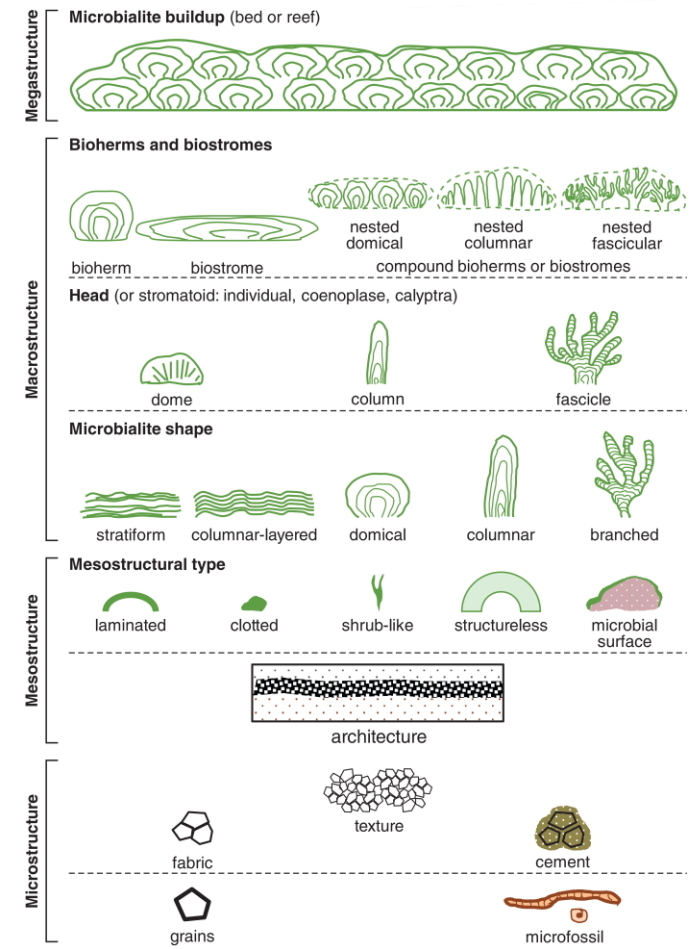


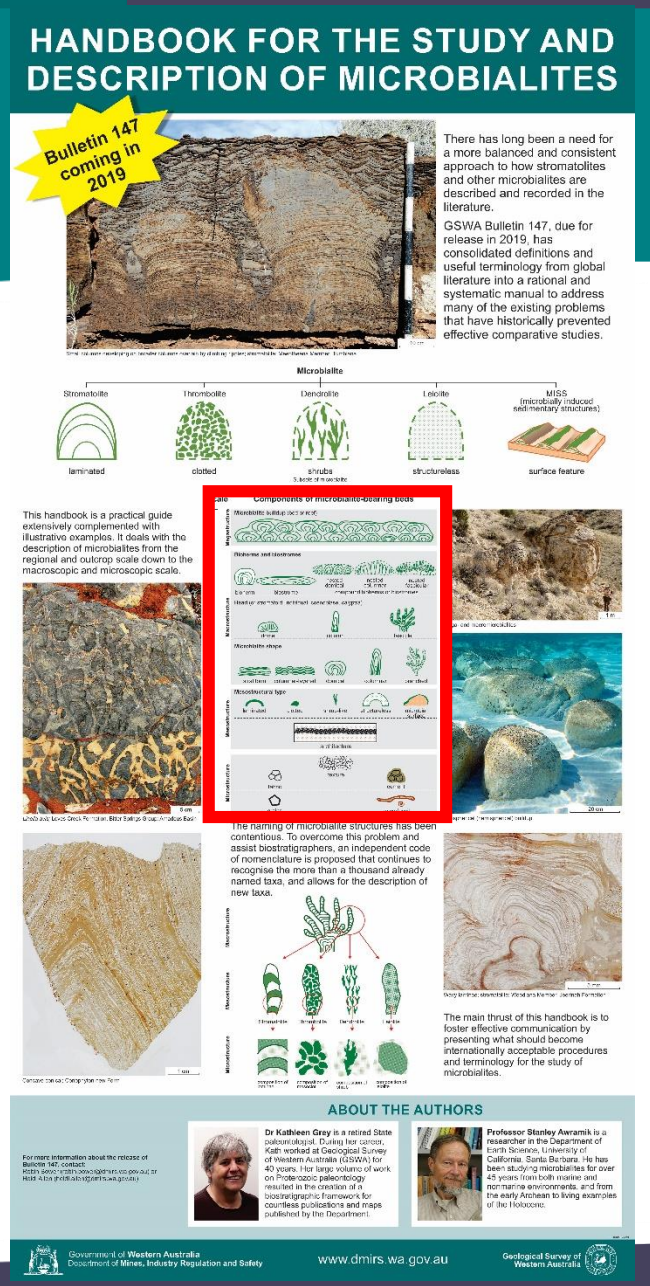
Small columns developing on broader columns overlain by climbing ripples; stromatolite; Meentheena Member; Tumbiana

There has long been a need for a more balanced and consistent approach to how stromatolites and other microbialites are described and recorded in the literature.

GSWA Bulletin 147, due for release in 2019, has consolidated definitions and useful terminology from global literature into a rational and systematic manual to address many of the existing problems that have historically prevented effective comparative studies.

Bulletin 147: Microbialite handbook





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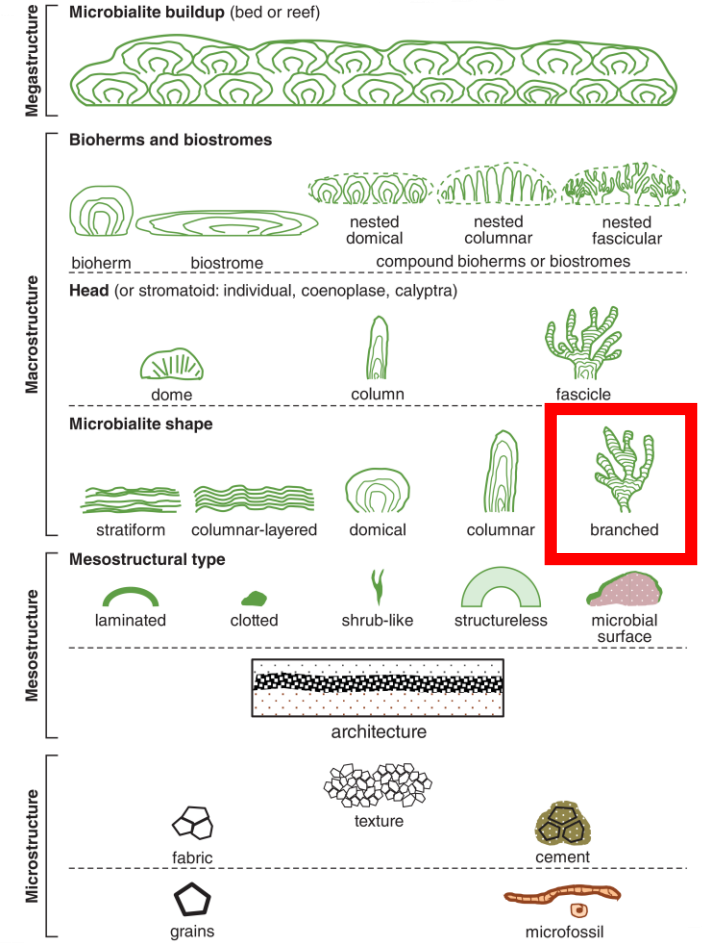

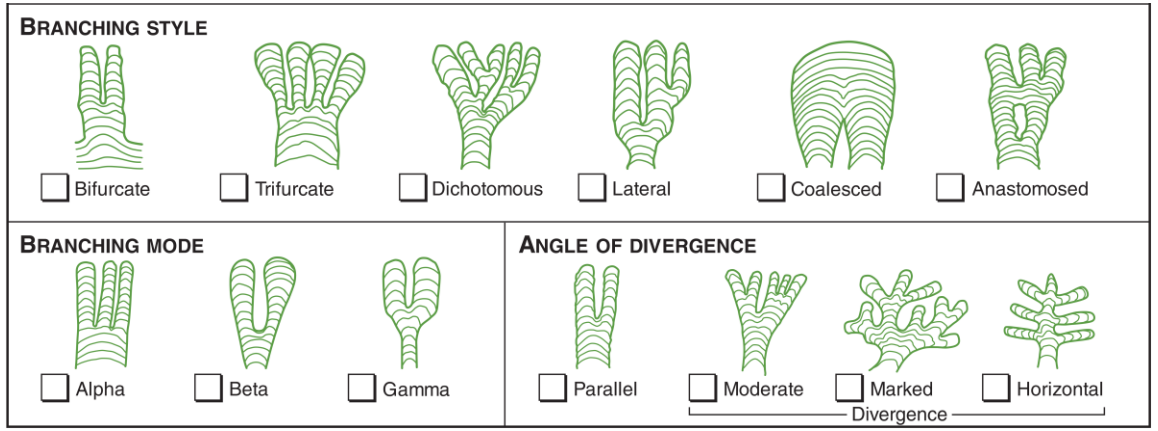

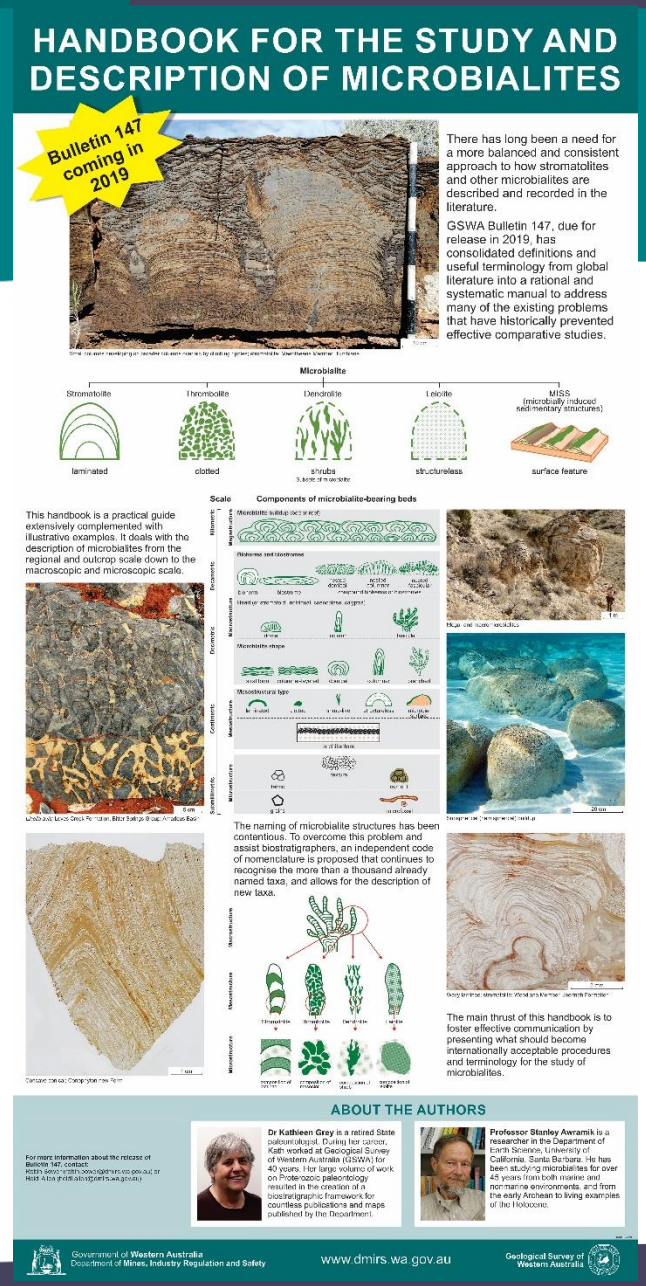

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