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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**Microbialite buildup (bed or reef)**

**Macrostructure**

- **Bioherms and biostromes**
  - bioherm
  - biostrome
  - nested domical
  - nested columnar
  - nested fascicular
  - compound bioherms or biostromes

- **Head** (or stromatoid: individual, coenoplace, calypttra)
  - dome
  - column
  - fascicle

- **Microbialite shape**
  - stratiform
  - columnar-layered
  - domical
  - columnar
  - branched

2 cm scale marker
WA’s wealth of microbialites
WA’s wealth of microbialites
WA’s wealth of microbialites

<table>
<thead>
<tr>
<th>System / Period</th>
<th>Numerical age (Ma)</th>
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<td>Ediacaran</td>
<td>~ 635</td>
</tr>
<tr>
<td>Cryogenian</td>
<td>~ 720</td>
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<tr>
<td>Tonian</td>
<td>1000</td>
</tr>
<tr>
<td>Stenian</td>
<td>1200</td>
</tr>
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<td>Statherian</td>
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<td>Orosiran</td>
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</table>

Government of Western Australia | Department of Mines, Industry Regulation and Safety | www.dmirs.wa.gov.au
Early microbialite research
A changing focus

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

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

Biostratigraphic application
Amadeus Basin
Tonian Aa Assemblage
Amadeus Basin
This Cryogenian Aralka Formation, deposited during the interval just prior to the Huronian orogeny, comprises a major interval for the Earth's transition. The formation includes a variety of sediments and is well-sampled in the Amadeus Basin. The formation is characterized by the presence of stromatolites and microbial structures. The formation is a key element in understanding the transition from late Precambrian to early Cambrian assemblages. The formation is a critical interval for understanding the transition from the Cryogenian to the Ediacaran Period.
RECORD 2014/11

GEOLOGY OF THE BOORD RIDGES AND GORDON HILLS: KEY STRATIGRAPHIC SECTION IN THE WESTERN AMADEUS BASIN, WESTERN AUSTRALIA

By
PM Holms and SJ Allen

Geological Survey of Western Australia

BIOSTRATIGRAPHIC REVIEW OF THE CRYOGENIAN ARALKA FORMATION, AMADEUS BASIN
Officer Basin

- Paleontology Report 2018/1
- New stromatolite work will revise and refine older biostratigraphic schemes
Hamersley province
HANDBOOK FOR THE STUDY AND DESCRIPTION OF MICROBIALITITES

Bulletin 147 coming in 2019

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

Microbialite buildups (bed or real)

Bioherms and biosromes
- nested domical
- nested columnar
- nested tabular
- compound bioherms or biosromes

Head (orstromatoid; individual; coenosparse; calyptrae)

Microbialite shape
- dune
- column
- areole

Mesosomatic type
- stratiform
- columnar-layered
- dimeric
- columnar

Microstructure
- laminated
- clothed
- shrub-like
- structuralless
- microbial surface

Architecture
- fabric
- texture
- cement
- grains
- microfossil

Branching style
- Bifurcate
- Trifurcate
- Dichotomous
- Lateral
- Coalesced
- Anastomosed

Branching mode
- Alpha
- Beta
- Gamma

Angle of divergence
- Parallel
- Moderate
- Marked
- Horizontal

HANDBOOK FOR THE STUDY AND DESCRIPTION OF MICROBIALITES

There has been a need for a clear method by which microbialites may be described and recognized in the field. This handbook aims to provide a framework for the classification and recognition of microbialites from both the field and the laboratory. It includes a comprehensive guide to the morphology of microbialites, as well as detailed descriptions of the various morphological and environmental factors that contribute to their formation. The handbook also provides guidance on how to interpret the ecological and environmental significance of microbialite structures, making it an essential resource for researchers, students, and practitioners in the fields of geology, biology, and paleoecology.

ABOUT THE AUTHORS

Authors: [List of authors]

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