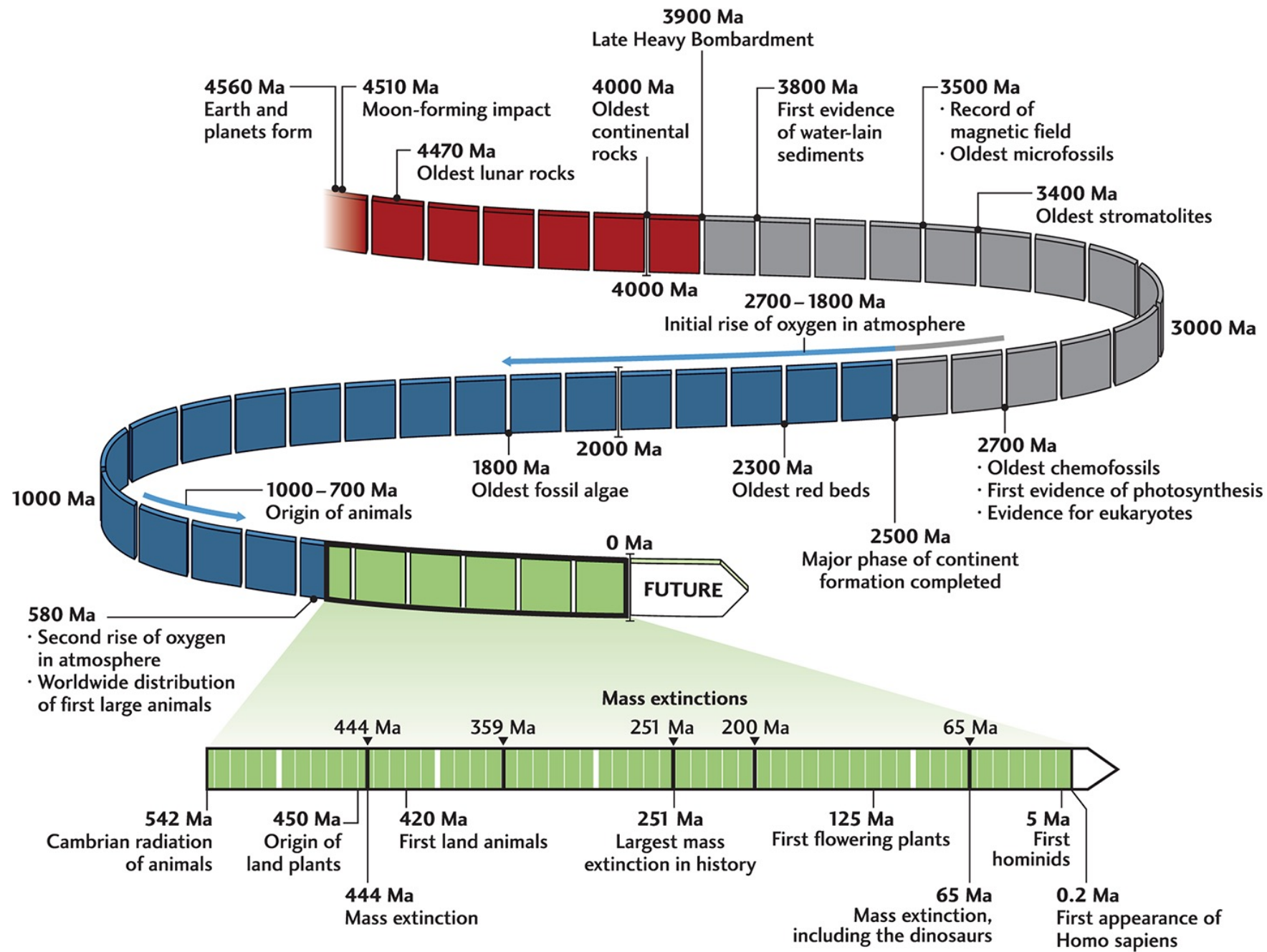


Microbialites and microfossils from the early Earth

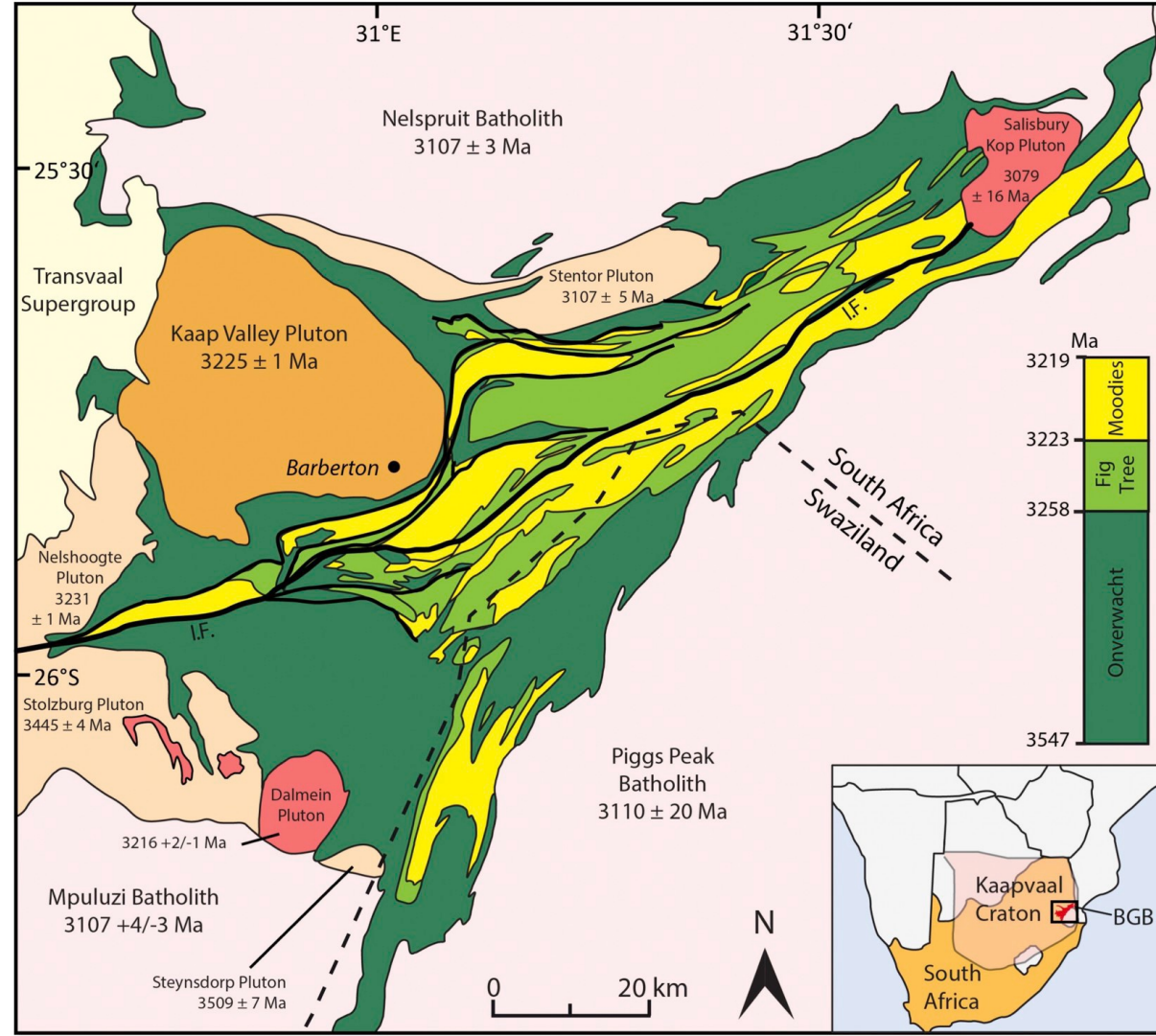
- When did life begin?
- What were the early environments for life?
- Types of evidence for biological origin (biogenicity)
- What were the early metabolisms?



Fossilization

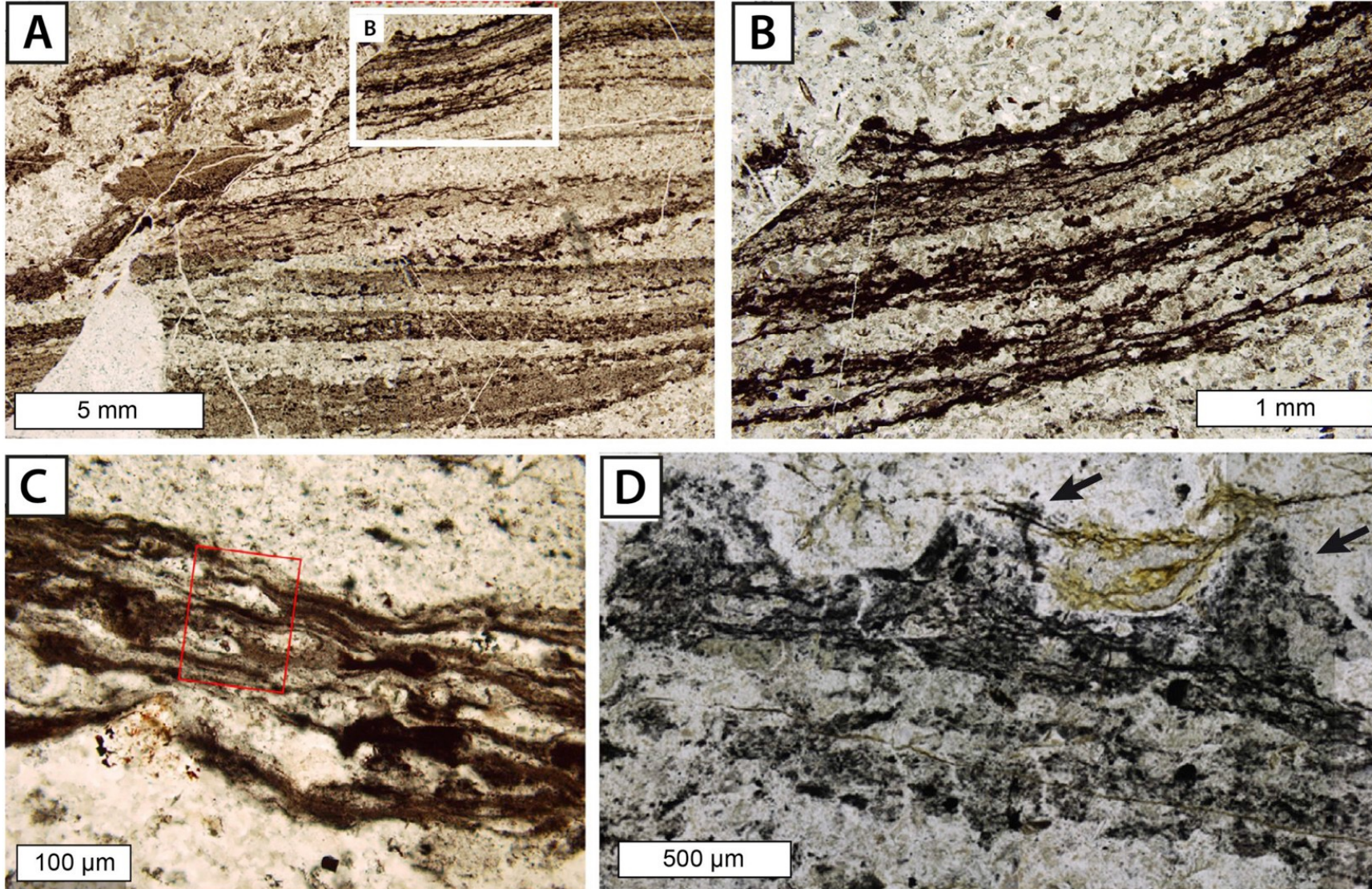
- Preservation of the organismal or community morphology and structure due to the incomplete decay of organic substances or replacement of tissues by minerals
- Minerals: early diagenetic precipitates, sediments or biomineralized
- Decay slower than mineral formation/delivery
- *Taphonomic window*: typical mode/facies/process of preservation during different time intervals

The Barberton Greenstone Belt, South Africa



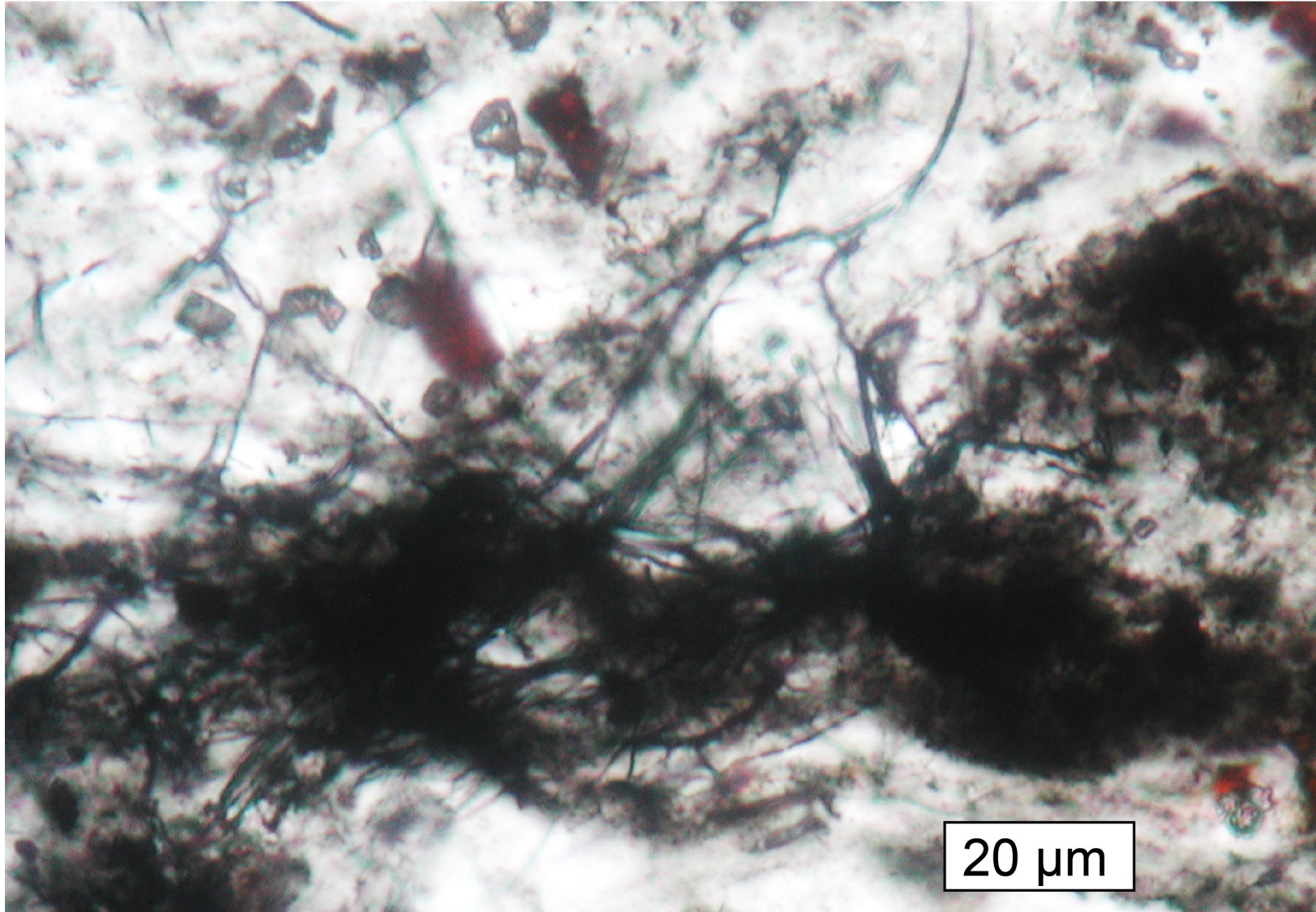
Early continents, a lot of volcanic activity

3.47 Ga Silicified Microbial Mats



(Hickman-Lewis et al., 2018)

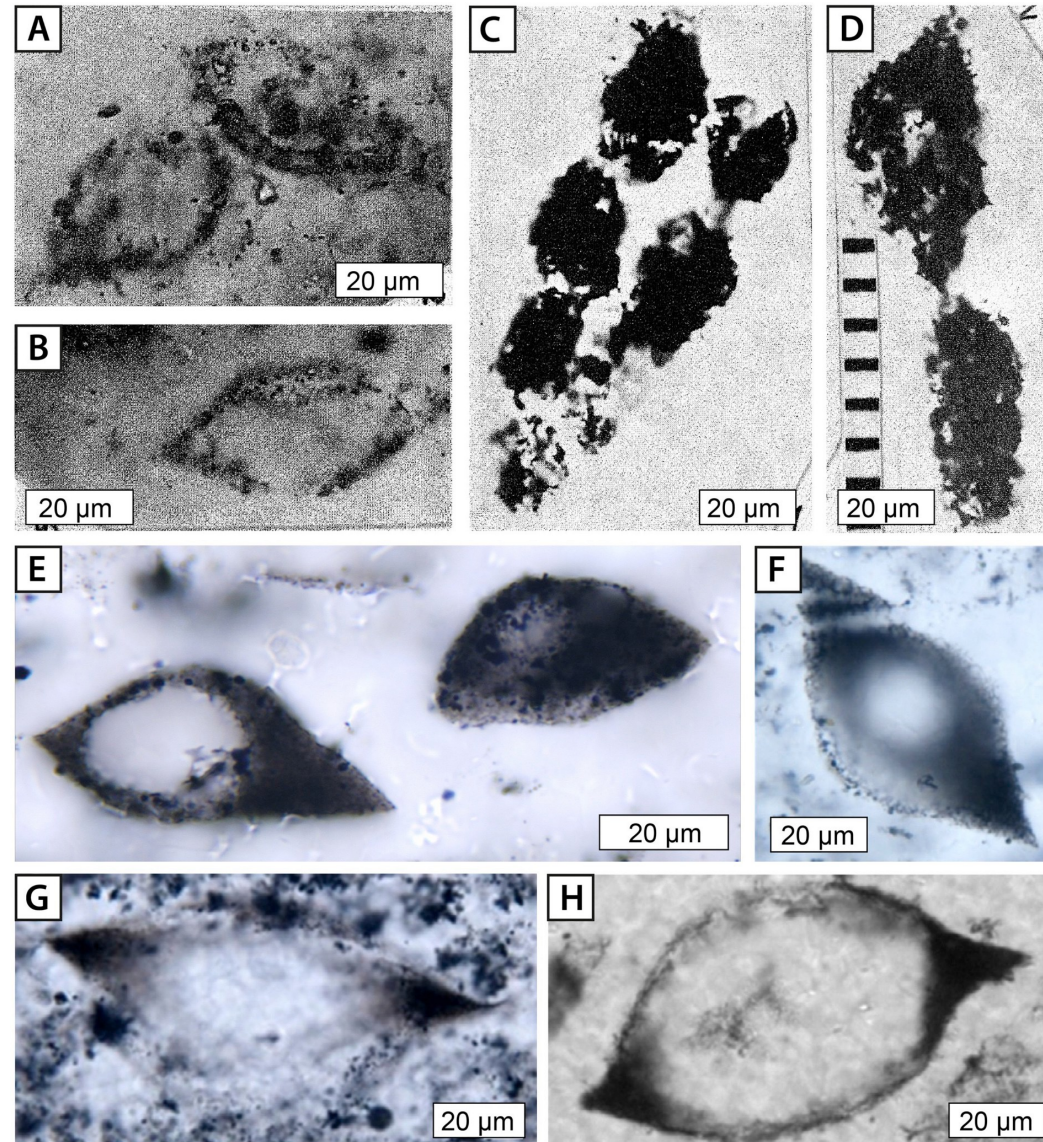
3.47 Ga Silicified Microbial Mats



20 μm

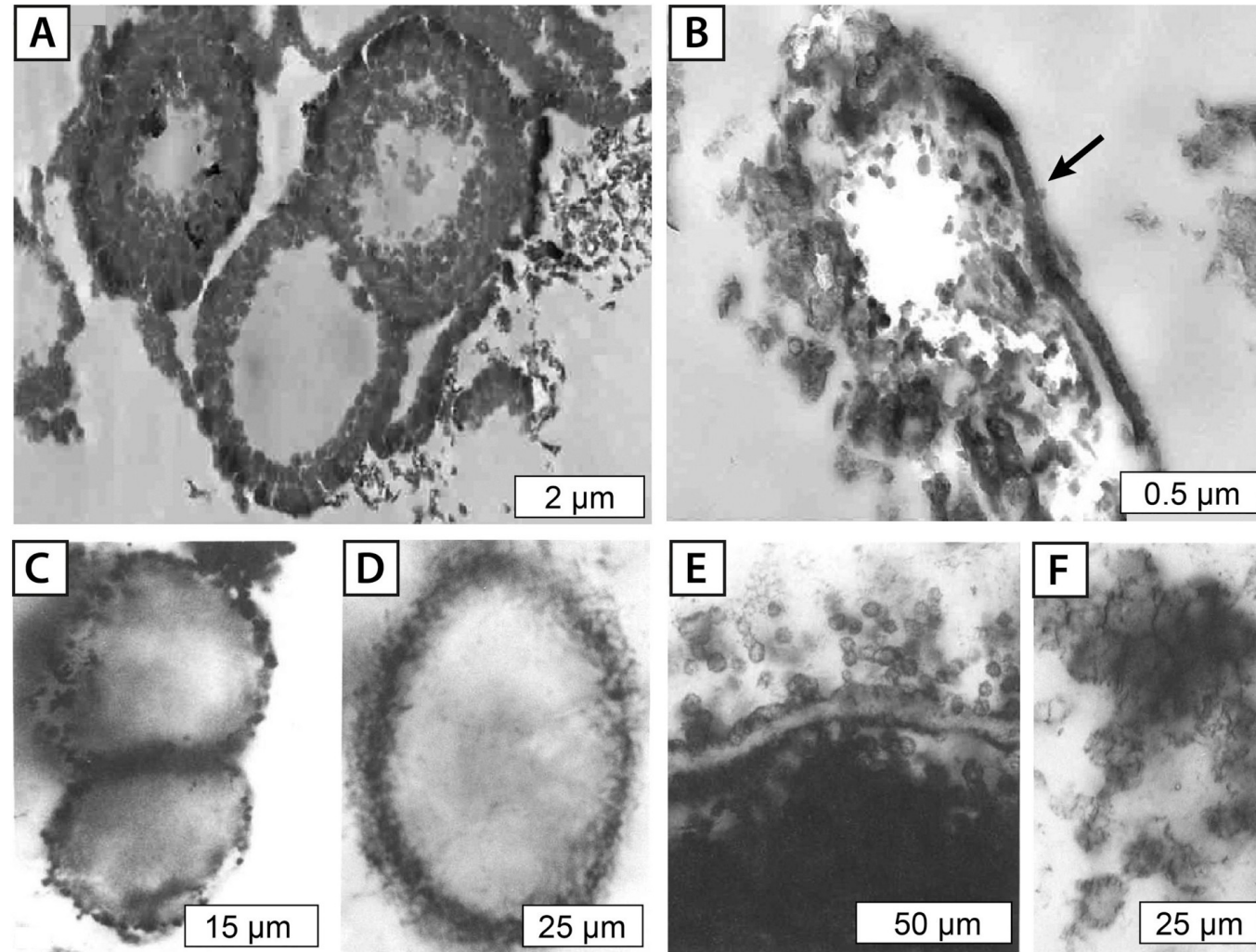
(Homann, 2019)

3.47 Ga Silicified Carbonaceous Structures



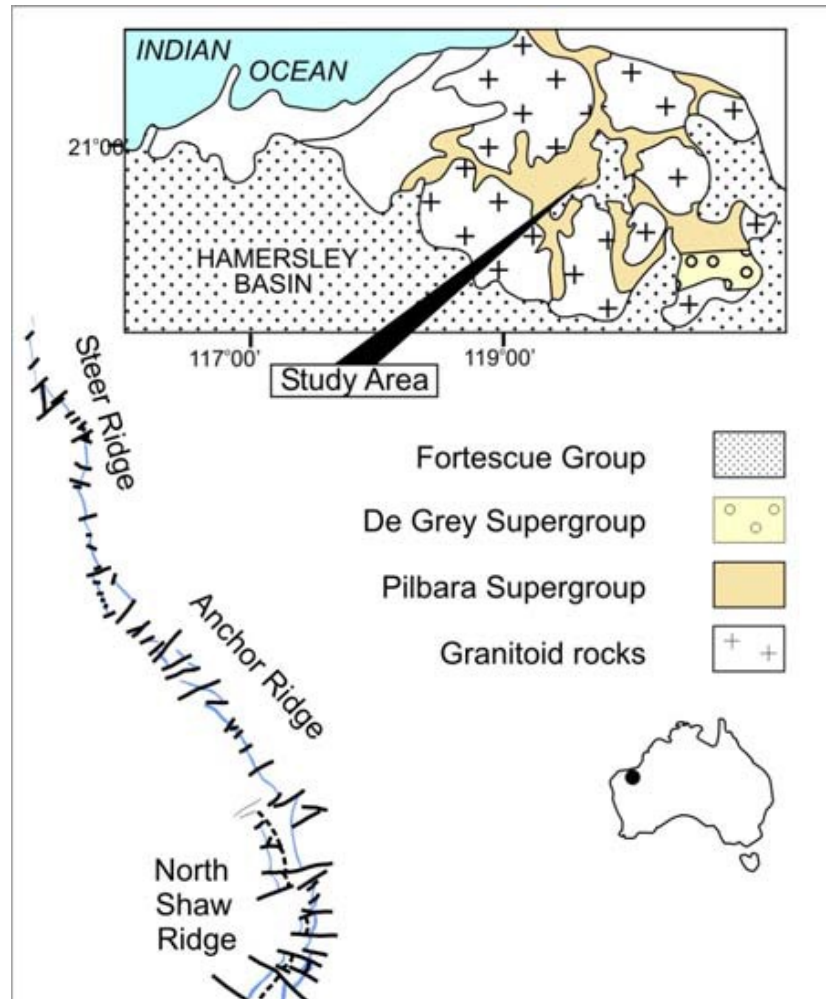
(Homann, 2019)

3.42 Ga Silicified Structures



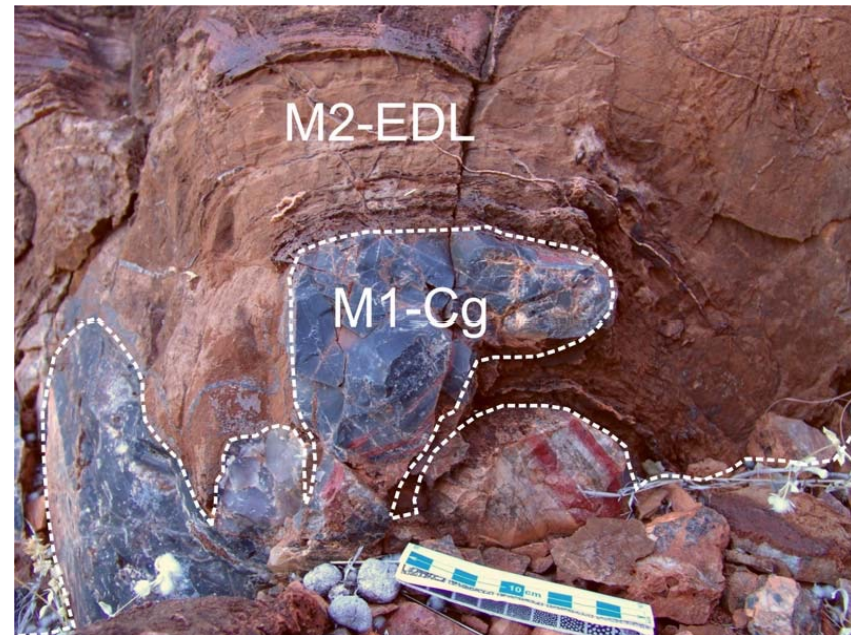
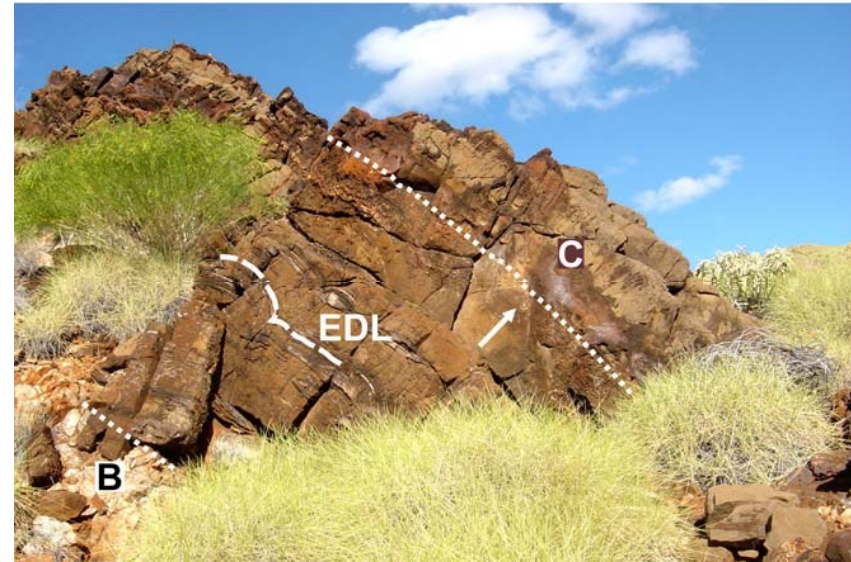
(Glikson et al., 2008; Walsh, 1992)

3.43 Ga Carbonate Deposits, WA



Basalts (B), chert (C), mudstone (M1),
overlain by carbonate (EDL), evaporite
crystals (C)

(Allwood et al., 2006)



The Oldest Archean Stromatolites, Warrawoona, Western Australia, 3.43 Ga



<https://www.youtube.com/watch?v=HIniR9KOA1E>

Modern stromatolites in Shark Bay, Australia, grow in the intertidal zone.



Figure 11.11a
Understanding Earth, Sixth Edition
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Fossilization in Carbonate Rocks

- Biologically influenced or biologically controlled carbonate precipitation
- Organic surfaces critical for mineral precipitation
- Microbially mediated carbonate precipitation requires saturated solutions
- Trapping and binding of minerals by microbes

The layering reveals how both modern and ancient stromatolites grow.

1 Microorganisms live on the surface of the stromatolite.

2 Sediment is deposited on the microorganisms,...

3 ...which react by growing upward through the sediment, forming a new layer.

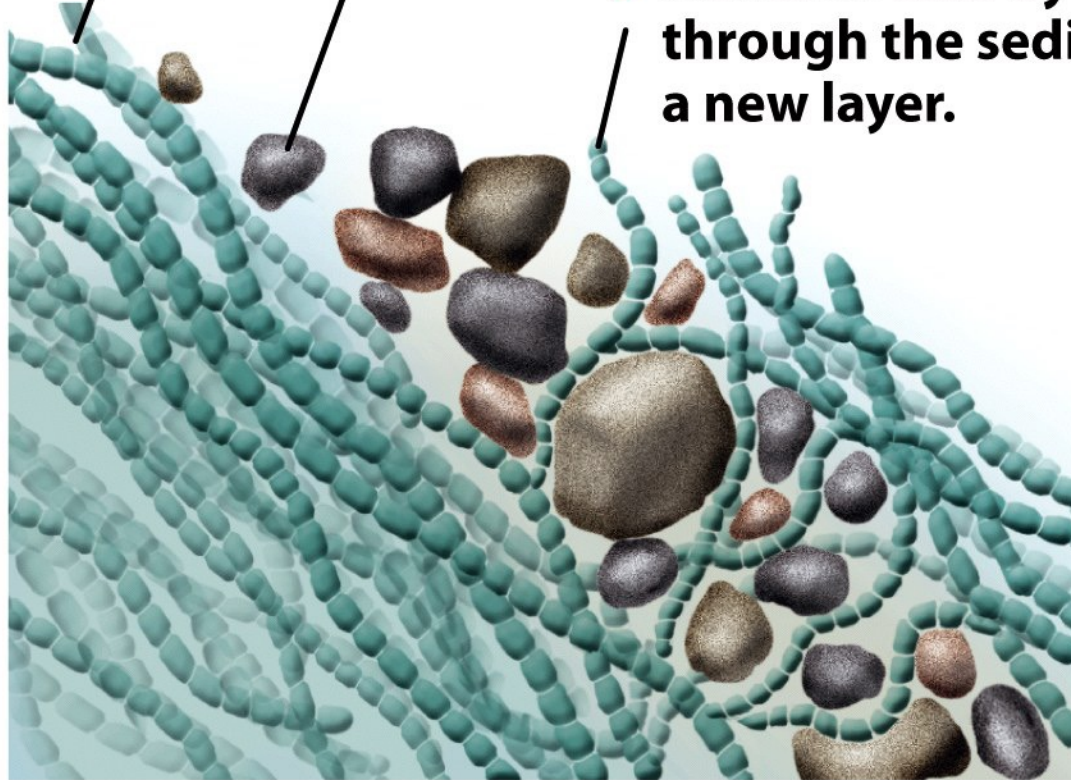
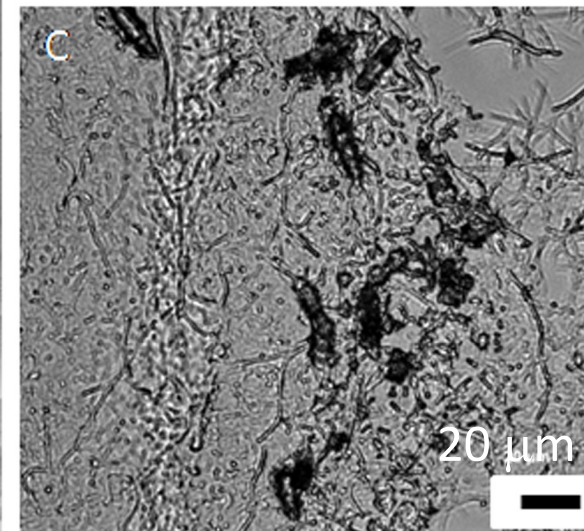
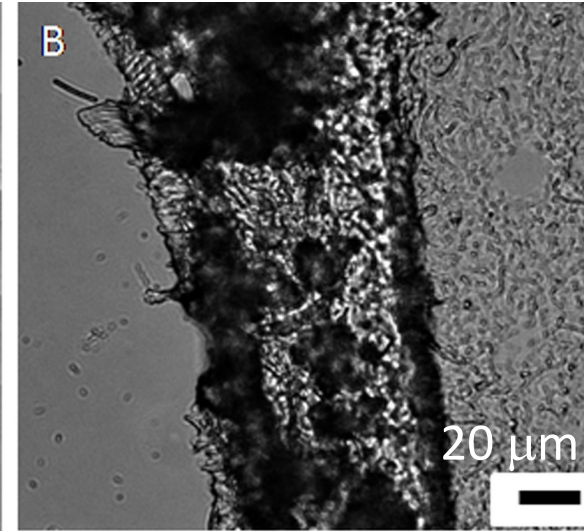
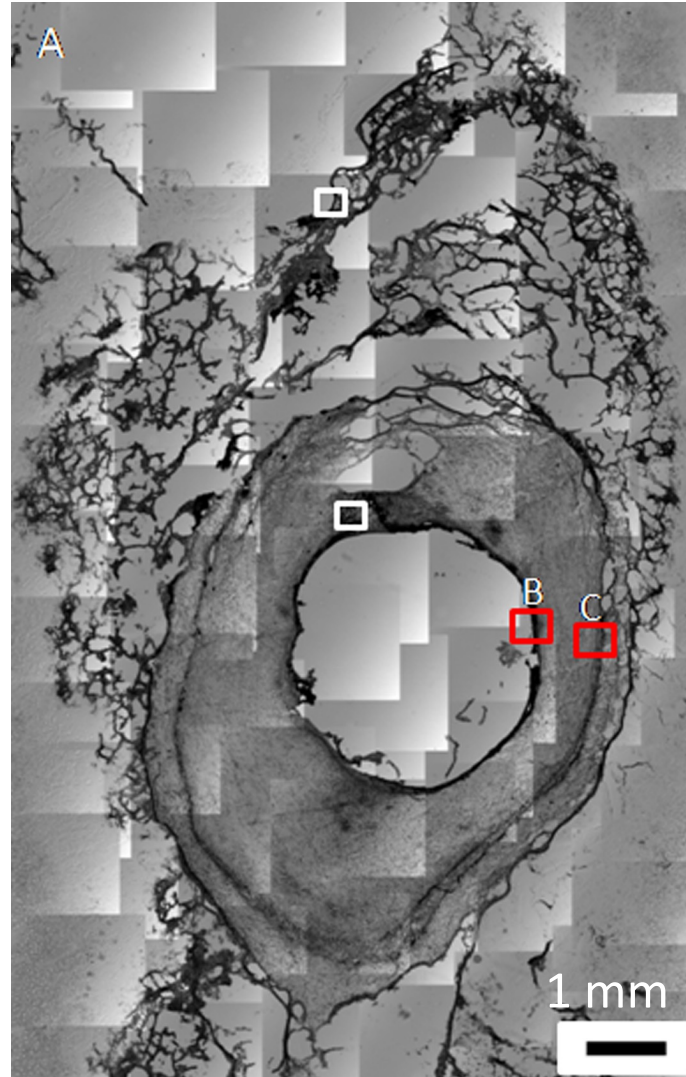
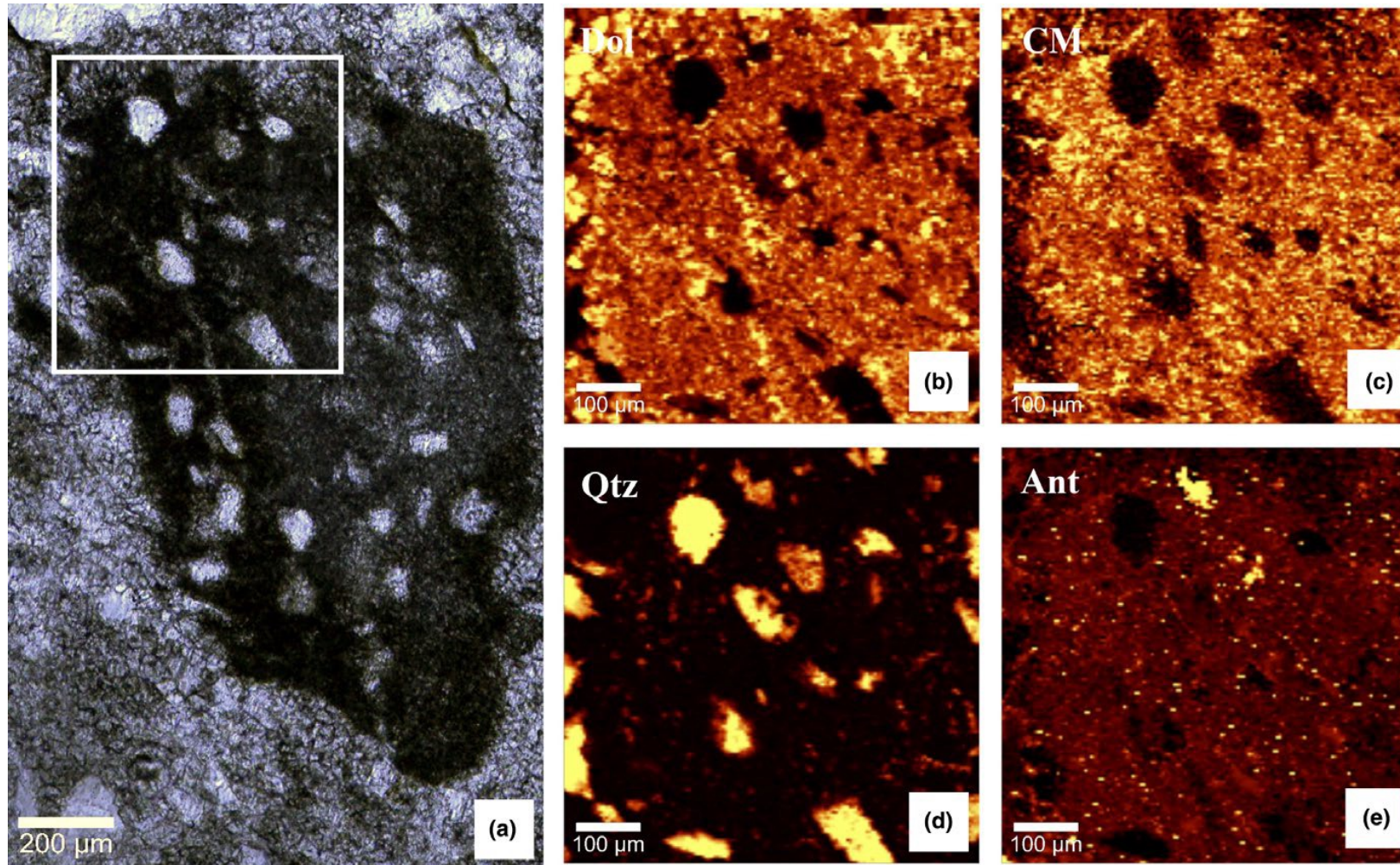


Figure 11.11d
Understanding Earth, Sixth Edition
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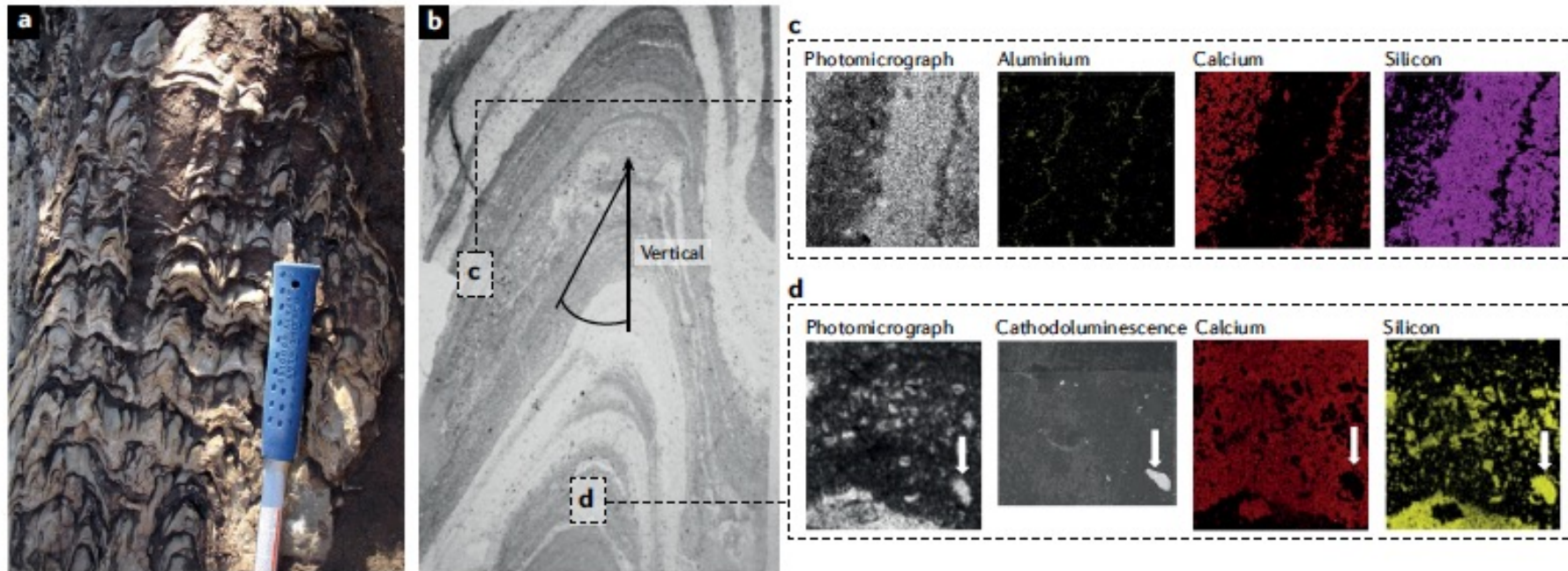


Microbial Mat Chip in ~ 3 Ga Old Stromatolites in the Chobeni Formation, South Africa



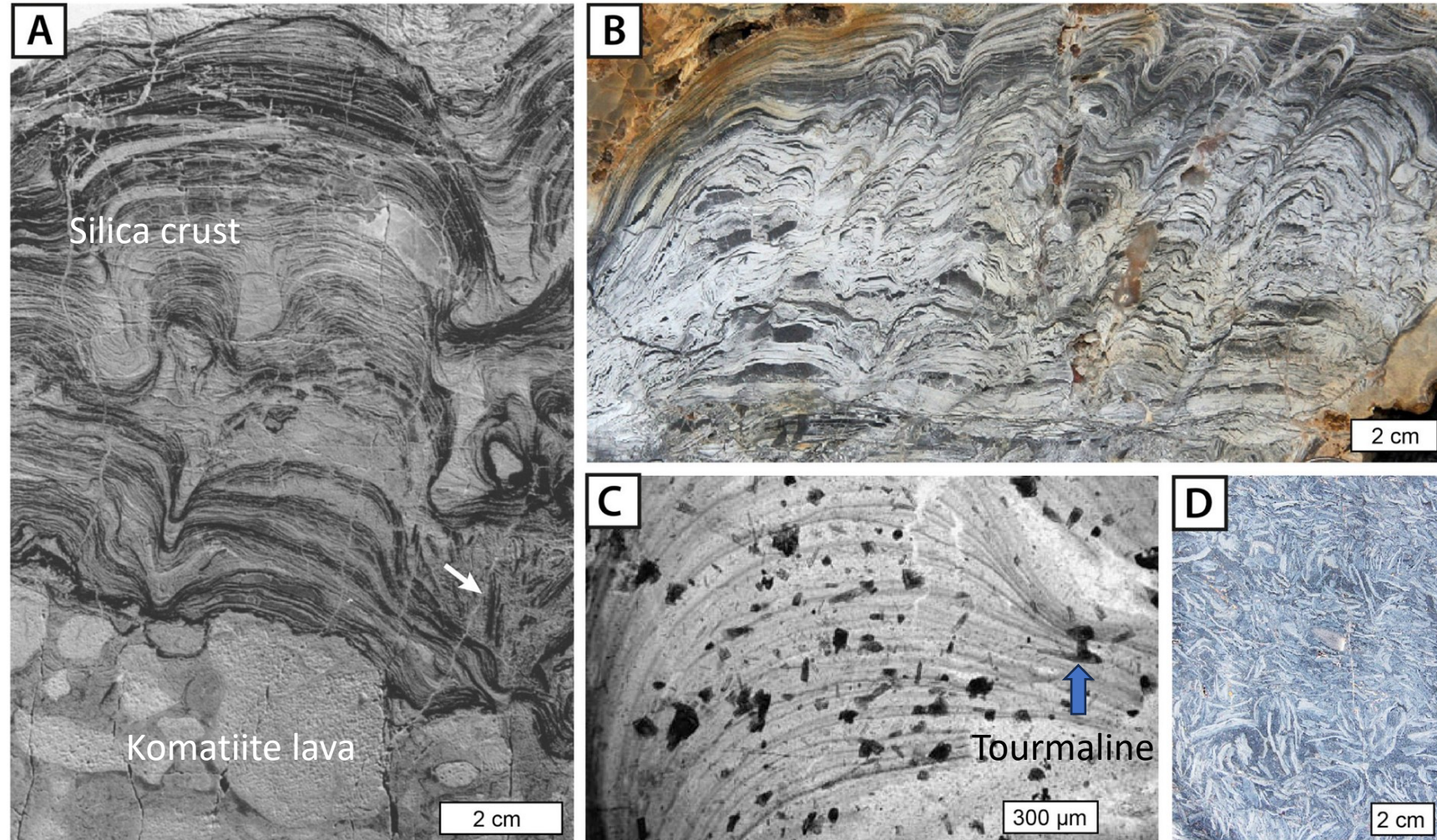
(Siahi et al., 2016)

Trapping and Binding in ~ 3 Ga Old Stromatolites in the Chobeni Formation, South Africa



(Bosak et al., 2021)

Abiotic Crusts or Biological Stromatolites?



(Byerly and Palmer, 1991; Walsh, 2004; Lowe and Byerly, 2018)

