Microbialites within a Lowstand Coral Reef, Offshore Mozambique

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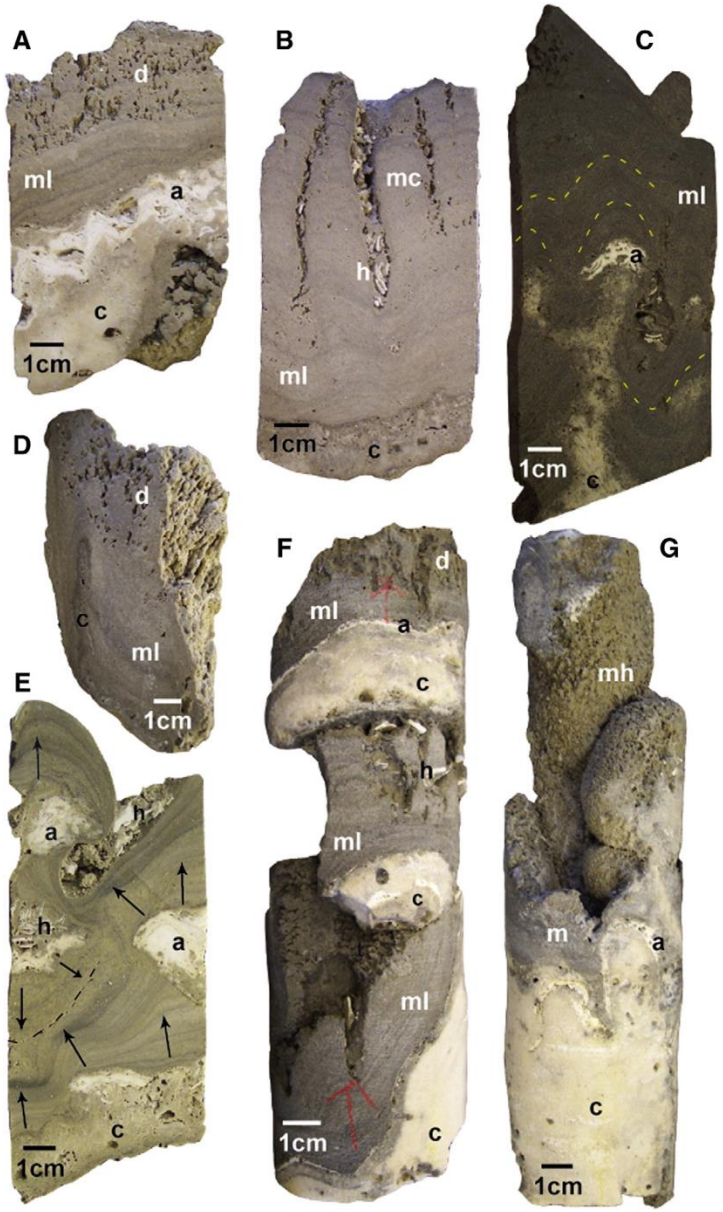
Key Points

- Microbialites are an important component of the lowstand reefs

- Microbialites encrust/grow after the coral's demise, usually some hundred years later (150 – 500 years)

- They vary in abundance and types within the core
  - In core 103, crusts start to appear at core 39
  - Crusts are abundant in the reef crest

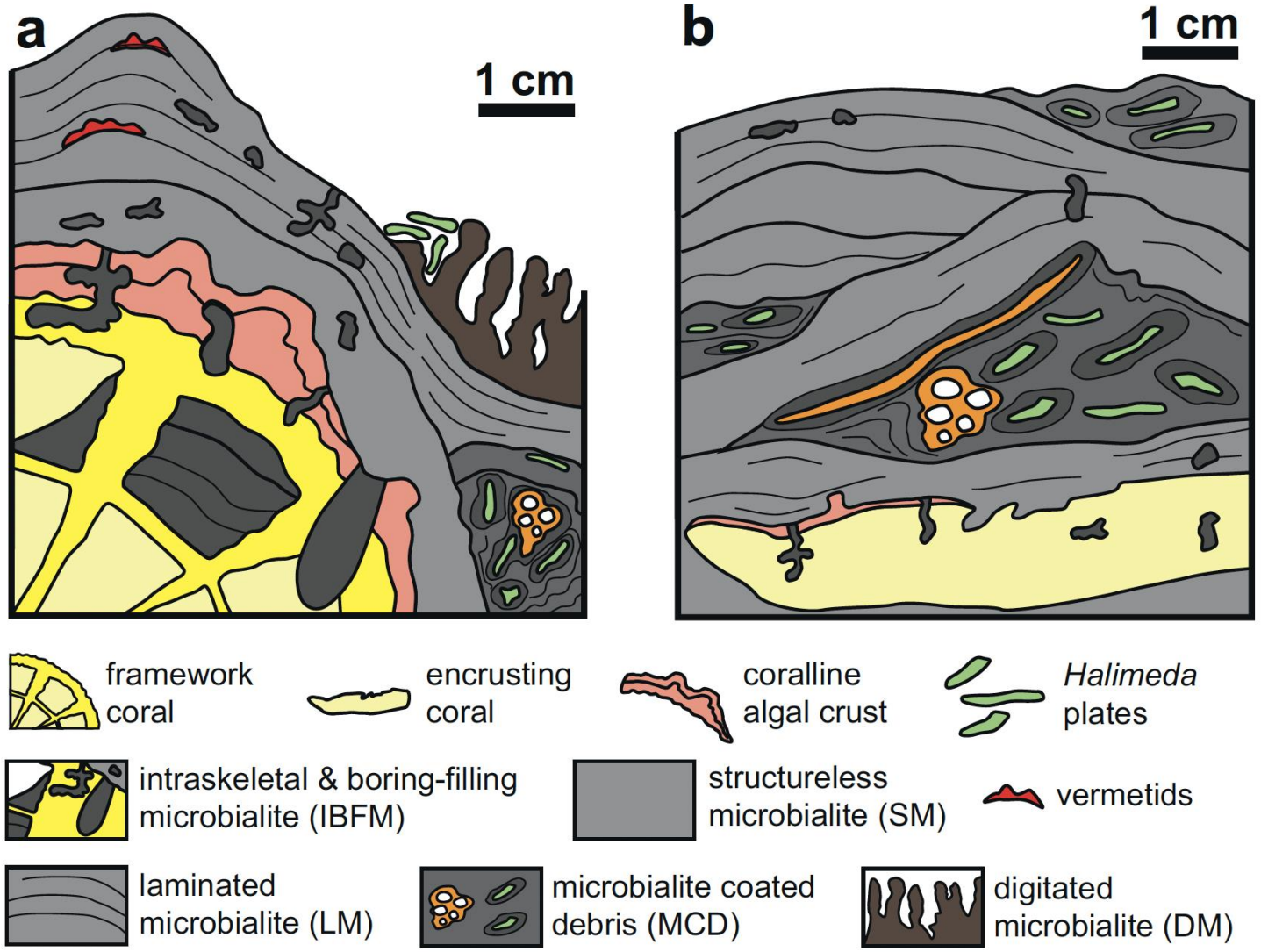
Microbialite types in the Tahiti core



Core slabs displaying the various morphologies of microbialite crusts: m: microbialites, ml: laminated microbialites, d: digitate microbialites, mc: columnar microbialites, mh: hemispheroid microbialites, c: coral; a: coralline algae. These pictures show the typical biological successions recorded in deglacial reefs from Tahiti.

Seard et al. 2011

Microbialite types (after Braga et al. 2019)



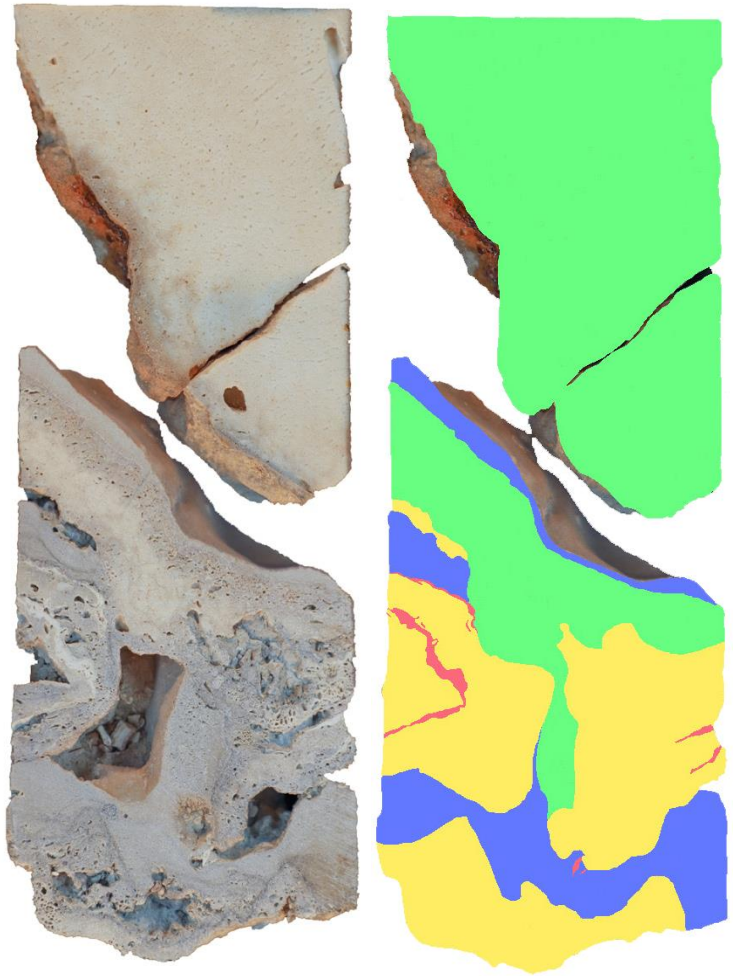
Microbialite types (after Braga et al. 2019)

Microbialites are common in core 103.

The microbialites types include

- Laminated microbialite,
- structureless microbialite,
- digitate microbialite,
- microbialite-coated debris,
- intraskeletal and boring-filling microbialite

Mozambique

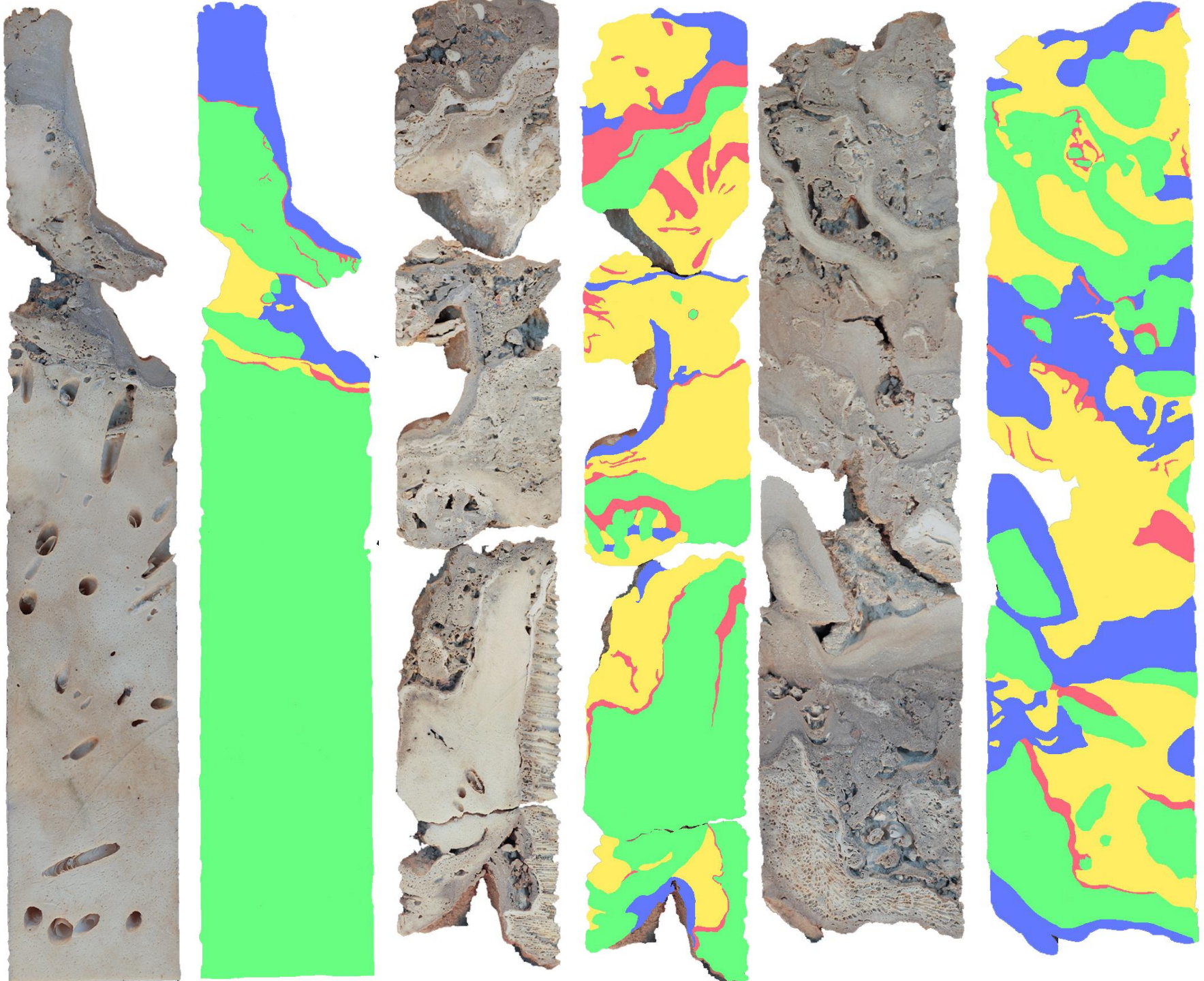


Coral

Microbialite

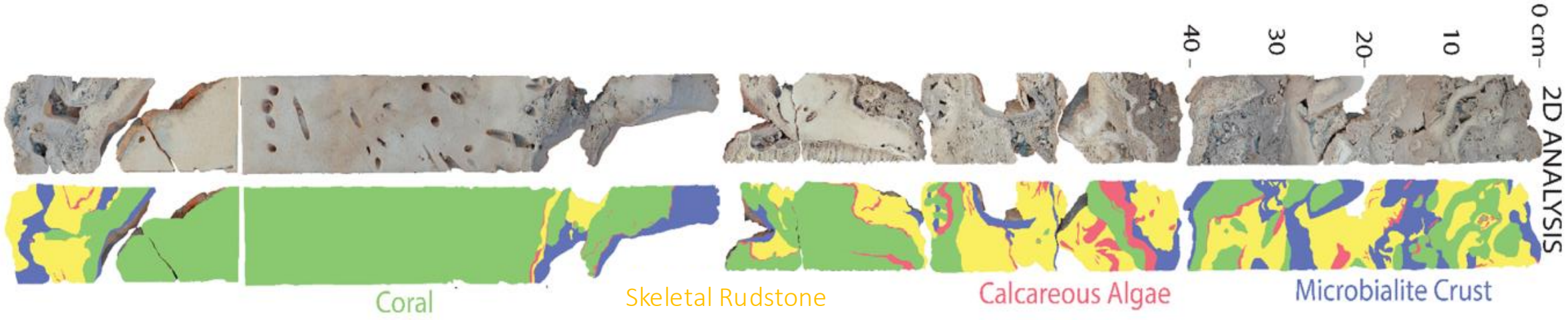
Skeletal Rudstone

Calcareous Red Algae



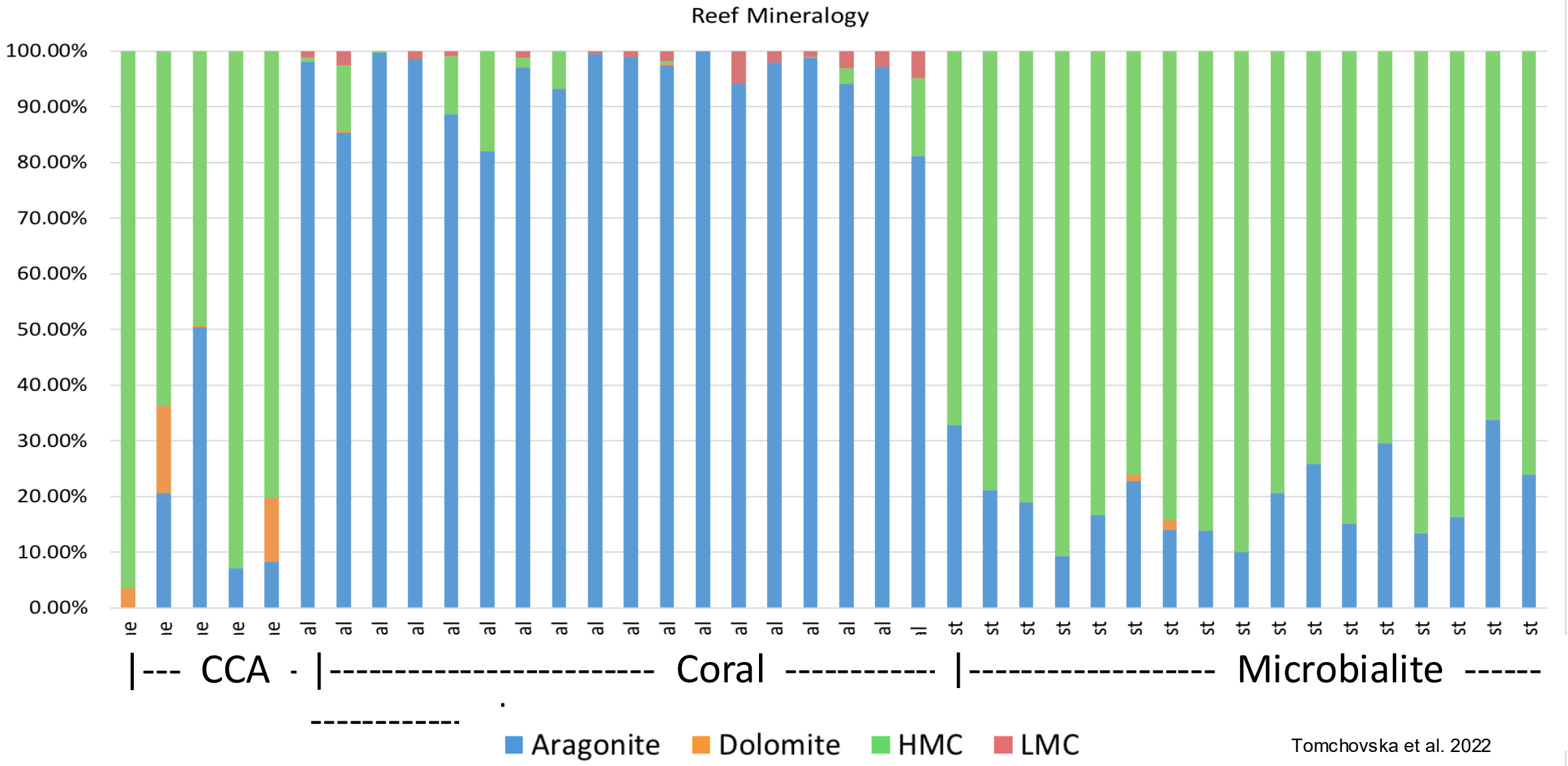
Core and Quantitative Analysis

Component	Percentage of Surface Area
Coral	53.6%
Microbialite crust	14.1%
Calcareous coralline algae (CCA)	3.8%
Skeletal rudstone to grainstone	28.5%



Tomchovska et al. 2022

Mineralogy

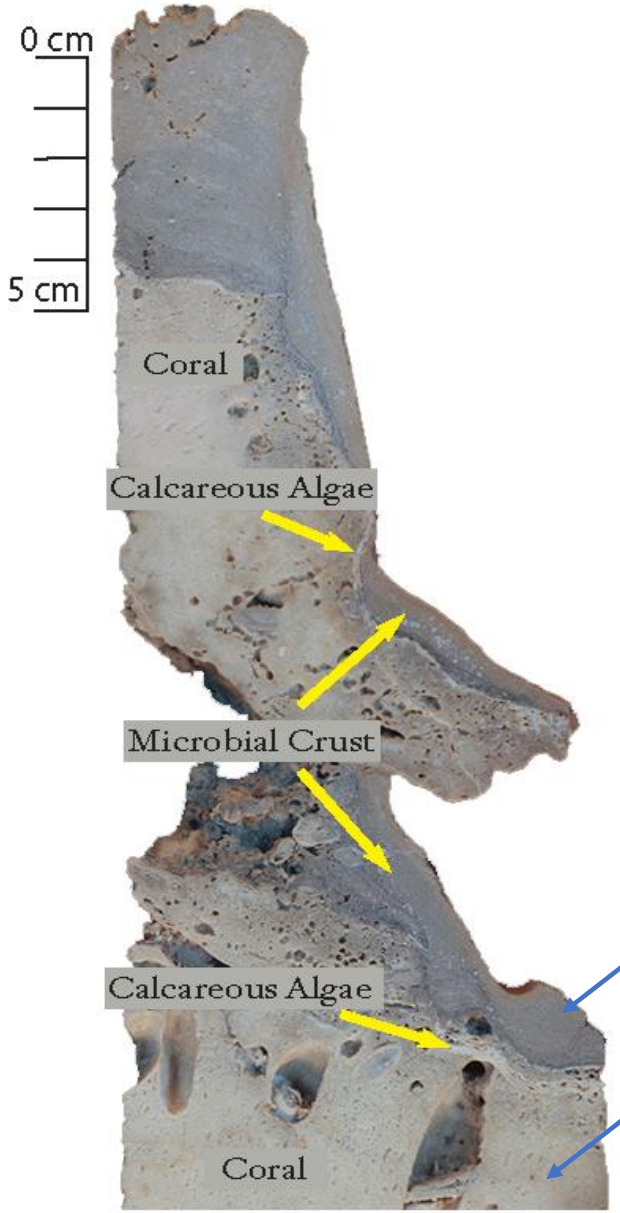


Tomchovska et al. 2022

Encrustation Pattern

- Coral skeletons are often encrusted by two successive generations of encrustation
- Encrusted first by alcareous coralline algae
- Encrusted second by the microbialites crusts

Tomchovska et al. 2022



In Tahiti, the mirocbialite is 125 – 500 years younger than the coral (Sear et al.,2011)

Microbialite: ~12,900 ya

Coral: ~13,400 ya

Cavities in Microbialites core 103

Microbialite-coated debris

Digitate microbialite

Laminated/Structureless Microbialite

Multiphase Microbialite

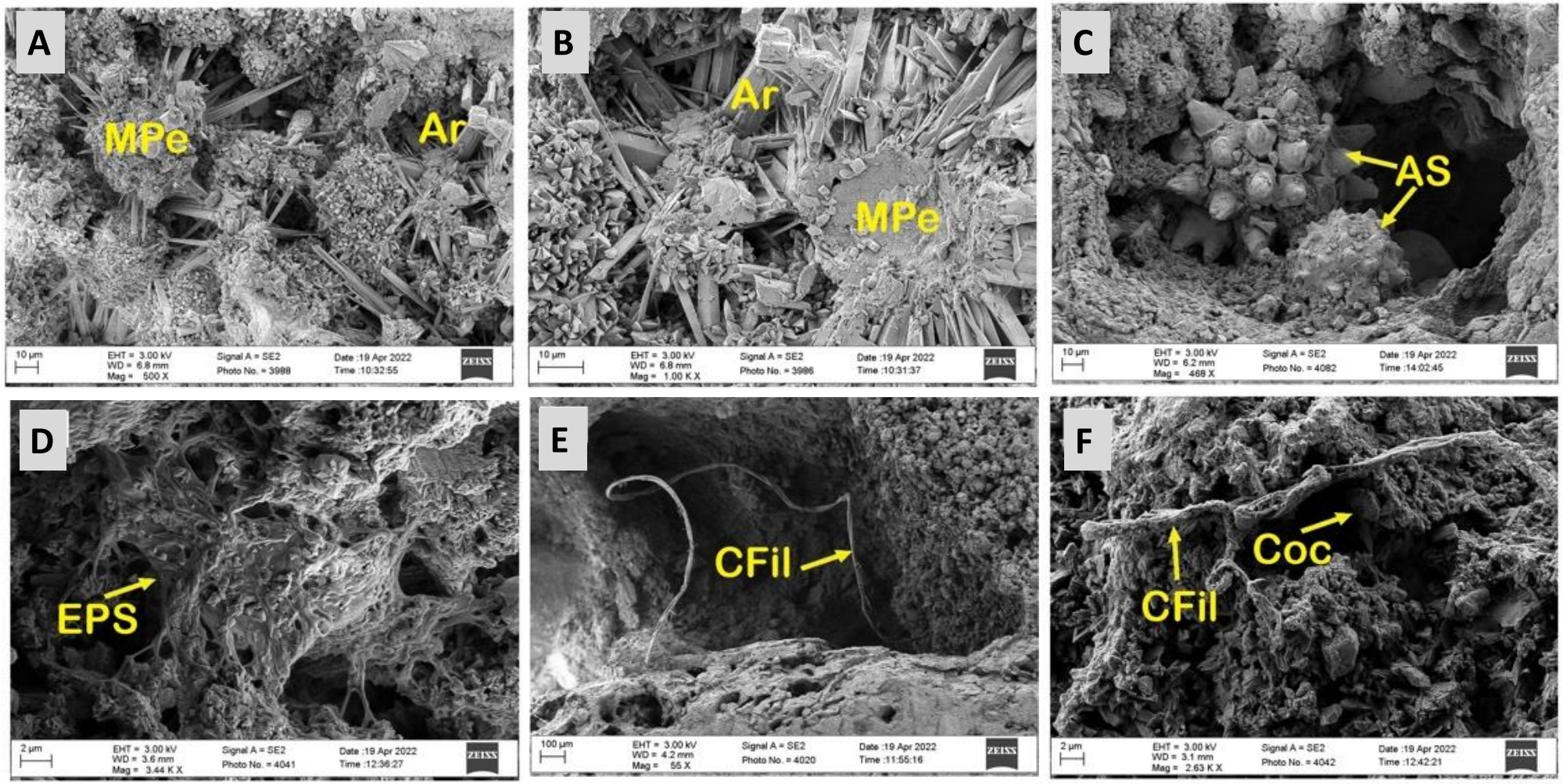
Structureless Microbialite with cavity partly filled with sediment

Laminated/Structureless Microbialite + MCD


5 cm

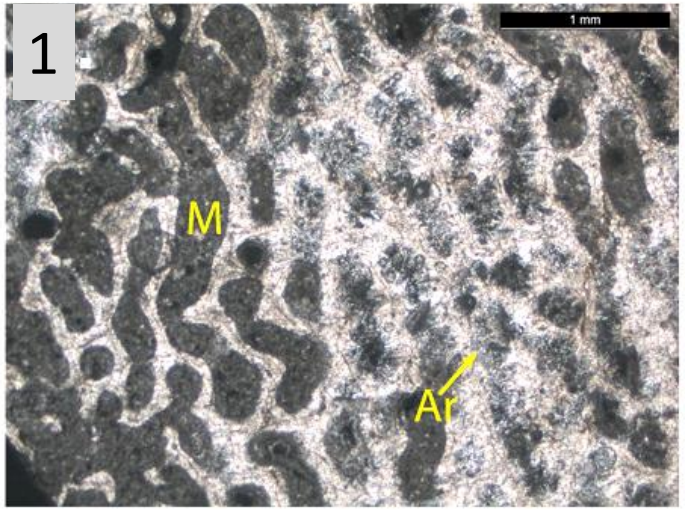
SEM Imaging

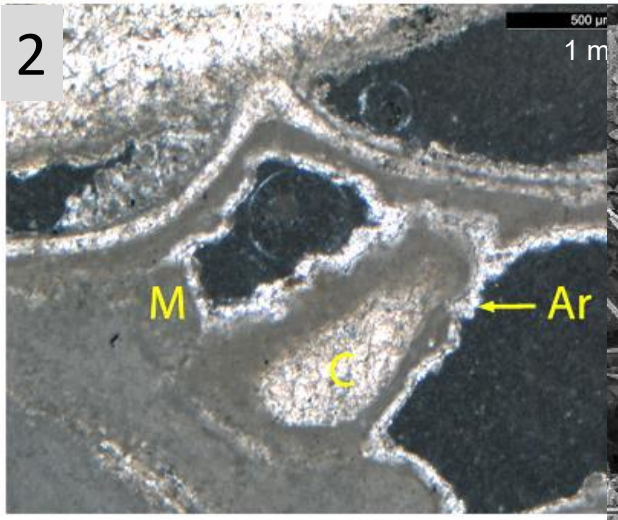
Tomchovska et al. 2022

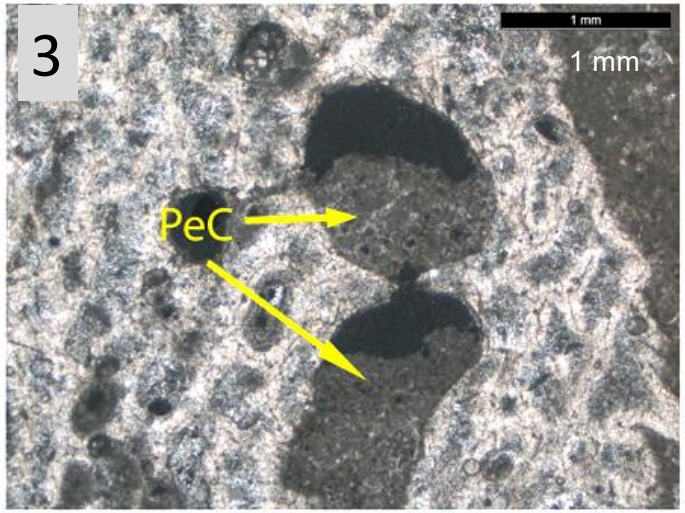


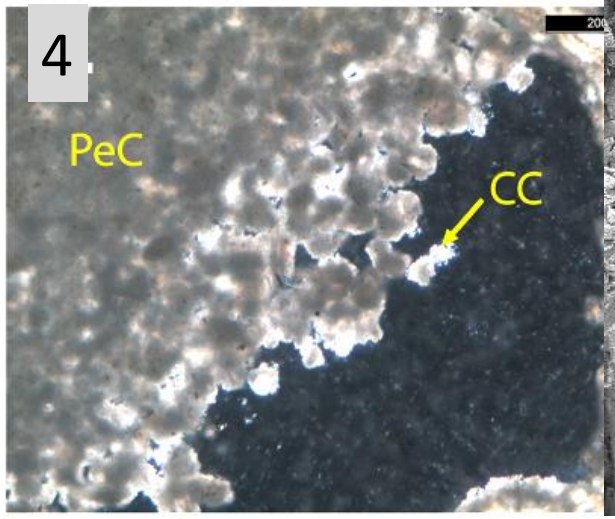
SEM images illustrate the involvement of microbes in the formation of early micritic cements and the development of crusts. In general, the microbialite crusts shows a homogenous texture of a smooth calcified crust with sporadic cavities.

intraskeletal and boring-filling microbialite



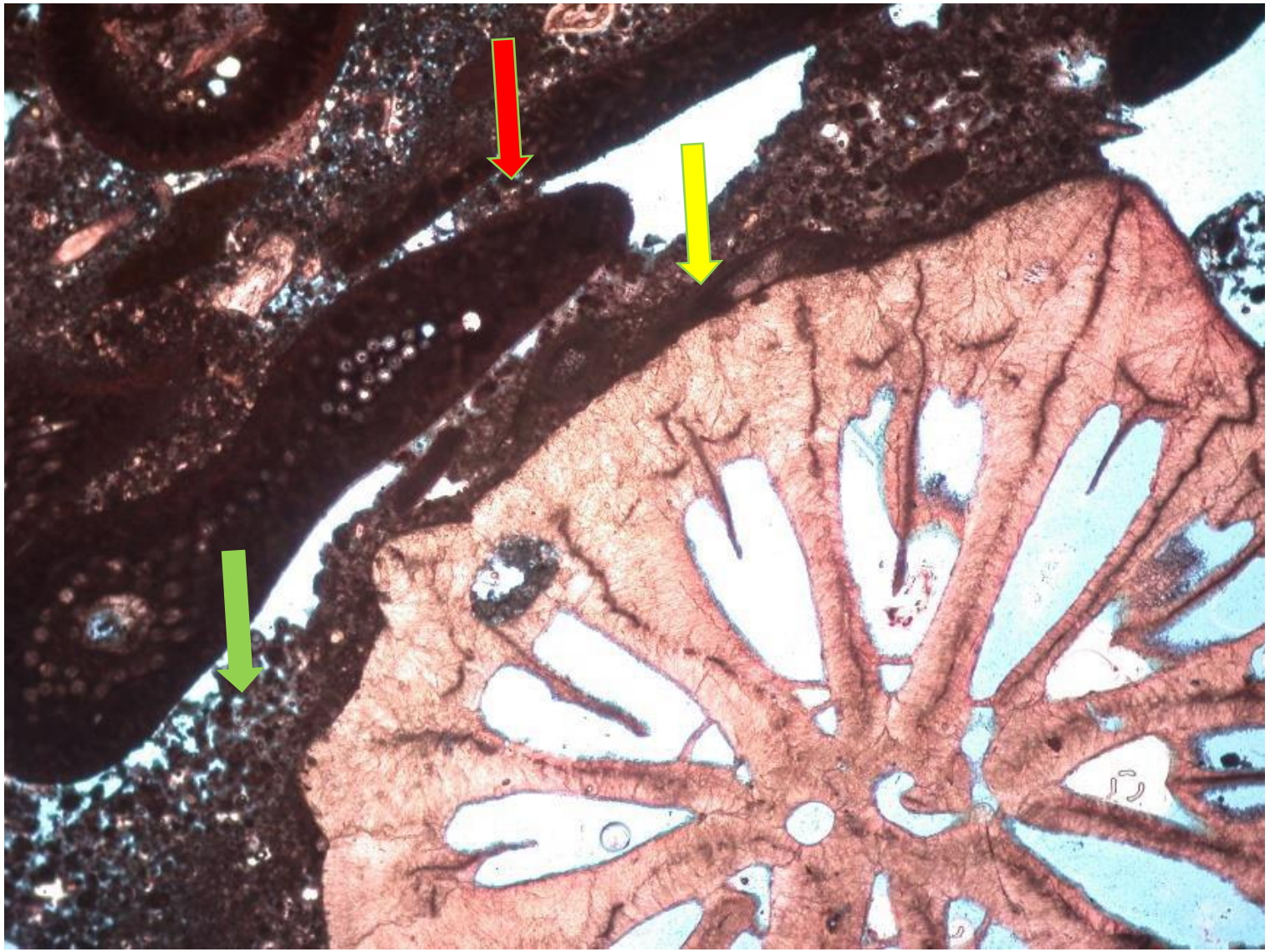






Tomchovska et al. 2022

intraskeletal and boring-filling microbialite



BOREHOLE: ES-103-BH DEPTH: 16.75m SAMPLE: RC23 Bag B

This view shows the bioclastic packstone-wackestone fabric, rich in green algal plates, with a large, solitary coral preserving aragonitic fascicular internal skeletal structures.

The cementation between the grains is nearly exclusively micritic with micritic bridge (red arrow), micritic envelope (Yellow arrow) and micritic peloids (green arrows).

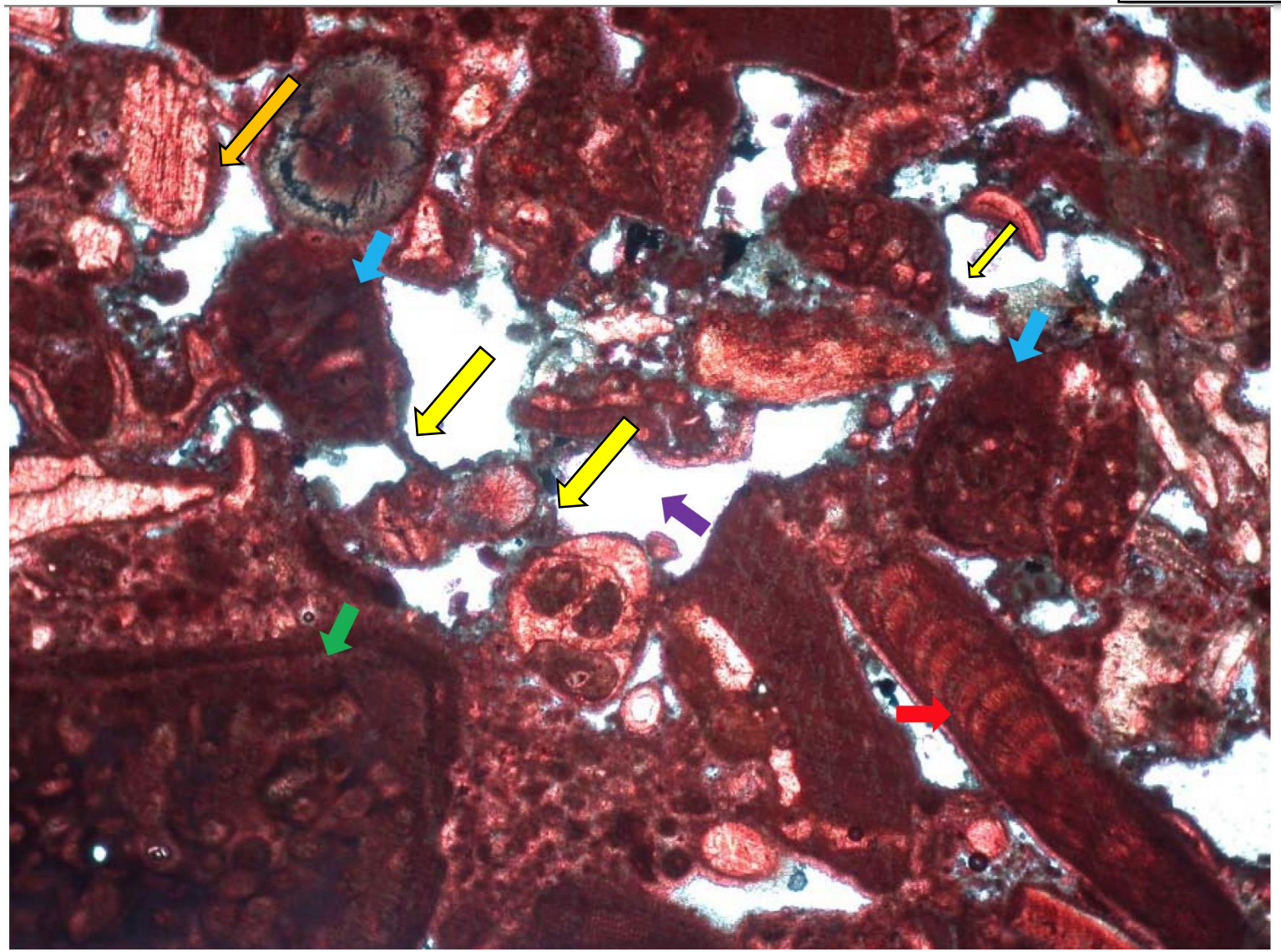
intraskeletal and boring-filling microbialite

BOREHOLE: ES-101-Bha DEPTH: 43.3m SAMPLE: RC38 Bag B

This view shows the presence of both green algal plates (green arrow) and red algal thalli (red arrow). Also visible are fragments of coral, foraminiferids and echinoderms, as well as micritic pellets (blue arrows).

Open intergranular porosity is preserved locally (purple arrow).

There are also micritic bridging cements (Yellow arrows), micritic envelopes (orange arrows). These are good indicators of microbial induced cementation

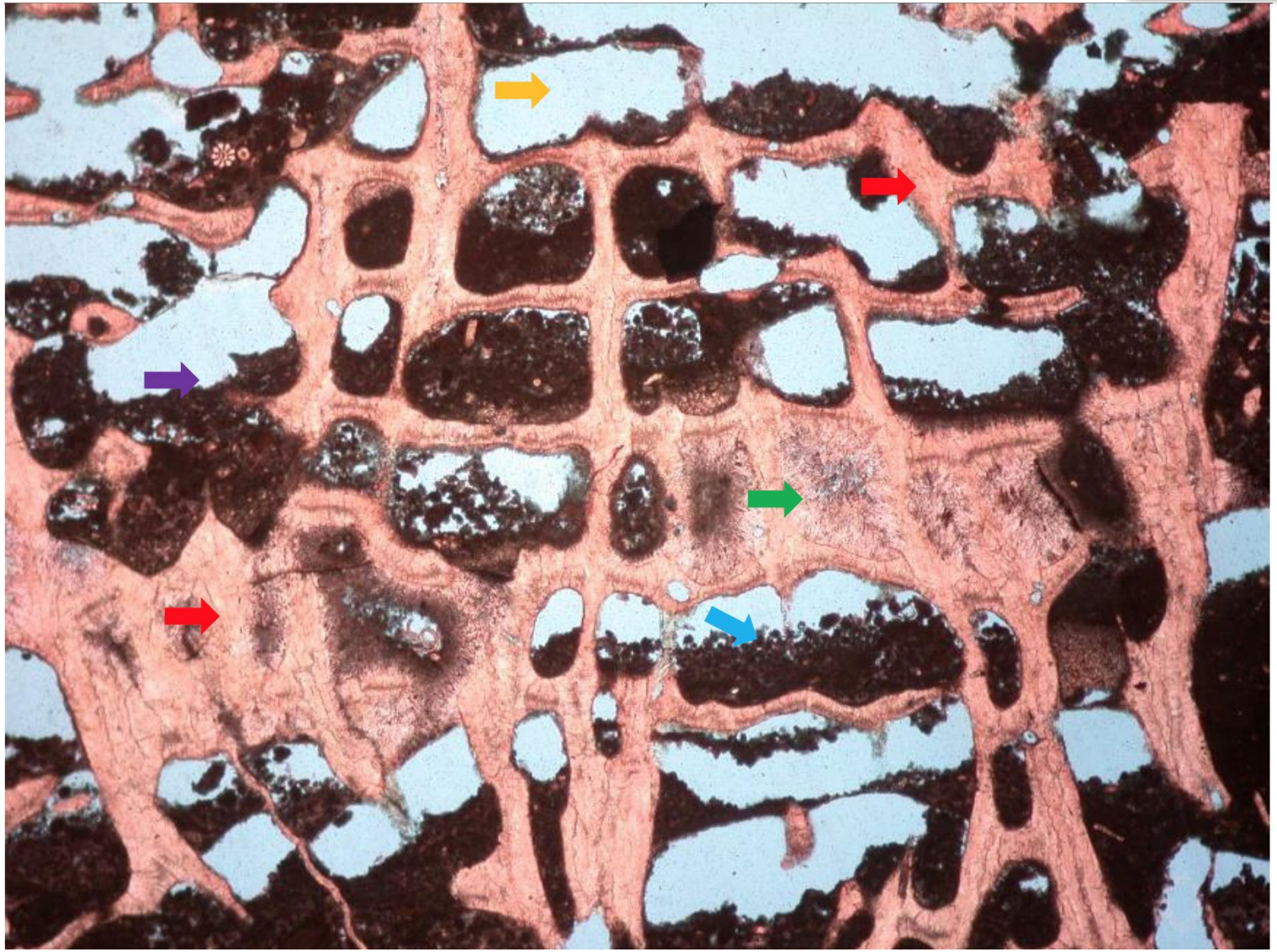


intraskeletal and boring-filling microbialite

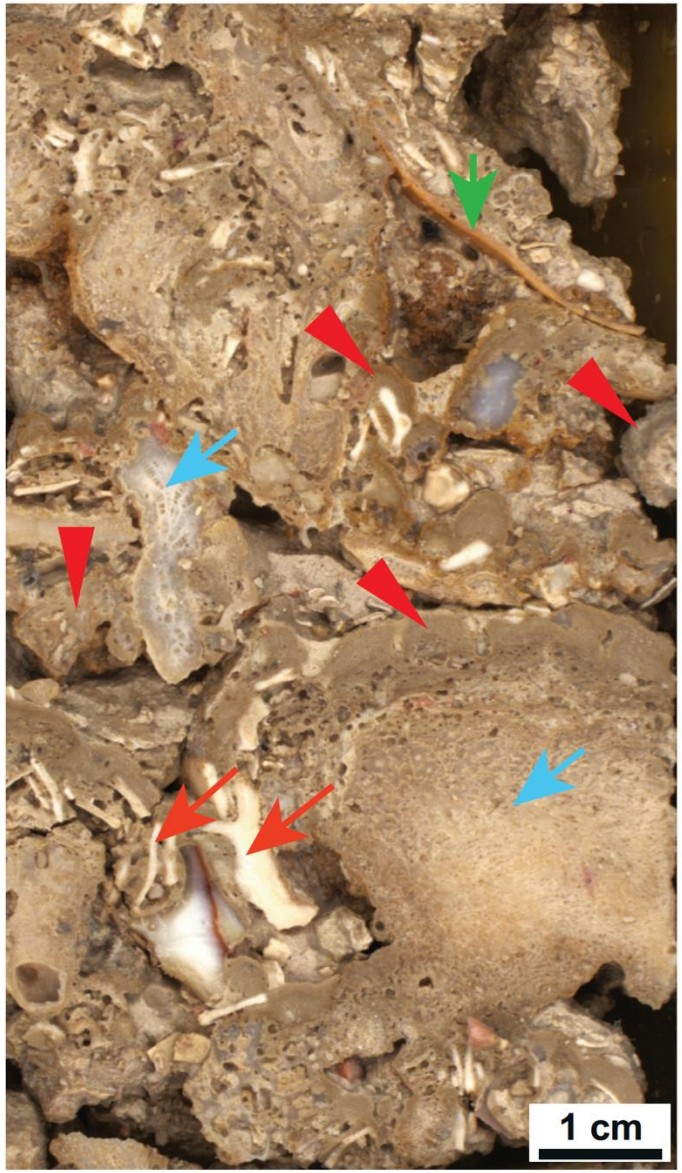
BOREHOLE: ES-103-BH DEPTH: 5.75m SAMPLE: RC06 Bag C

This view shows a section through a large colonial coral (red arrows) preserving original aragonitic fascicular structure. Individual cells within the coral are often open porosity (orange arrow), but geopetal pelletal micrite is also common (blue arrow).
Pores are locally virtually tightly cemented by acicular aragonite cement aggregates (green arrow), which appear to occur in discrete bands or zones.

The pelletal micrite is likely microbial induced precipitation



Microbialite types (after Braga et al. 2019)



Microbialite coated debris (MCD fabric). Coral fragments (blue arrows), Halimeda segments (red arrows), bivalve shells (green arrow) coated by microbialite (arrowheads). Note borings in both microbialite and bioclasts. Sample 39A 4.1.26–36.

Microbialite types (after Braga et al. 2019)

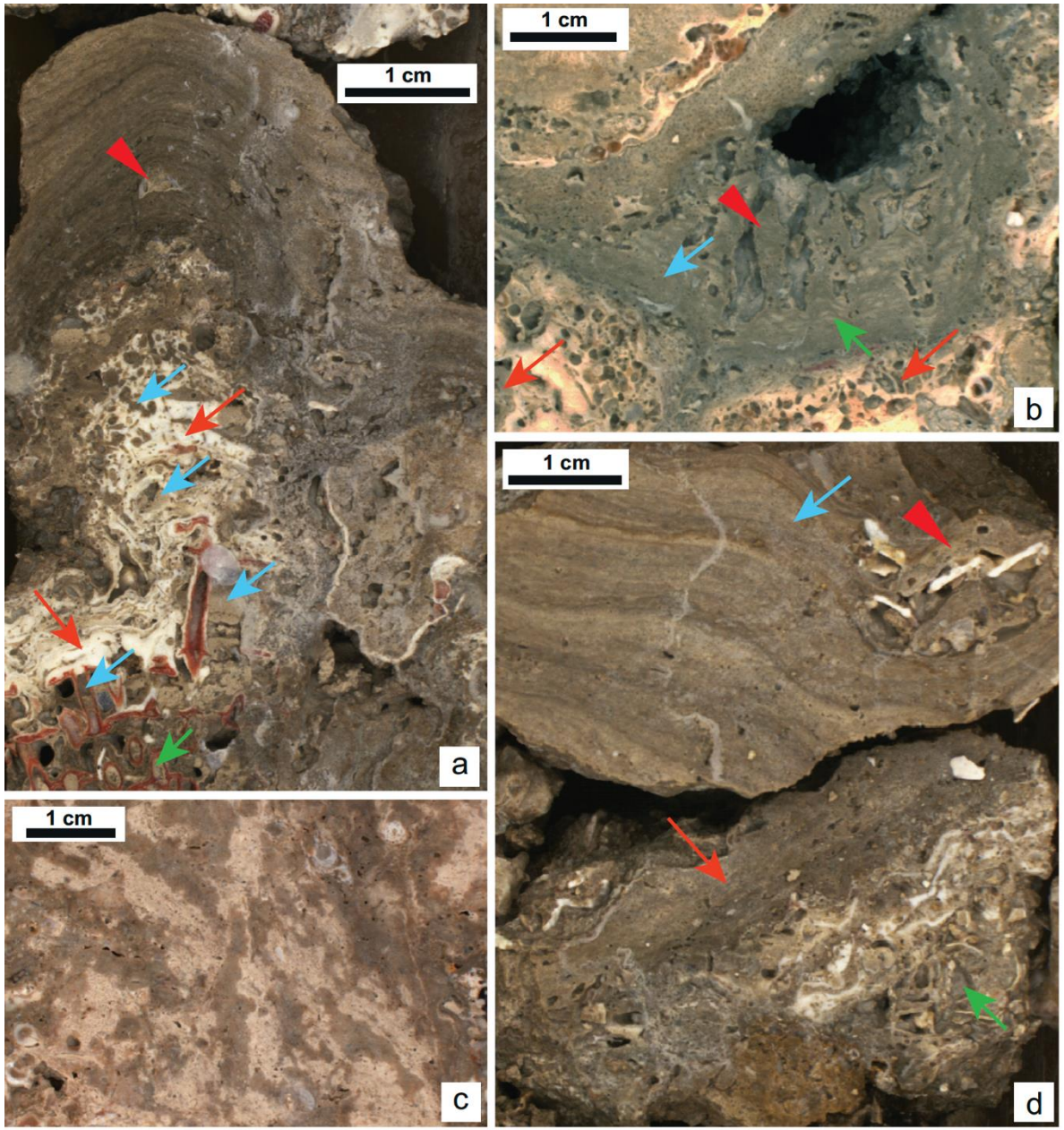


Fig. 8. Microbialite mesoscale fabrics. a) Intraskeletal and boring-filling microbialite (blue arrows) in coralline algal crusts (red arrows) and in the octocoral Tubipora (green arrow), all covered by a small dome of laminated microbialite. Note vermetid (arrowhead) growing on an accretion surface of the laminated microbialite. Sample 54B 6.1.66–75.
b) Intraskeletal and boring-filling microbialite (red arrows) in corals and coralline algal crusts covered by structureless microbialite (blue arrow), laminated microbialite (green arrow) and digitate microbialite (arrowhead) on top. Sample 33A 5.1.100–105.
c) Microbialite altered by soil processes. Sample 55A 4.2.1.113–118. d) Microbialite coated debris (green arrow) overlain by structureless microbialite (red arrow), and microbialite coated debris (arrowhead) overlying laminated microbialite (blue arrow) at the top. Sample 53A 20.1.23–29.
d) Microbialite coated debris (green arrow) overlain by structureless microbialite (red arrow), and microbialite coated debris (arrowhead) overlying laminated microbialite (blue arrow) at the top. Sample 53A 20.1.23–29. (

Vermetid

The **Vermetidae**, the **worm snails** or **worm shells**, These snails usually grow cemented onto a hard surface, or cemented together in colonies

The empty calcareous tubes of certain marine annelid tube worms, for example the Serpulidae, can sometimes be casually misidentified as empty vermetid shells, and *vice versa*. The difference is that vermetid shells are shiny inside and have three shell layers, whereas the annelid worm tubes are dull inside and have only two shell layers.