Schiaparelli and his legacy

Symposium: Milano, Oct 19-20, Torino Oct 21

On the centenary of his death

Under the High Patronage of the President of the Italian Republic

Complex textures of laminated sediments on Mars should be of biogenic origin

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References

Rizzo , V. & Cantasano, N. (2009). Possible organosedimantary structures on Mars. International Journal of Astrobiology 8 (4) , 267-280.

Rizzo , V. & Cantasano, N. (2009). Le “Blueberries” ed i sedimenti laminati del pianeta Marte sono strutture biogeniche? Geoitalia N.29, 41-46.

Rizzo , V. & Cantasano, N. (2009). Esiste vita su Marte? http://www.scienzeinrete.it, dicembre 2009.

A scientific discussion

Blueberries

Laminated sediments

Are they organosedimentary structures ?

An approach to overcome limits

On Earth

Exhaustive investigations:

1. Isotopic
2. Mineralogical
3. Microtextural
4. Textural
5. Sedimentological
6. Biochemical
7. ……

Limits on Mars

limited and "scanty":

1. Isotopic/mineralogical
2. textural
3. structural
4. Sedimentological

But….

….Thousands of High Quality Imagery on Mars (both microscopic and panoramic)

In depth study of:

- **Structures**
- **Textures**
- **Interrelations**
- **Comparisons**

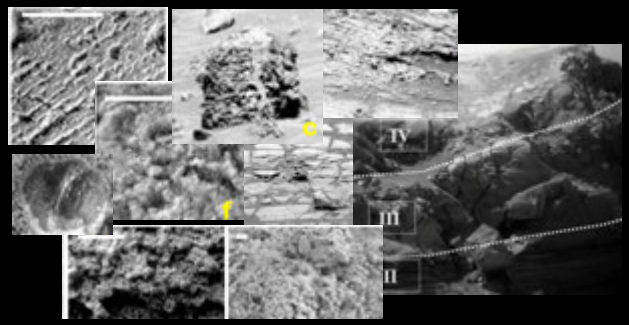
Structures and textures of sediments are fundamental in geology to understand their origin

An approach to overcome limits

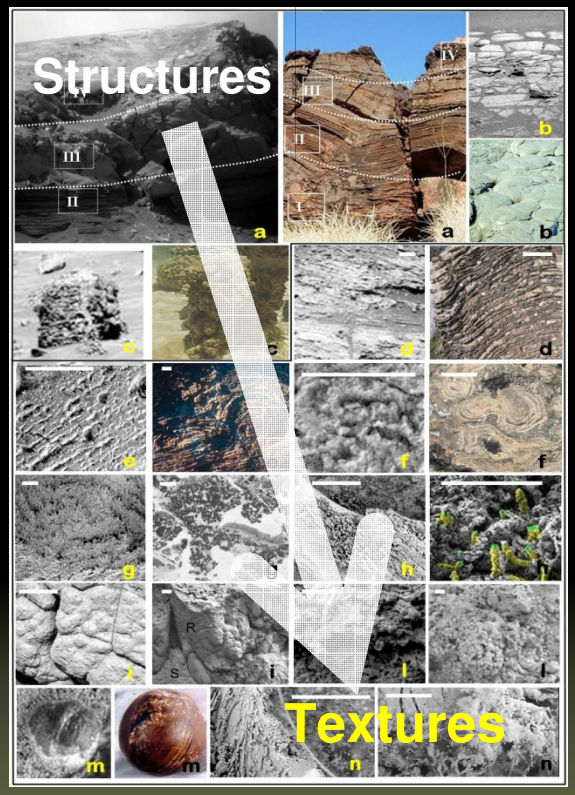
From an approach to a Metodology

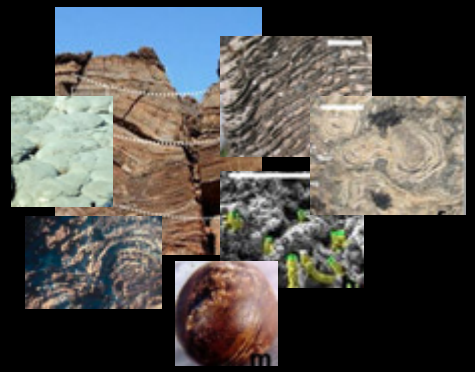
http://marsrovers.jpl.nasa.gov/gallery

Archives of earth images



Systematic analysis at different scales and by strong amplification: from panoramic to microscopic* imagery





Investigating archives for analysis and comparisons

* *Field of view = 3,2cm*
Enlargement= up to 300%
Resolution= 40 micron

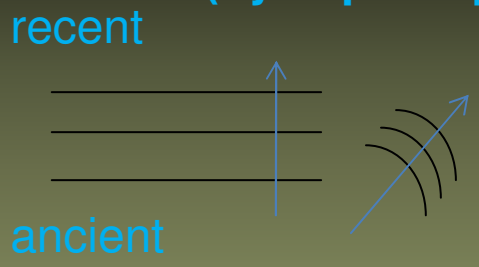
Looking over compatibility between structures and fundamentals of inorganic sedimentation (IS)

An easy answer looking through basilar principles

Inorganic Sedimentation (IS)

generates
a layers sequence by
granulometric or
compositional variation.

Growing at esternal surface (Lyell principle)

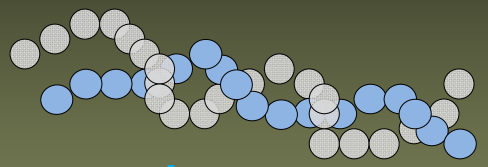


Organic Sedimentation (OS)

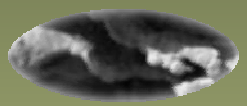
generates complex
distinctive
textural features

Internal growing

Intertwined filaments

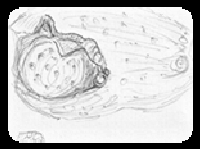


disarmonic laminae convolution

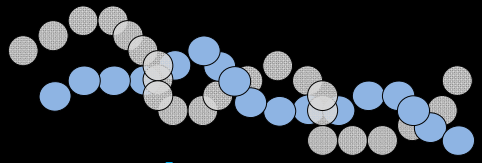


An easy answer looking through basilar principles

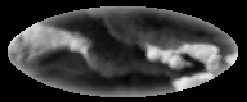
Internal growing



Intertwined filaments



disarmonic laminae convolution



Are in contrast with the fundamentals of inorganic sedimentation (IS)

Could the same reasoning not be applied to Mars?

An easy answer looking through basilar principles

The following slides show the structural features of mars sediments we pointed out:

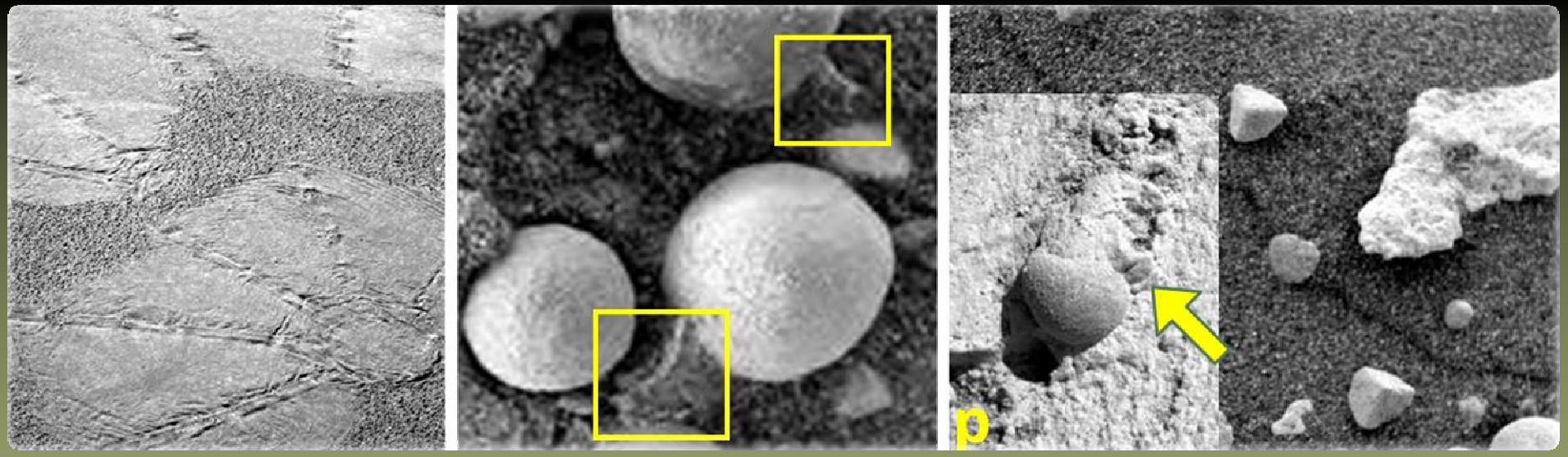
-FILMS (F)
- LAYERS (L)
- BLUEBERRIES (B)
- OTHER FINDINGS (OF)

-Denoting inconsistency to inorganic sedimentation

F/OF - Films and plastic/gelatinous/flowing substances

A structured translucid film

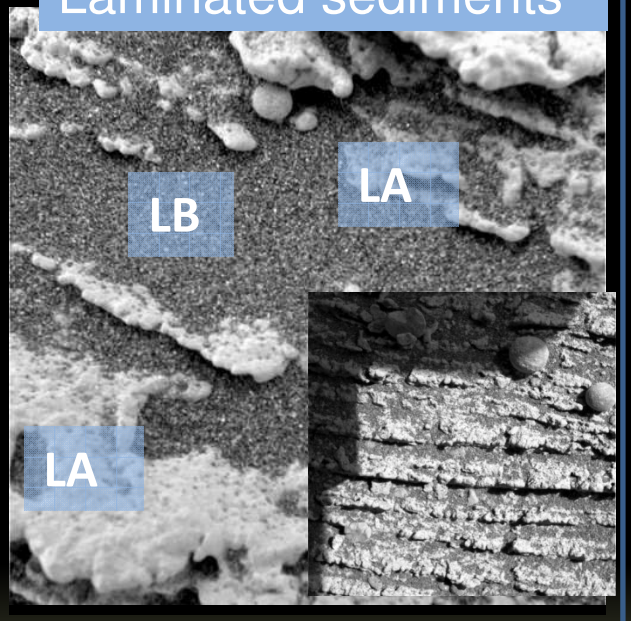
Plastic/gelatinous substances

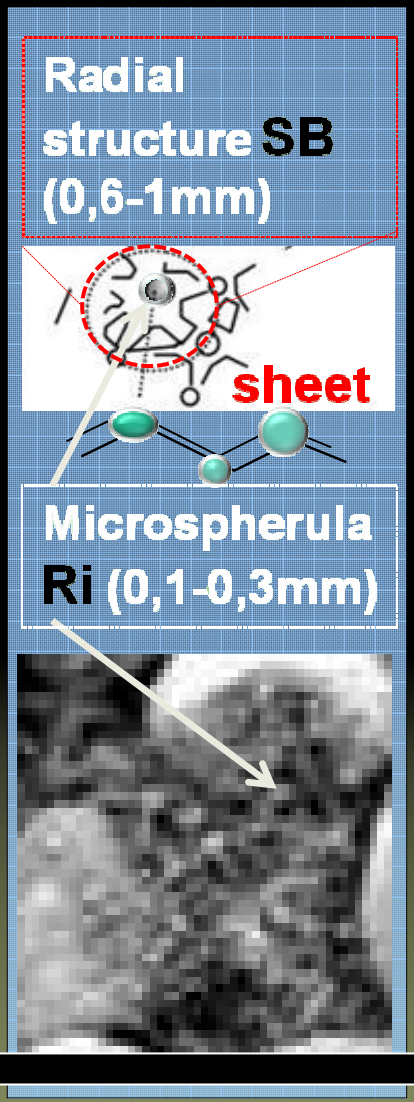


L – From films to thin lamination

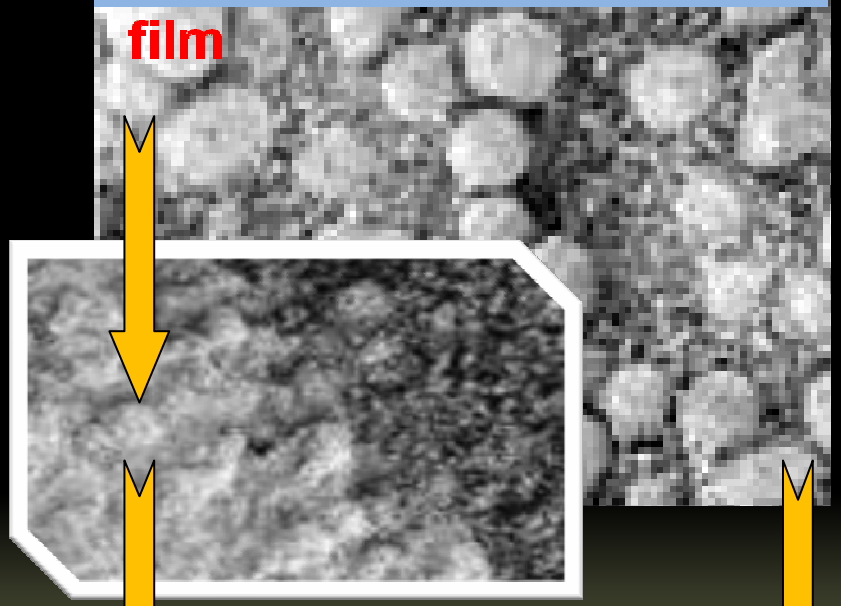
"Planar SB-Polycentric" type structure

Submillimetric Laminated sediments



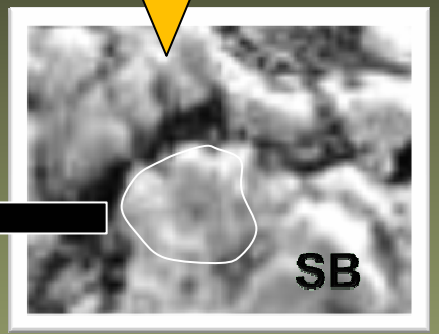


FILM passing to → LA and LB laminae, showing a similar basic "SB" structure

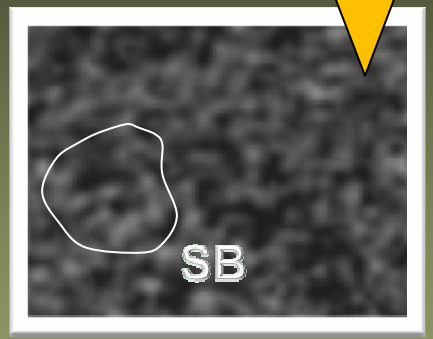


Accretion

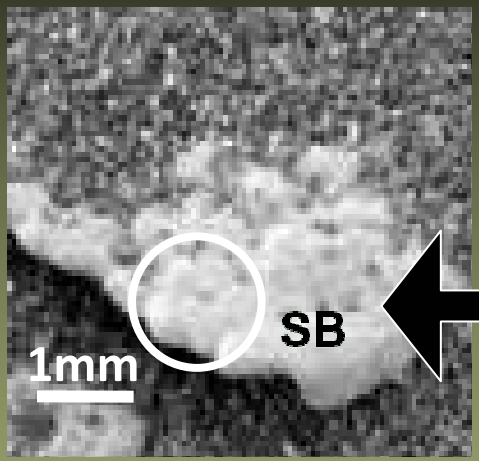
Agglutination



LA-skeletal type lamina

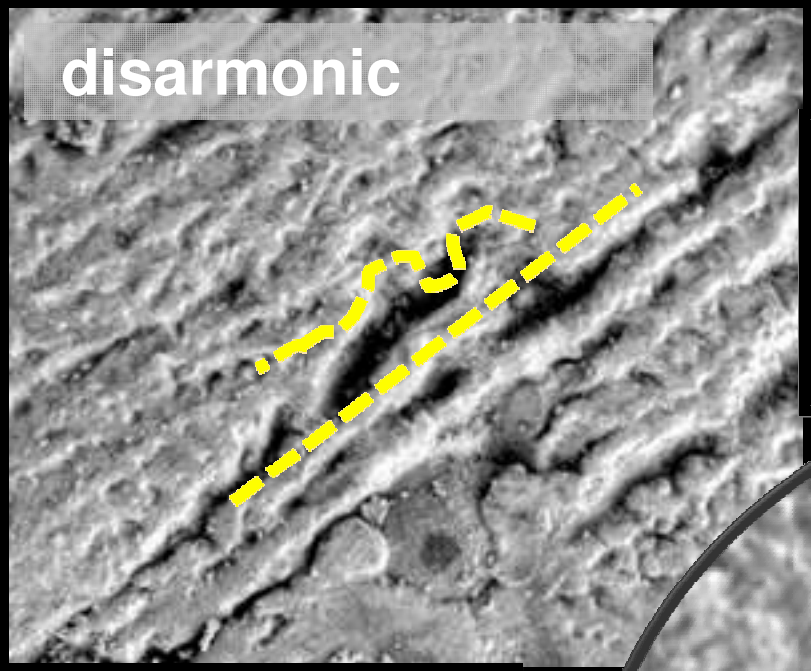


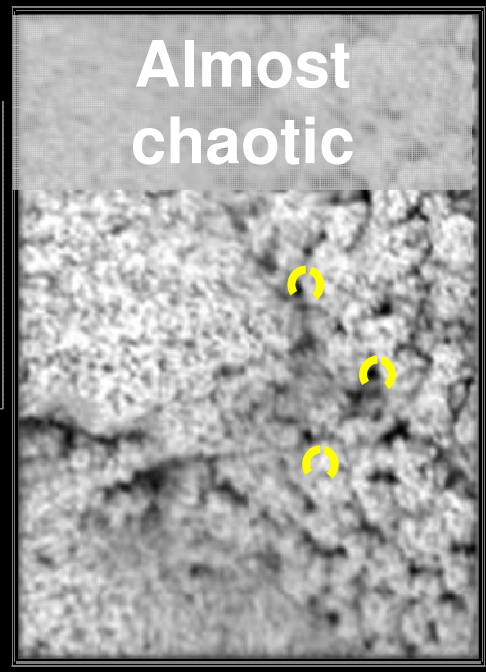
LB- type lamina

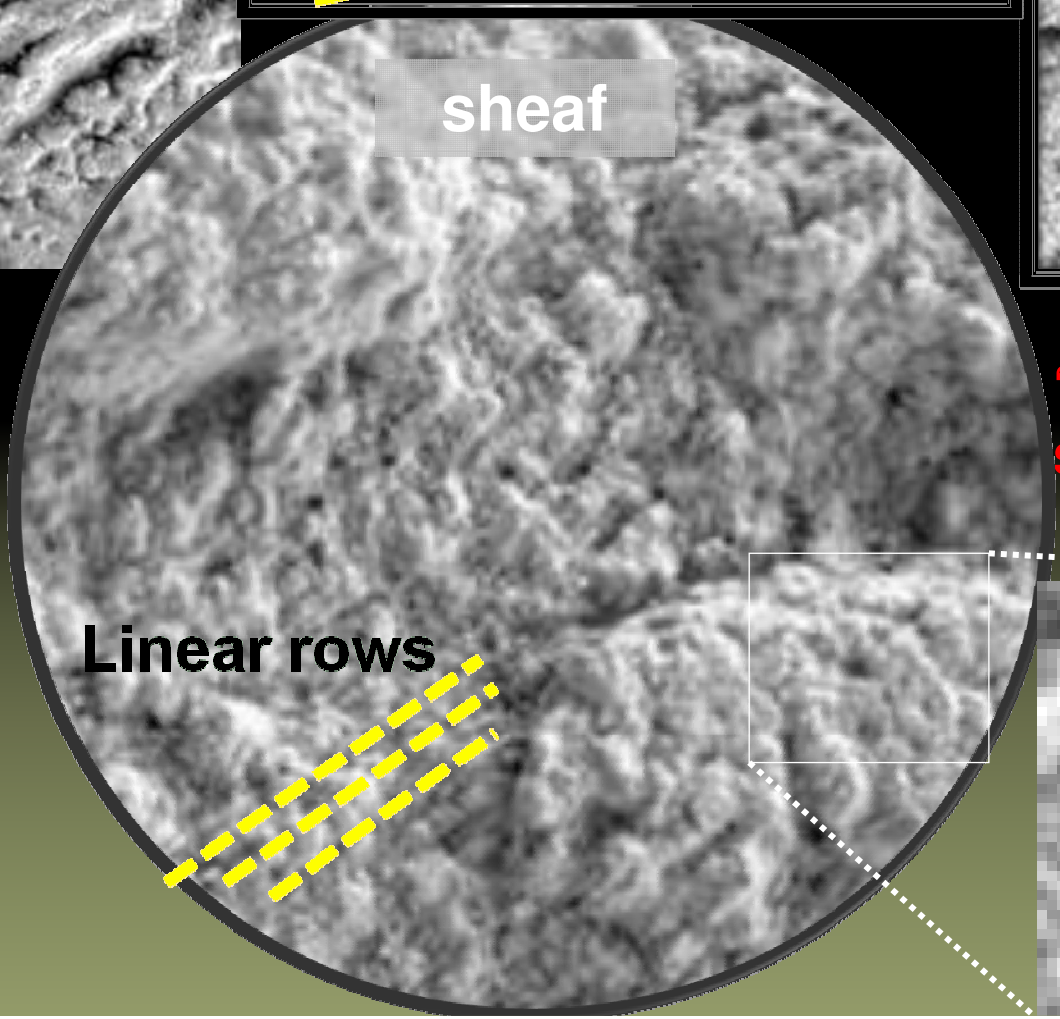


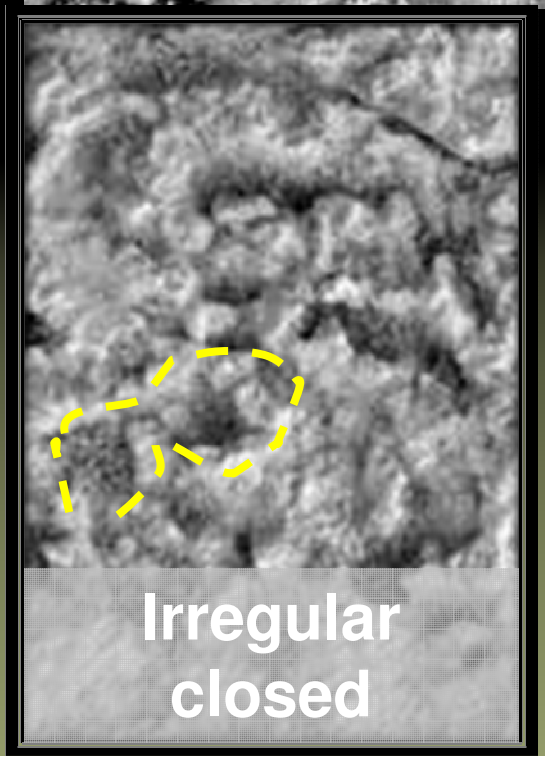
After accretion they assume a "rosette" shape

L - "SB" could also be assembled in different "linear rows"

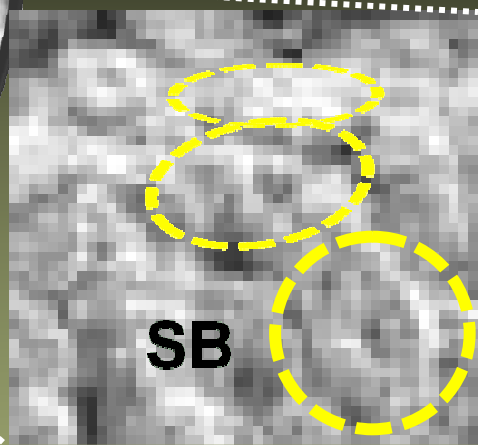




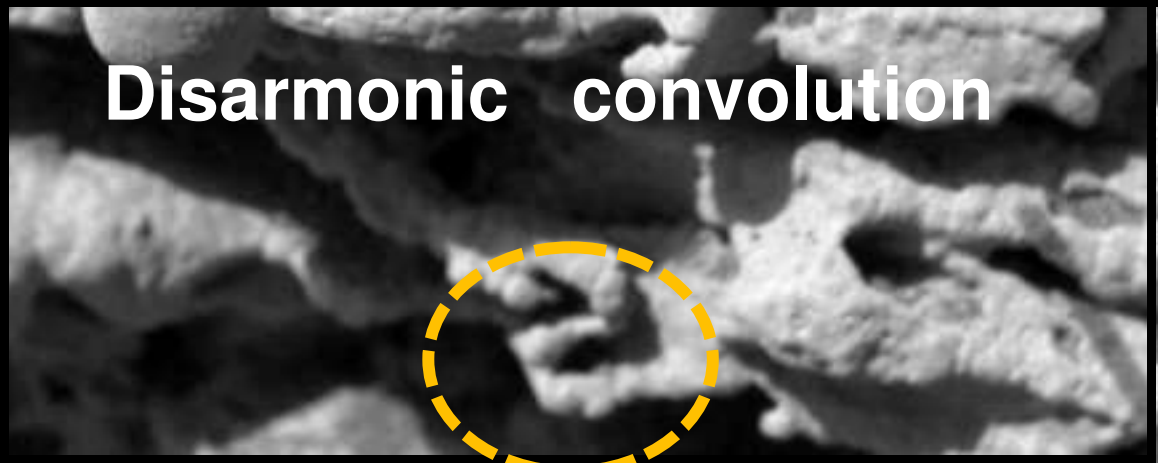


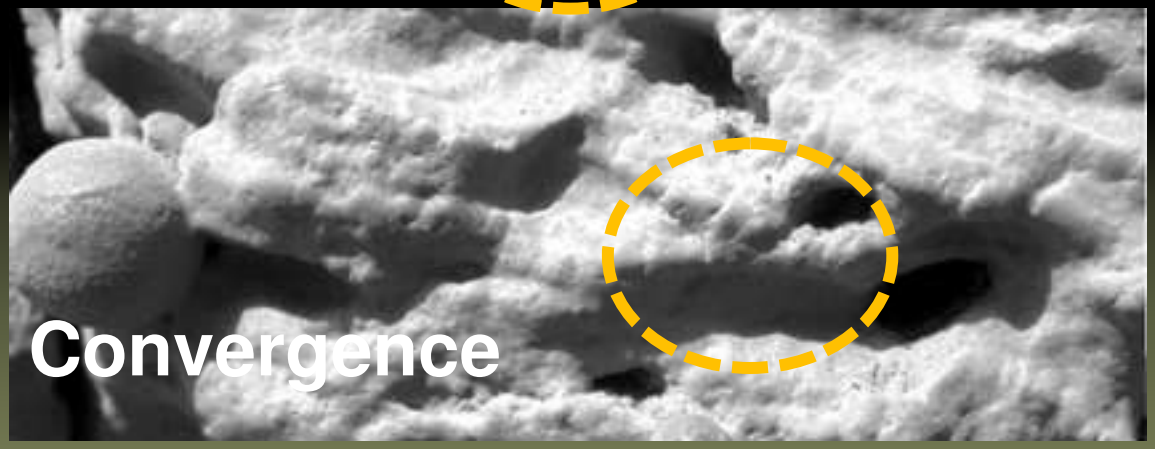


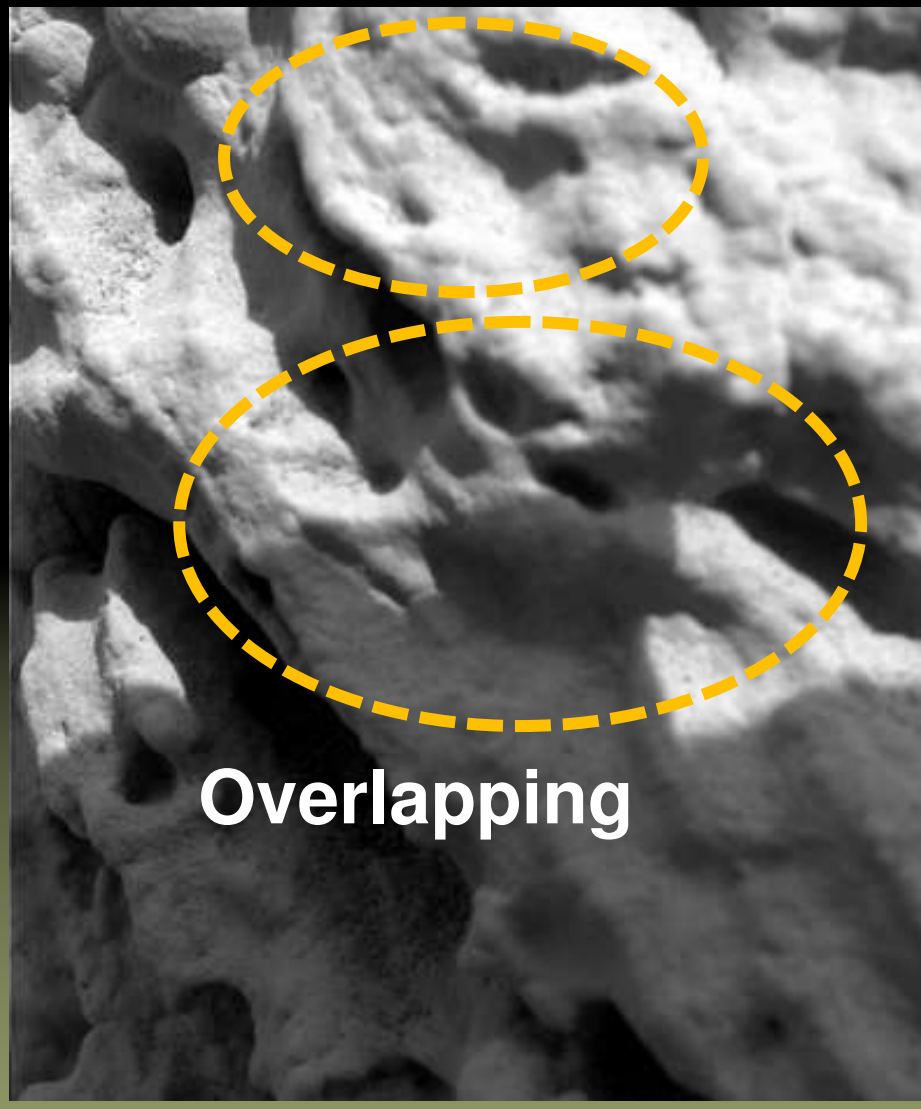
"SB Linear rows" structures



L – Laminae and rows show irregular settings[12]



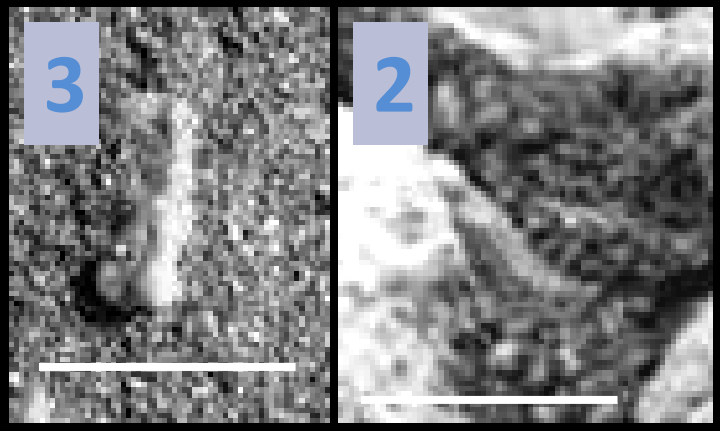


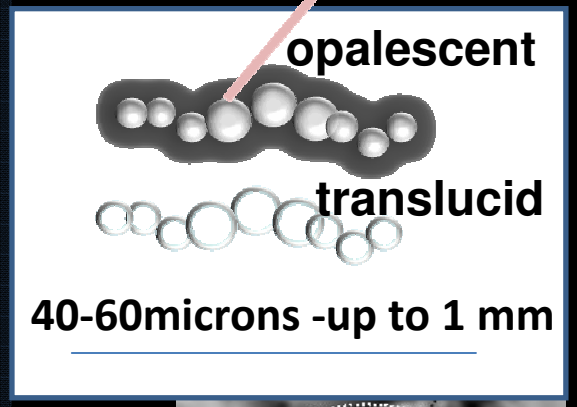


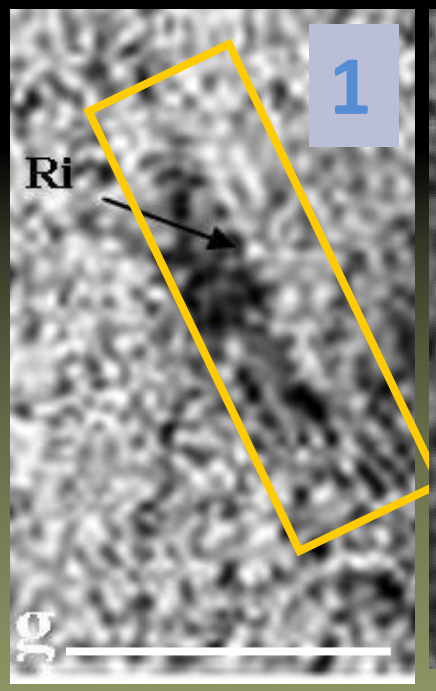
L - Filaments of coalescing microspherules "Ri"[13]

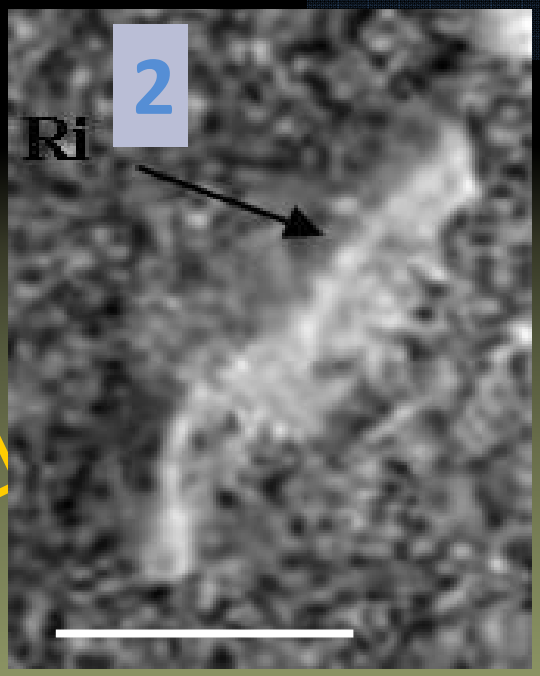
"filaments of coalescing microspherules" type structure having different Transparencies and arrays:

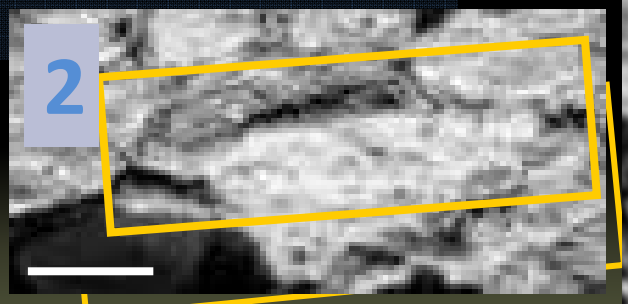
1) Linear
2) Serpentiform
3) Gradually enlarging
4) Spiralled
5) Globular or casual

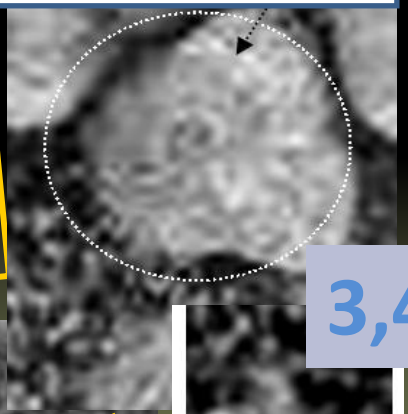


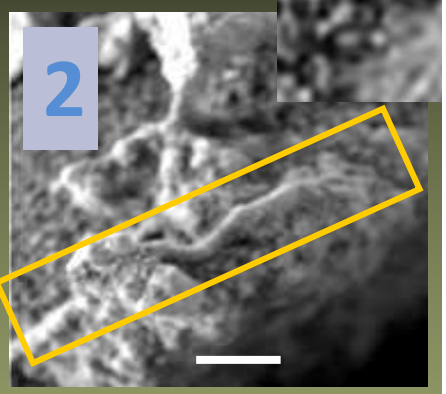


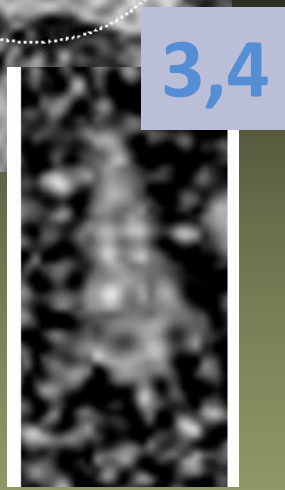




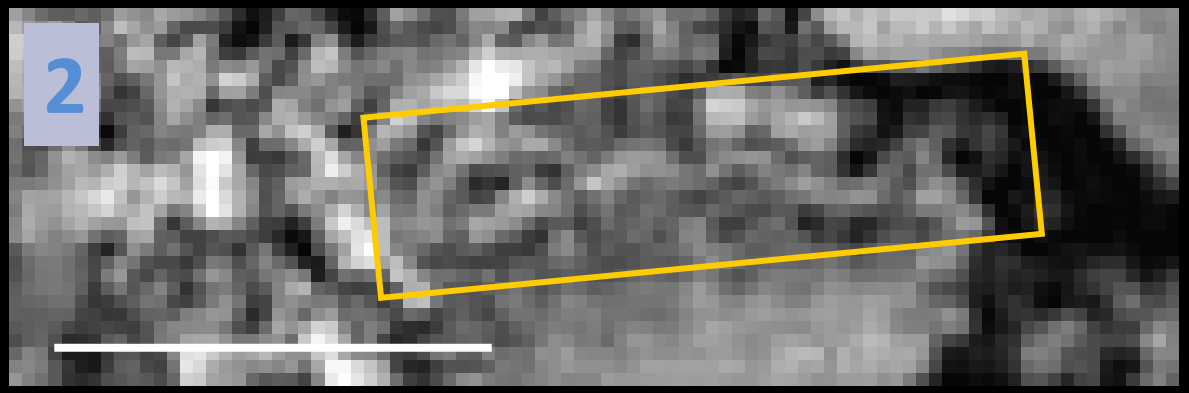


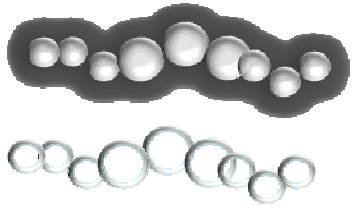




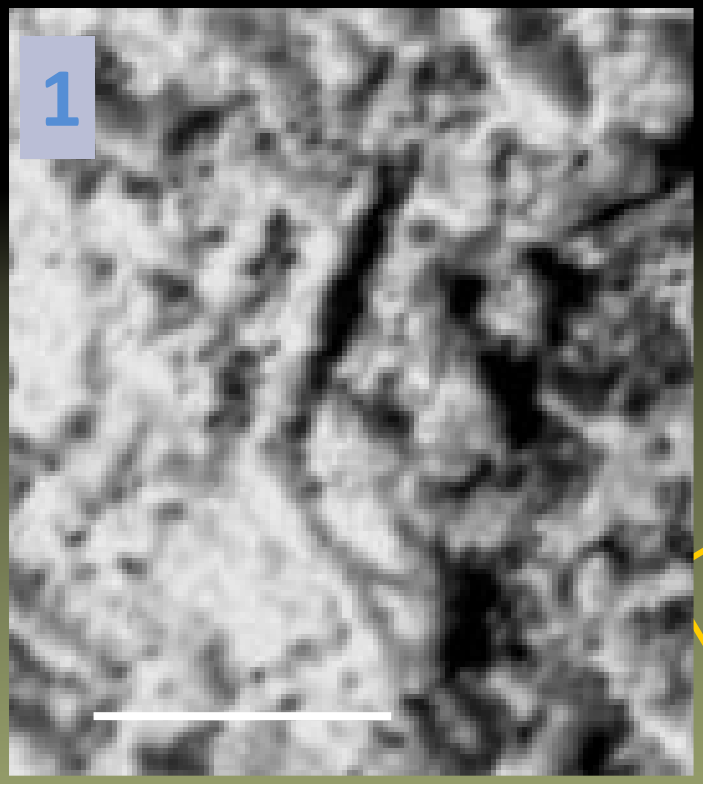


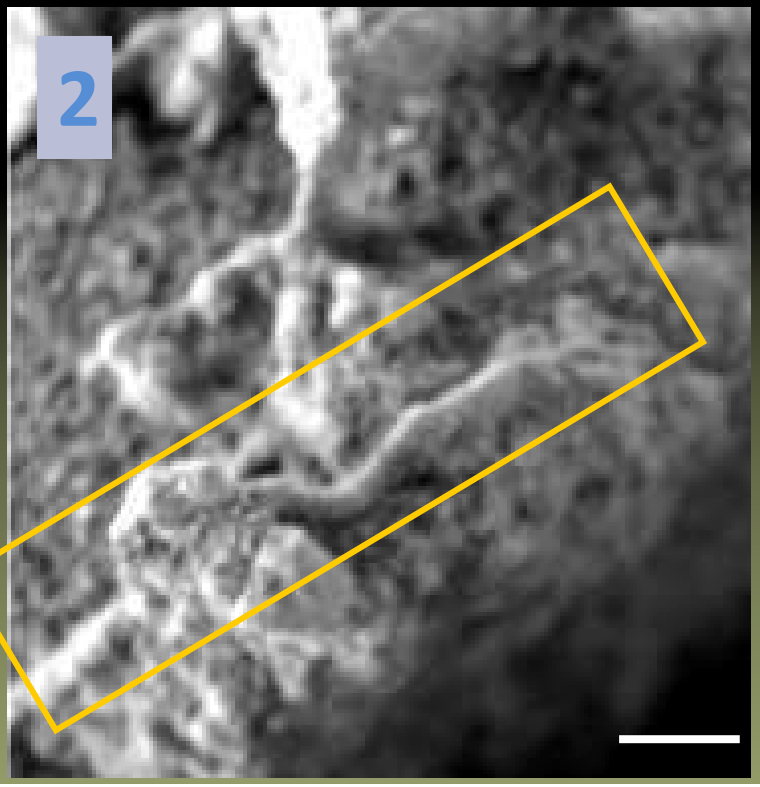
L - Filaments of coalescing microspherules “Ri”

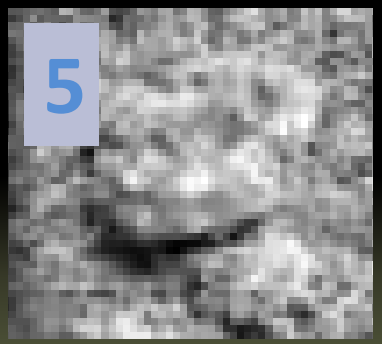




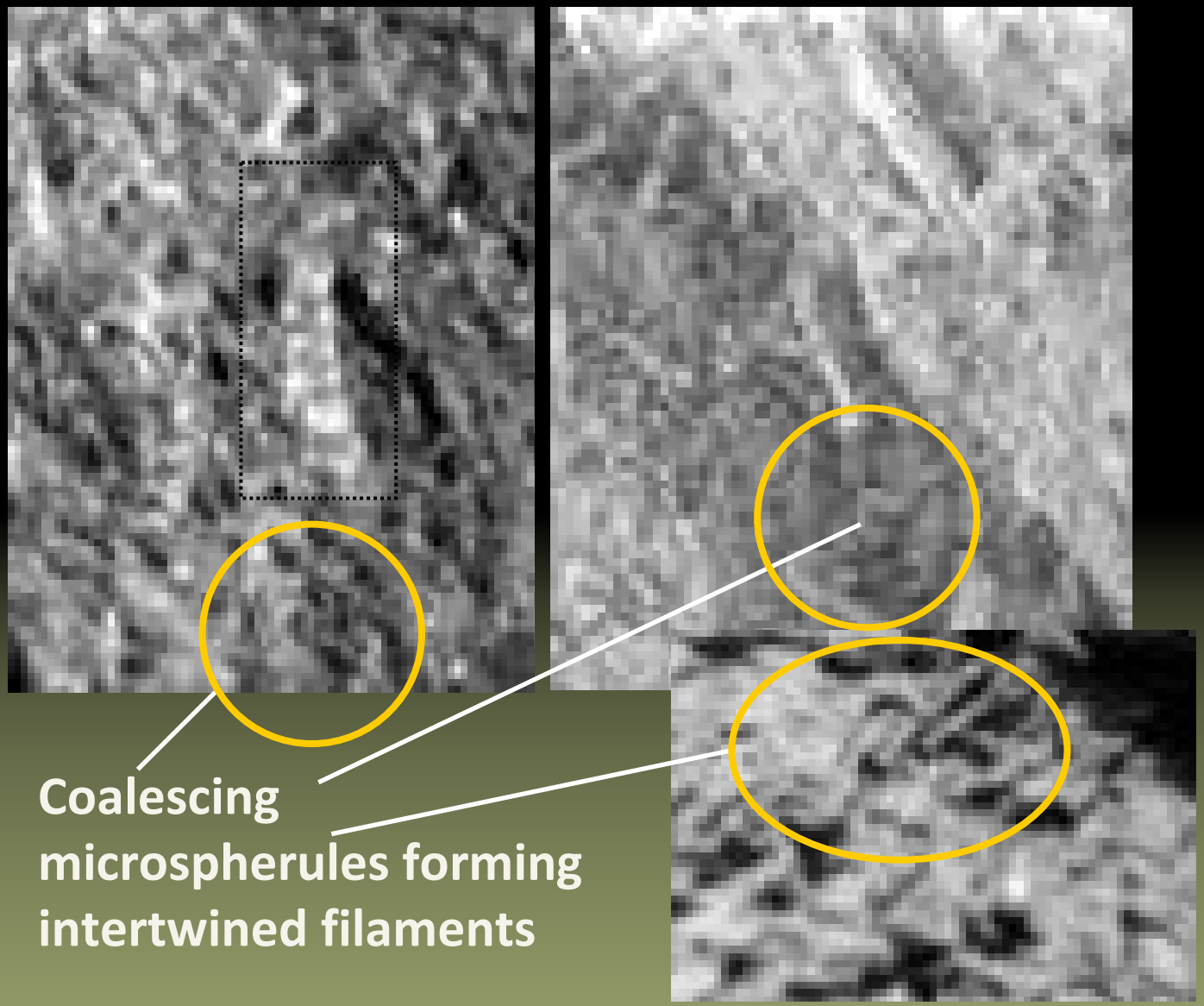
60microns -up to 1 mm





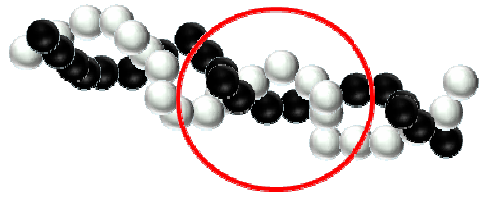


L - Intertwined filaments

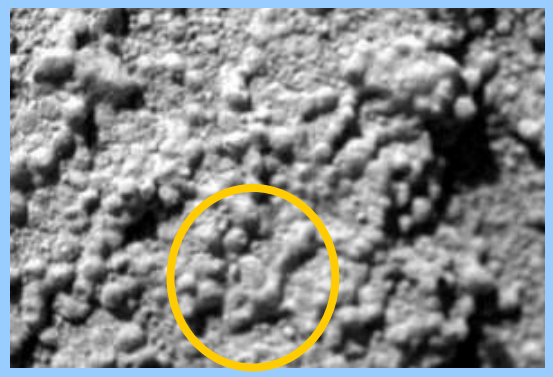


Coalescing microspherules forming intertwined filaments

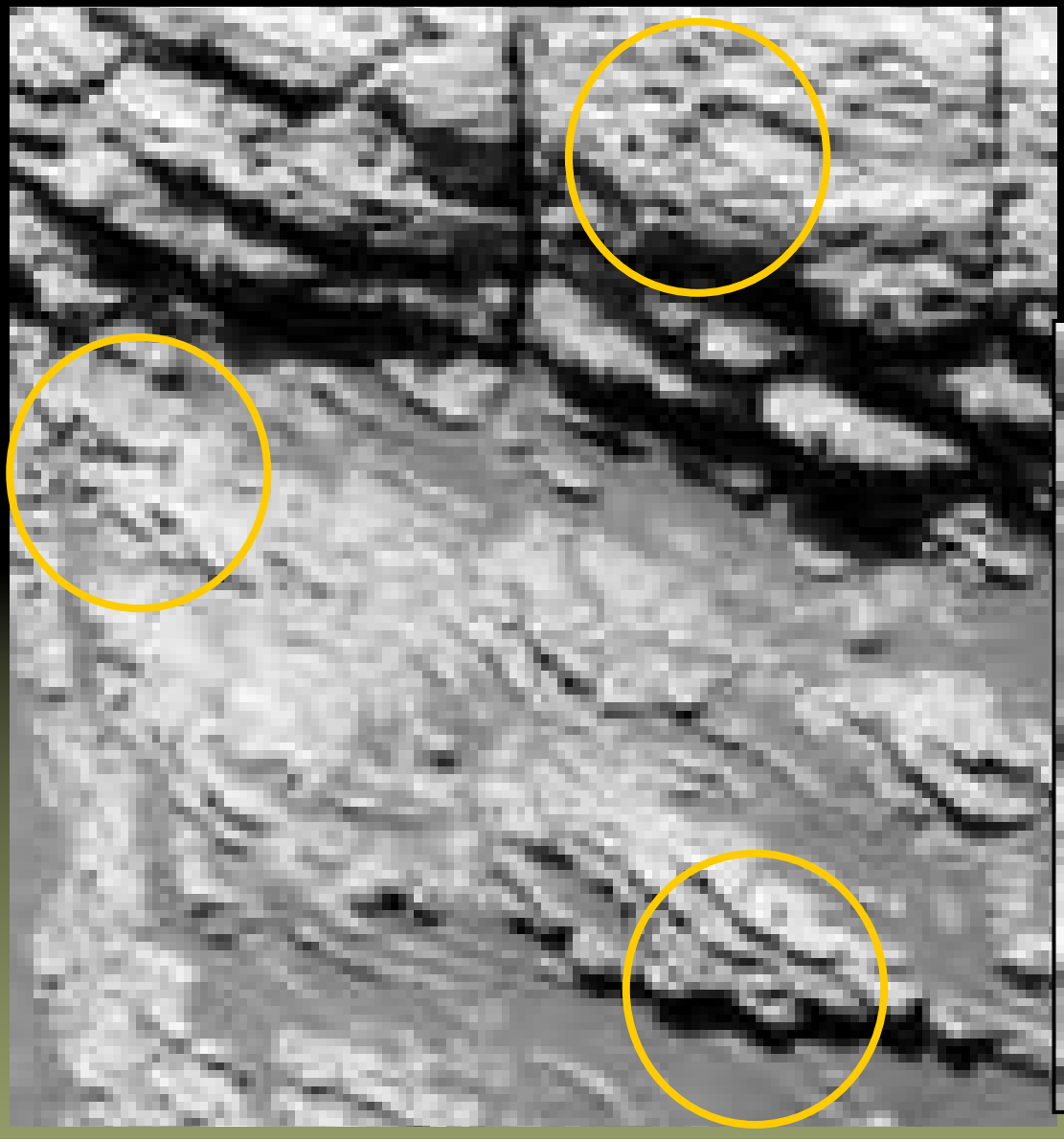
"Intertwined filaments" type structure

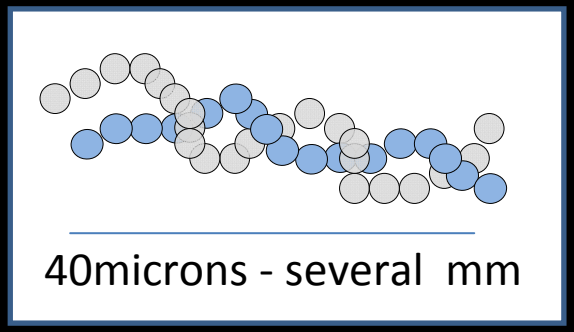


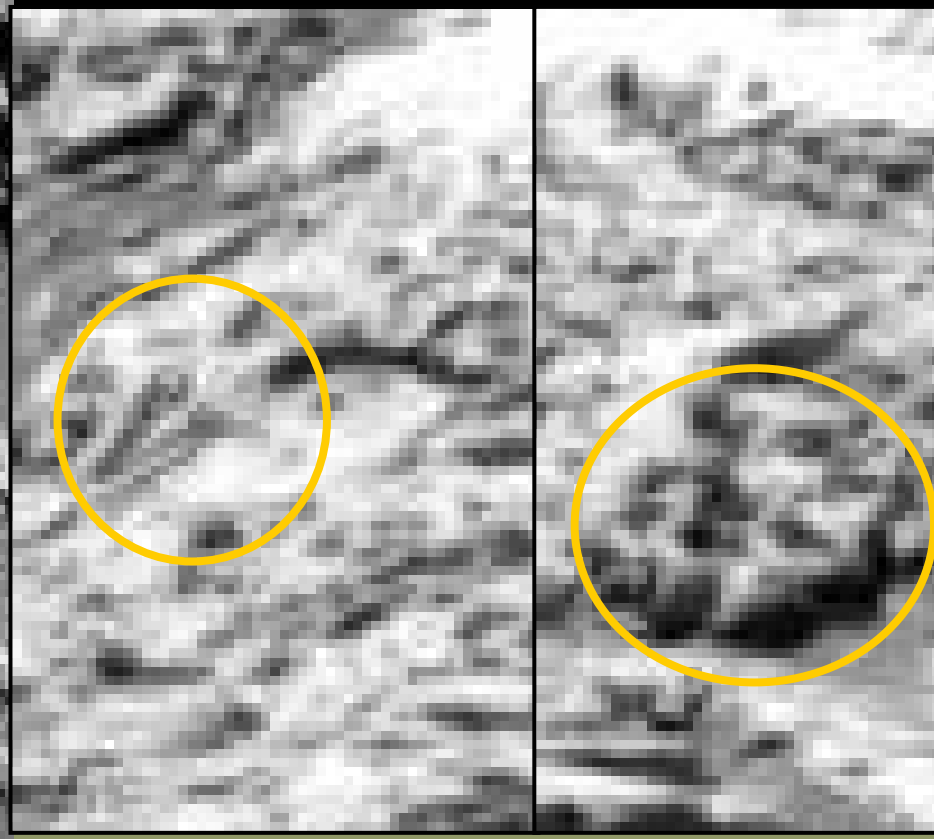
60microns - several mm



L - Twisted and Intertwined filaments

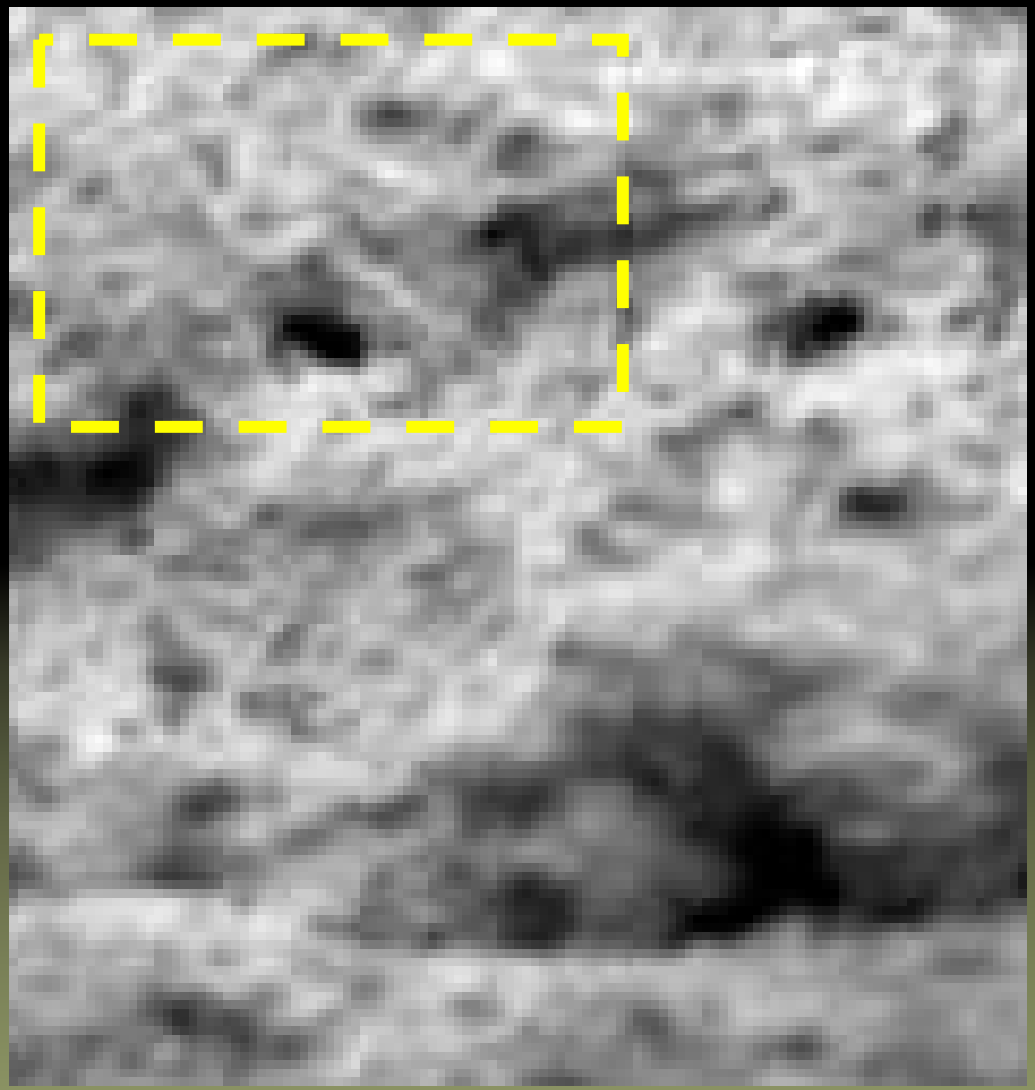




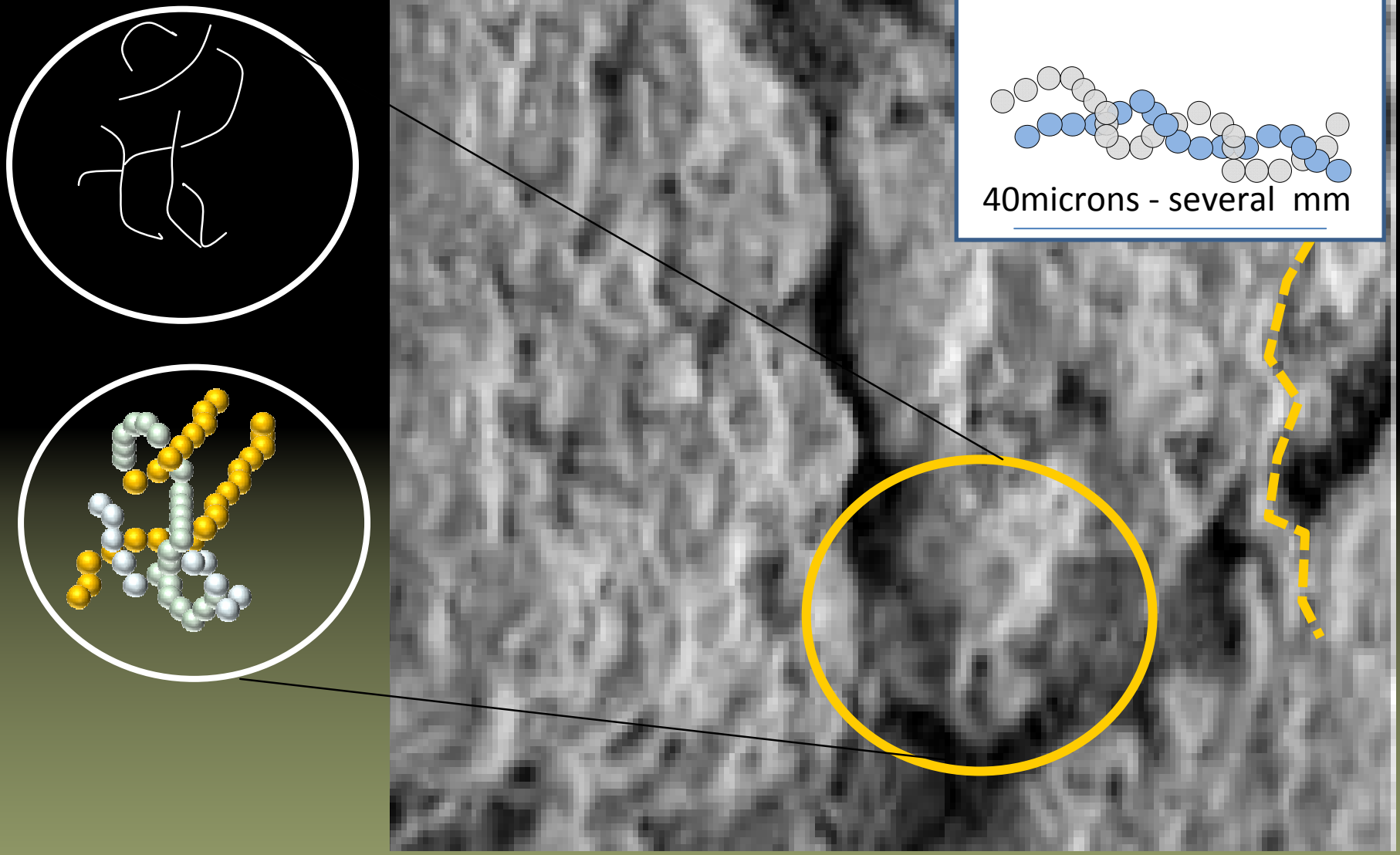


L - Intertwined filaments

Two clear examples

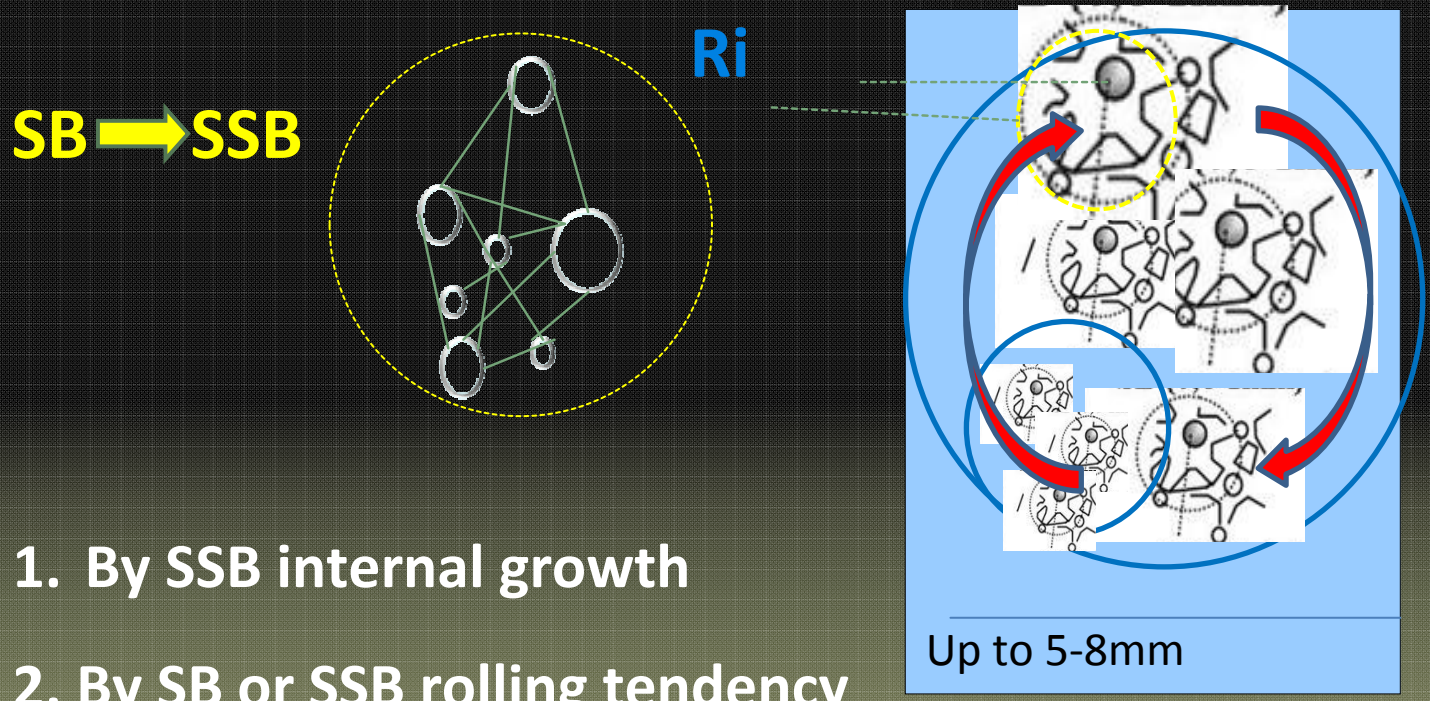


L - Intertwined filaments



B – Spatial polycentric structures of microspherules

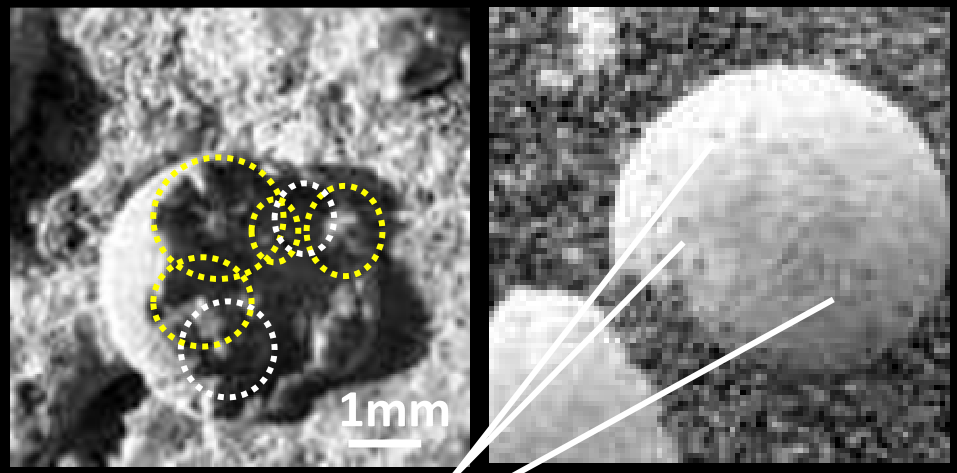
A "Spatial-polycentric SSB" type structure denoting two different processes:

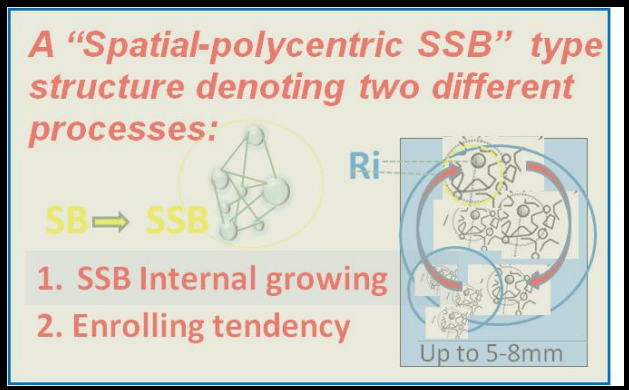


1. **By SSB internal growth**
2. **By SB or SSB rolling tendency**

B – Spatial polycentric structures of microspherules

Irregular SSB setting

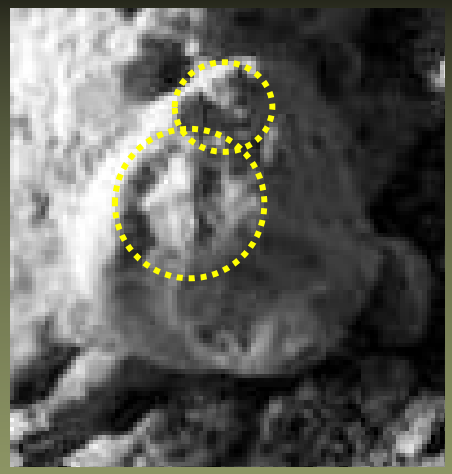


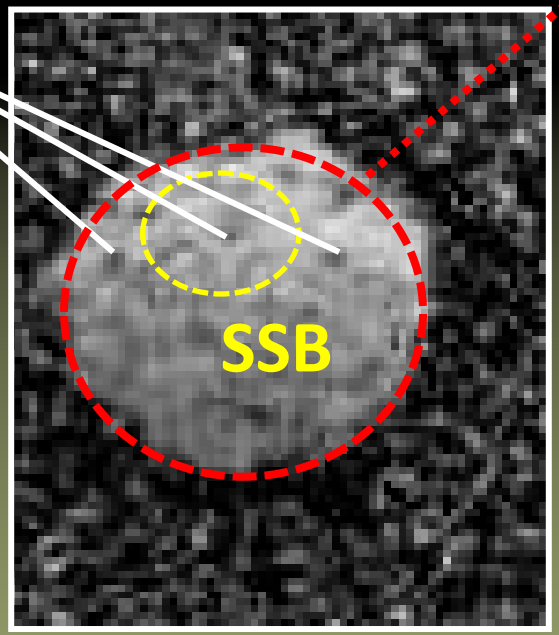


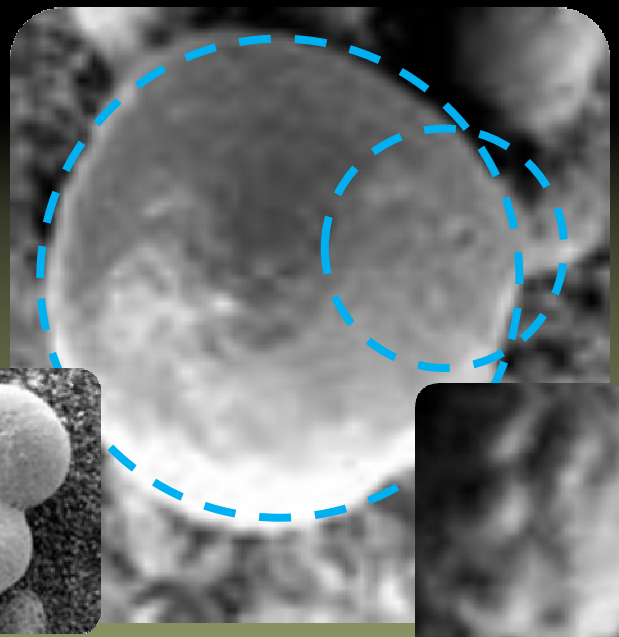
Ri

Blueberry

Polyispherules



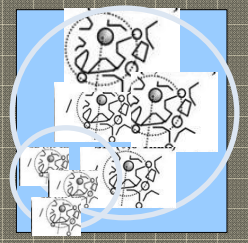


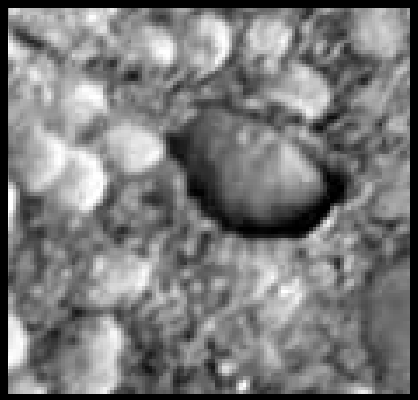


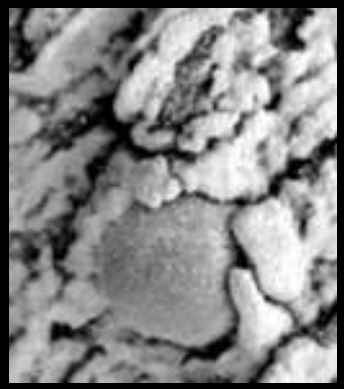
B - Spatial polycentric structures of microspherules

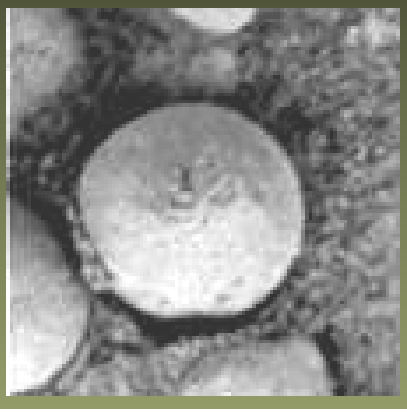
1 By SSB Internal growth

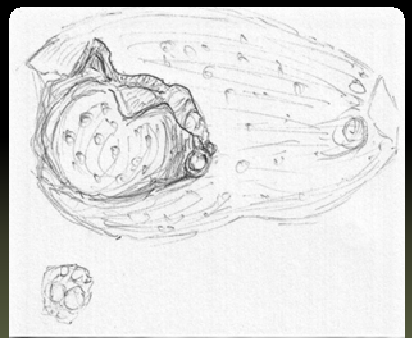
"Spatial-policentric" type structure denoting two kind of devepoment processes

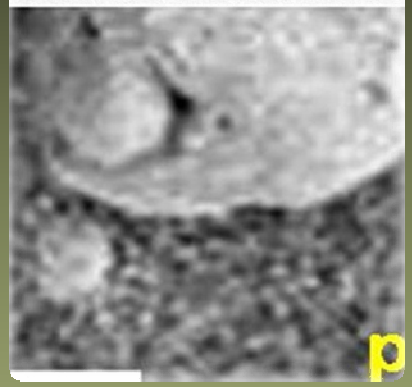




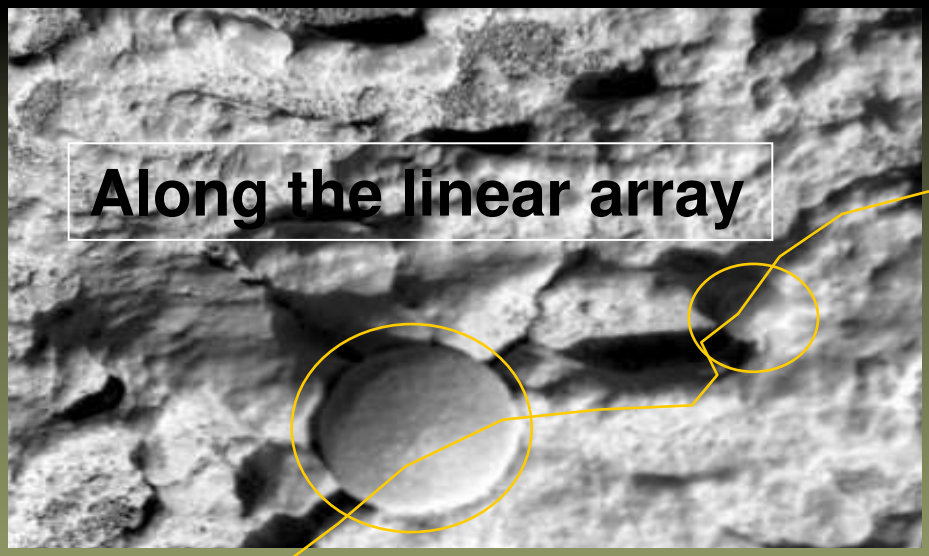








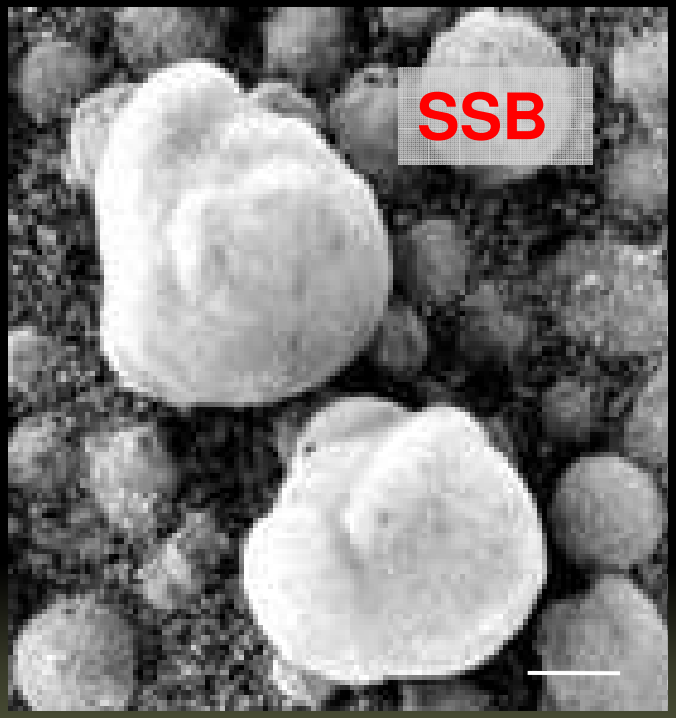
at the end of linear array



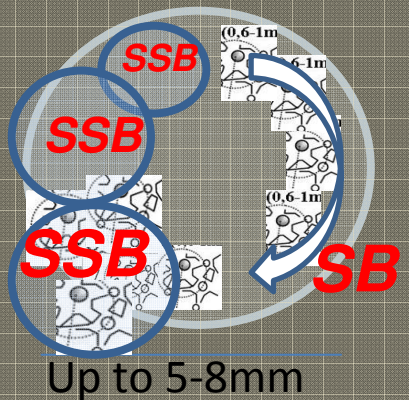
Along the linear array

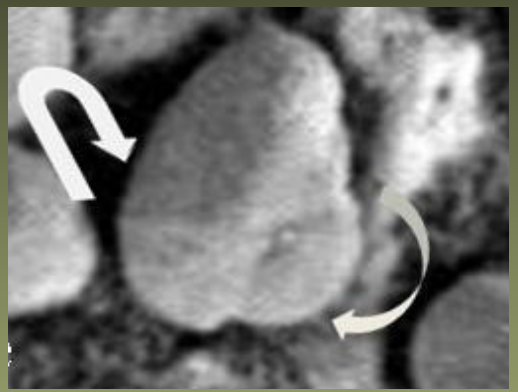
B - Spatial polycentric structures of microspherules

2 **By SB or SSB rolling tendency**

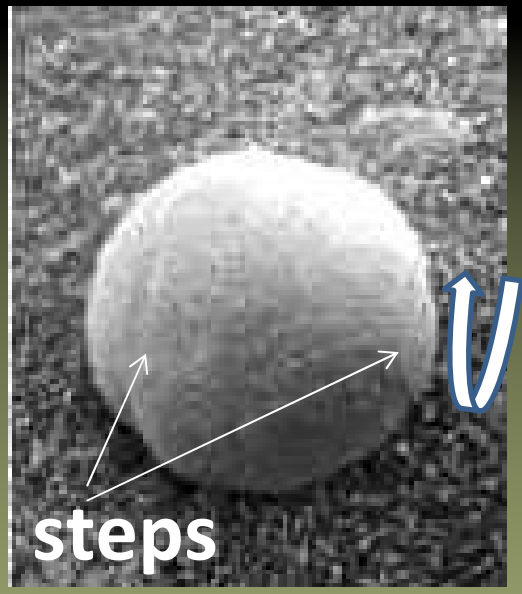


"Spatial-policentric" type structure denoting two kind of devepoment processes

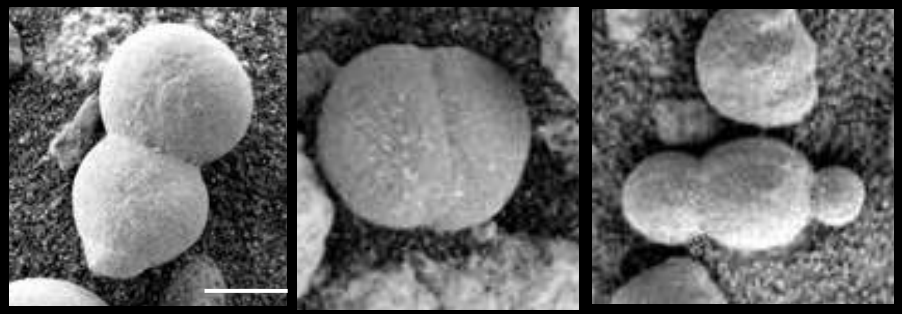




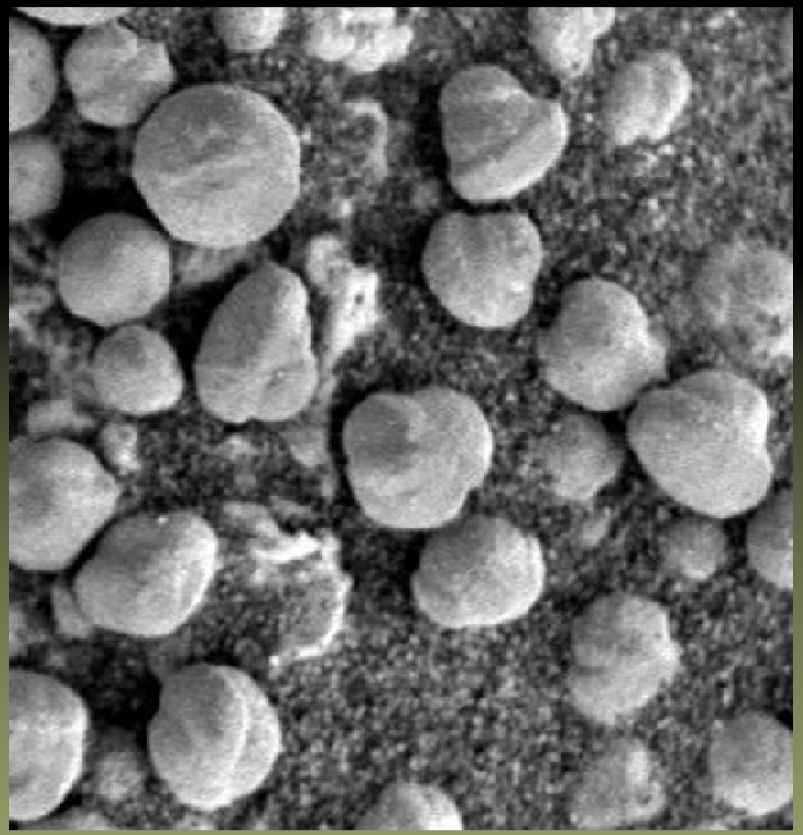
SB

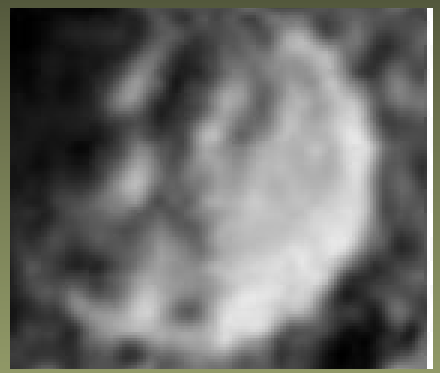


B – Complex structure and complex morphology

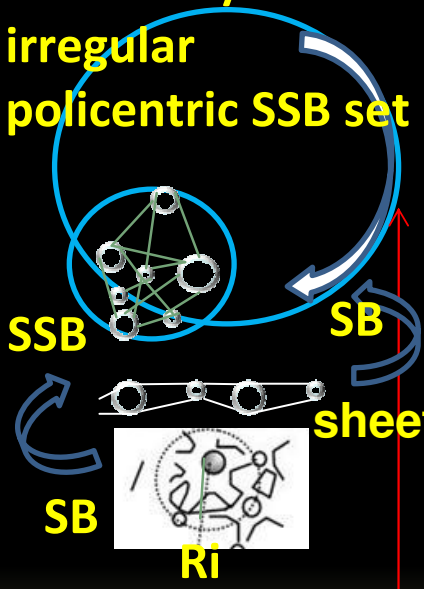


Morphology reflects internal structure





Irregular rolled SB-sheet and/or irregular policentric SSB set



From planar to spatial arrays…..
From Microspherules to Blueberries

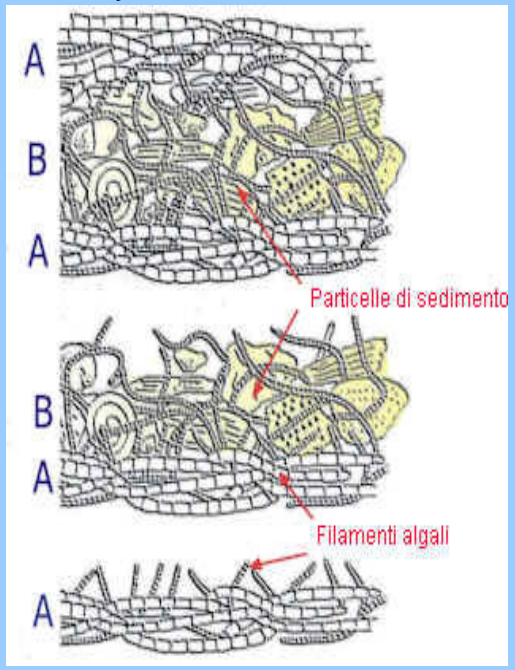
Terrestrial stromatolites

A sequence of a repetitive pair of layers (due to the activity of cianobacteria)

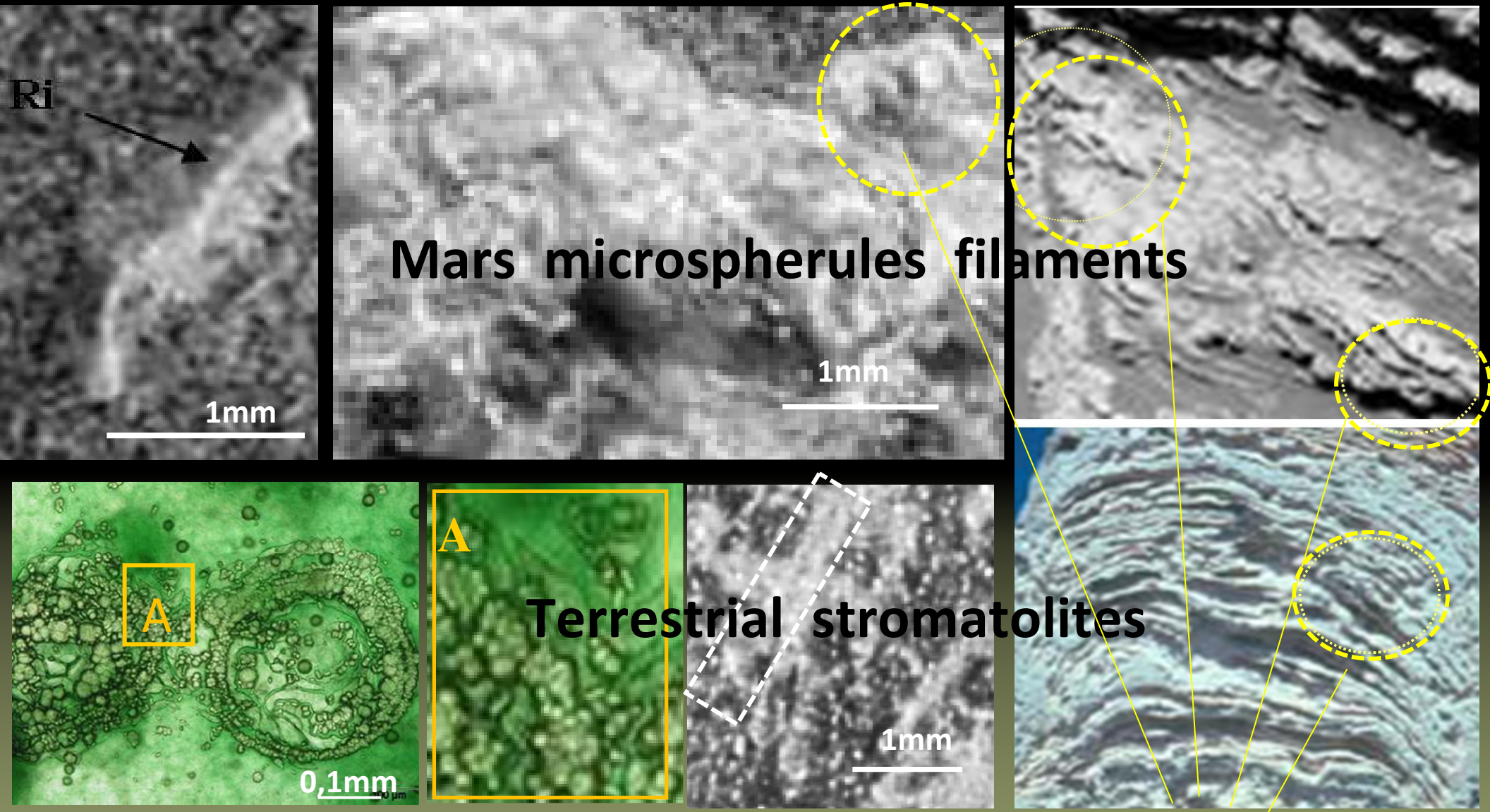
Made by a scheletric lamina (like LA, due to biomineralisation of intertwined spherules filaments)

and by an agglutinated lamina (like LB, made by trapped grain)

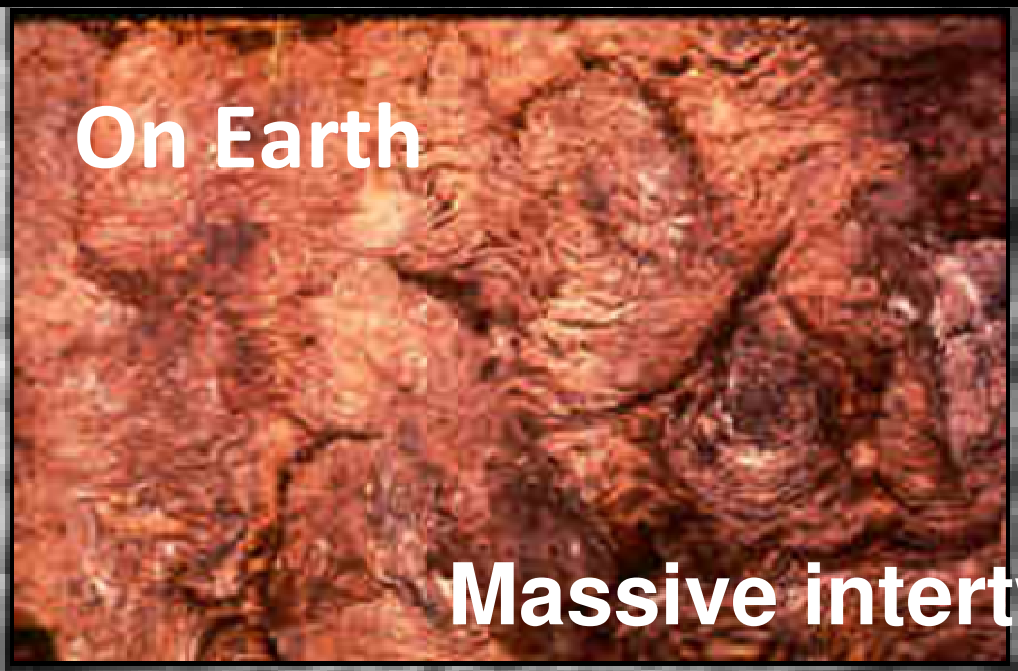
Film exists



Stromatolites: Earth vs Mars



Stromatolites: Earth vs Mars



Massive intertwined structures

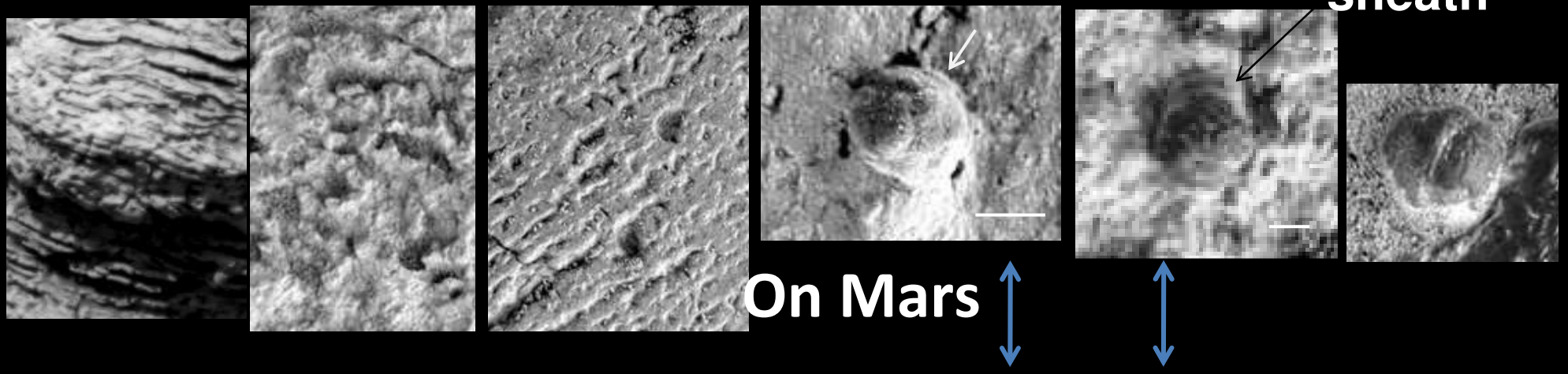
On Mars

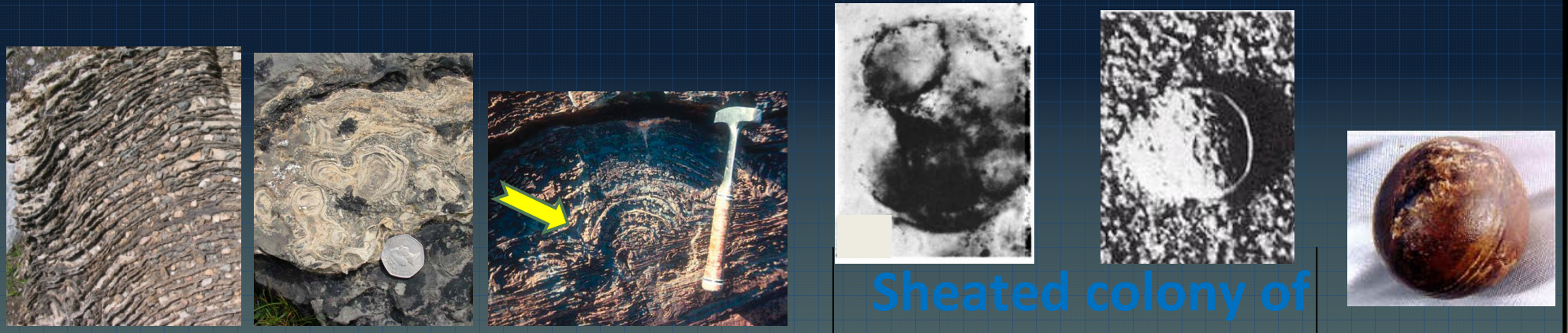
Stromatolites: Earth vs Mars

Stromatolites: Earth vs Mars

Stromatolites: Earth vs Mars

and at different scales



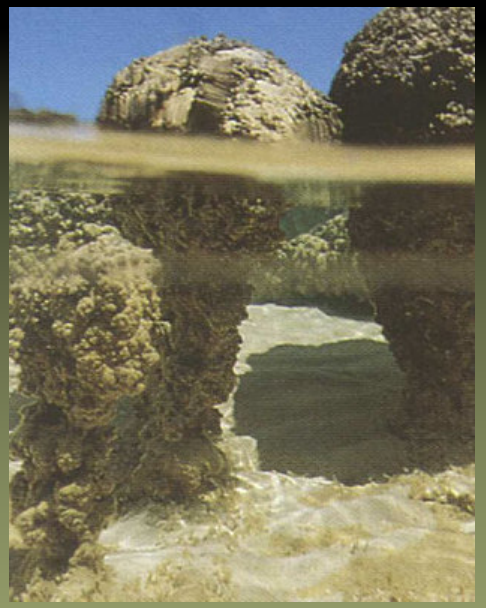


Stromatolites: Earth vs Mars

With parallels at macroscopic scales.....

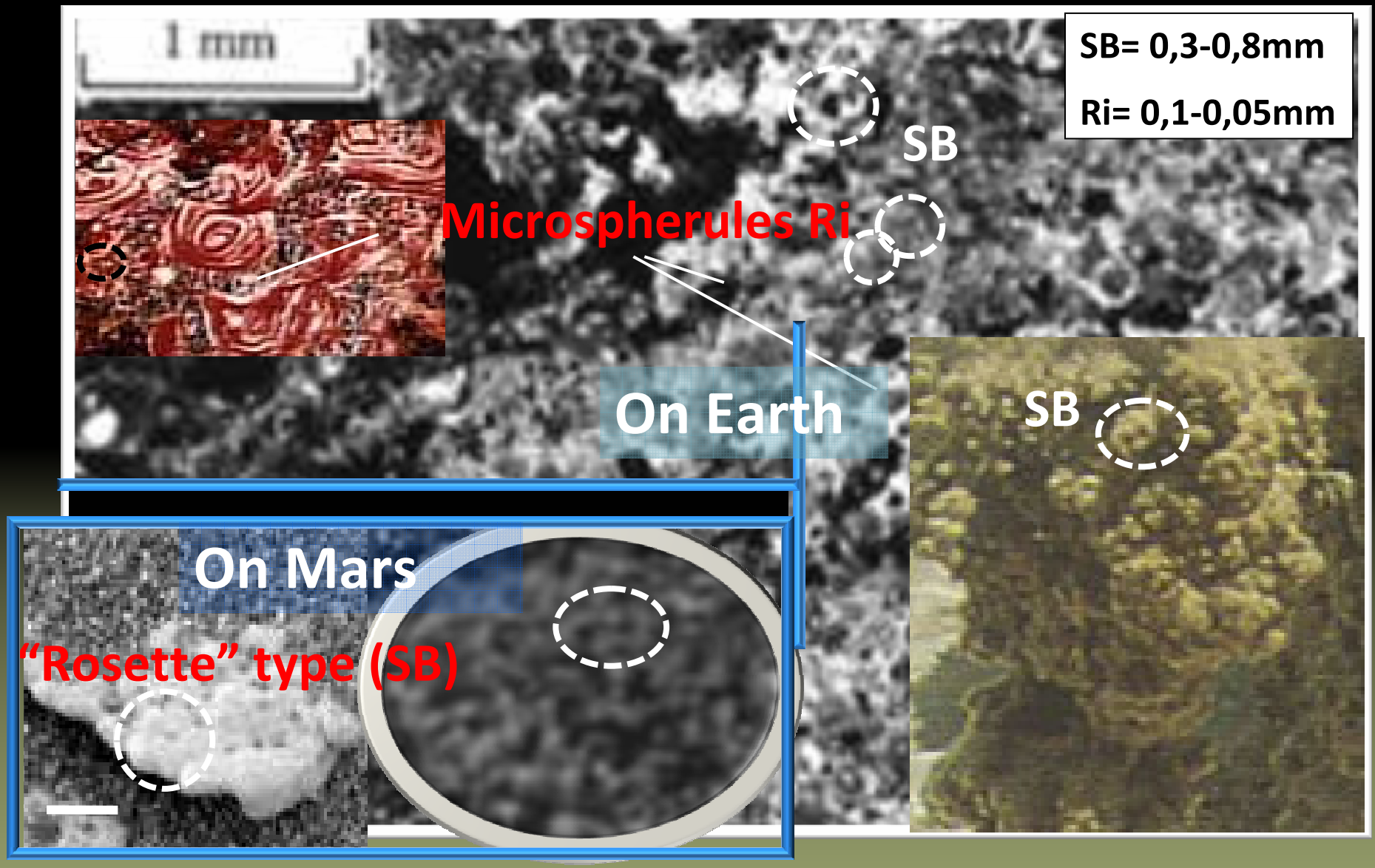
On Mars

On Earth

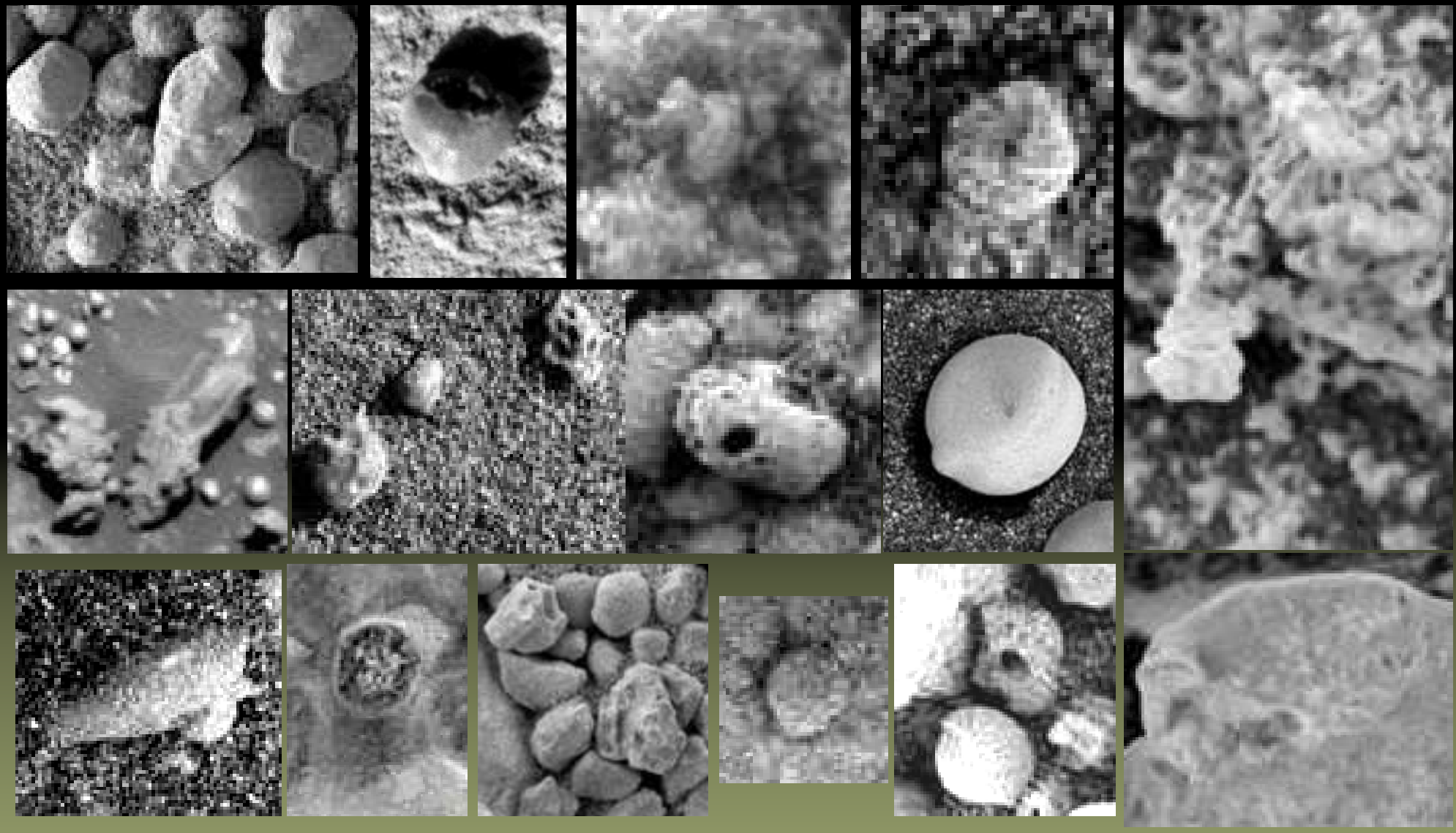


Stromatolites: Earth vs Mars

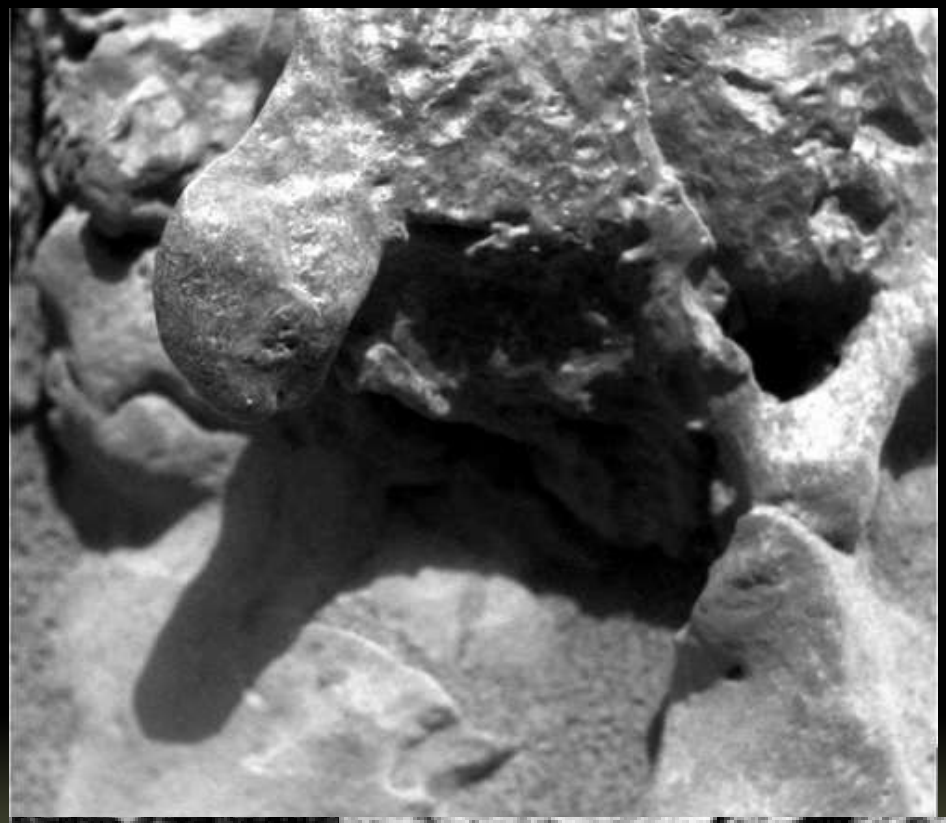
…Wit h parallels at microscopic scale

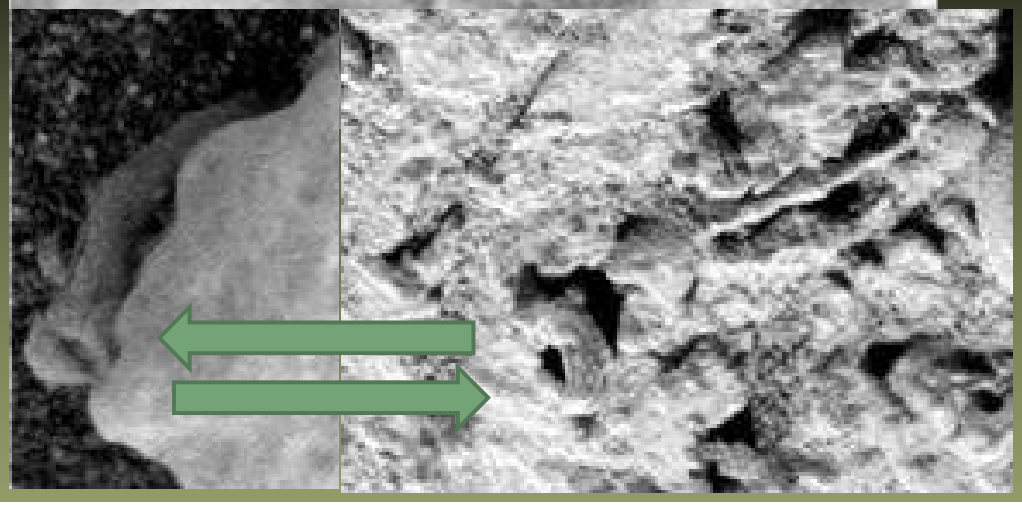


OF: strange findings resembling fossils or others biological structures



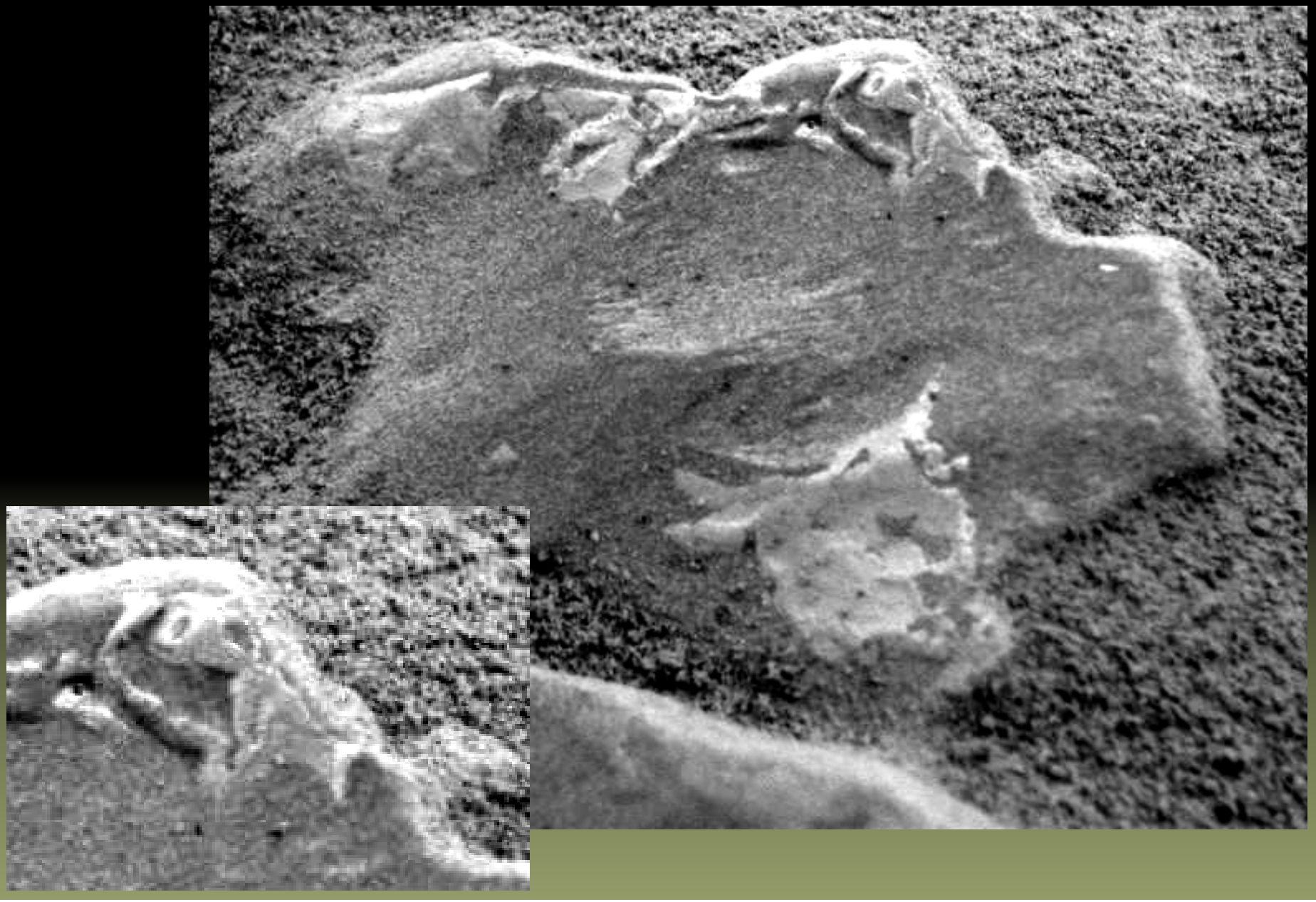
OF: strange findings resembling fossils or others biological structures





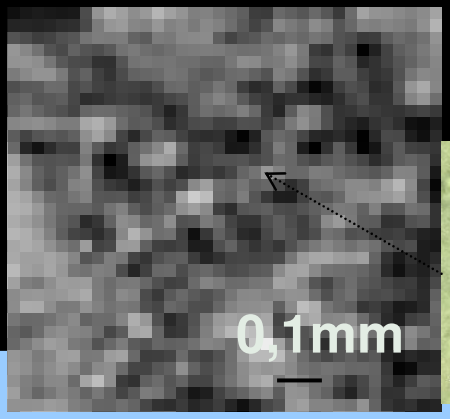
OF: strange findings resembling fossils

(on a meteorite from Mars)



Conclusions

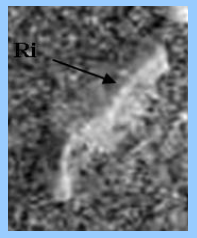
Mars microspherules

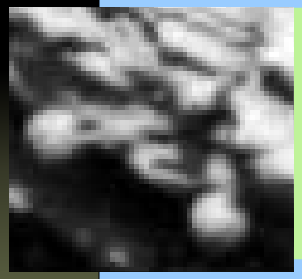


Colony of cianobacteria

Microspherules (we believe to be cianobacteria colonies)

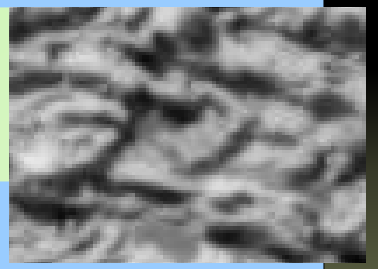
Planar (laminae) or Linear arrays (filaments)



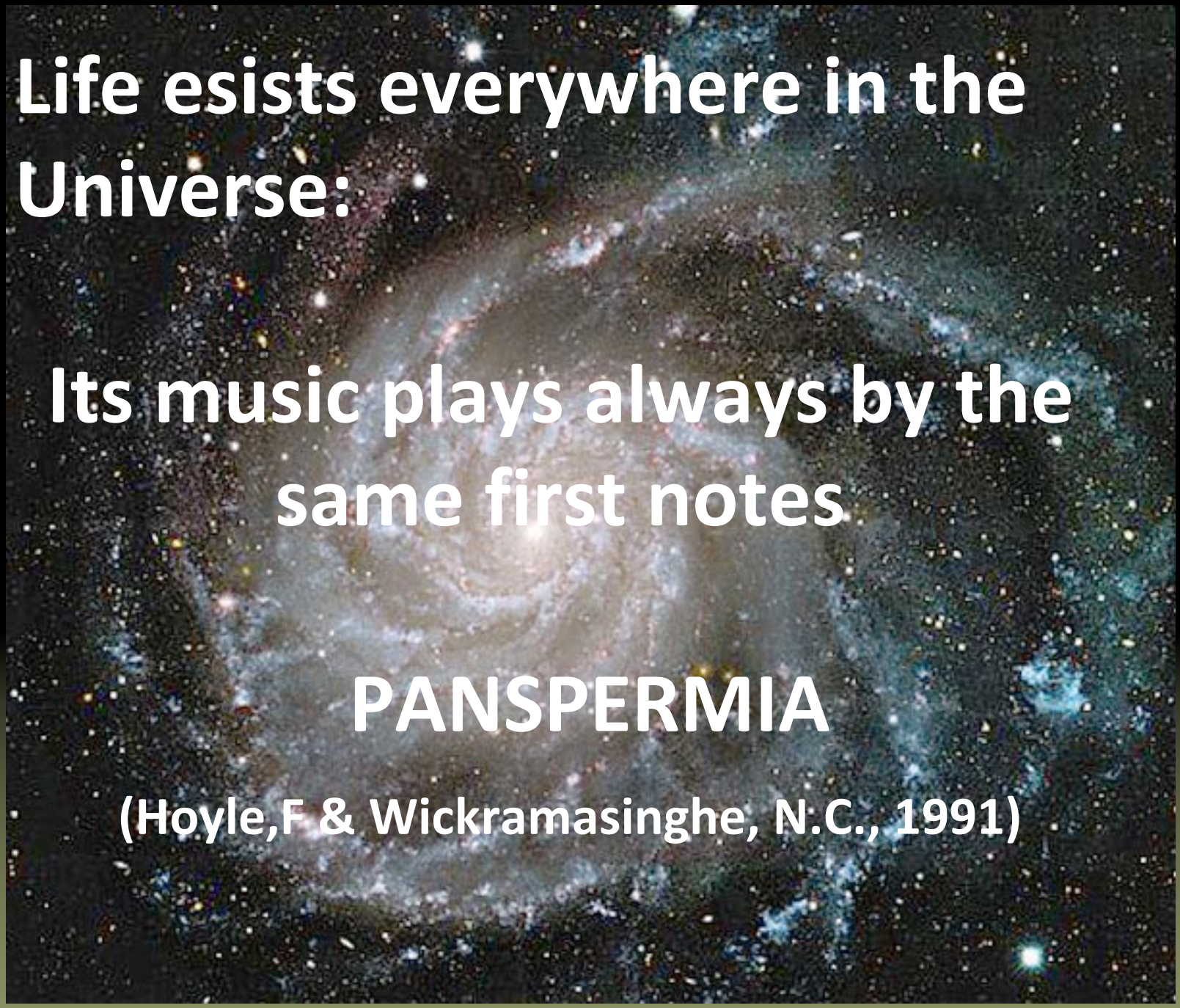


Forming sub-mm laminated sediments and Blueberries

Forming massive Intertwined structures



Very similar to terrestrial


Life esists everywhere in the Universe:
Its music plays always by the same first notes
PANSPERMIA
(Hoyle,F & Wickramasinghe, N.C., 1991)