

**Institut de Physique du
Globe de Paris**
UMR 7154
Comprendre et observer le
système Terre

GEOSPHERE

BIOSPHERE

INTERFACE GEOLOGIE/VIVANT

C. Pisapia

**Equipe Géomicrobiologie – IPGP
B. Ménéz**

geo@bio

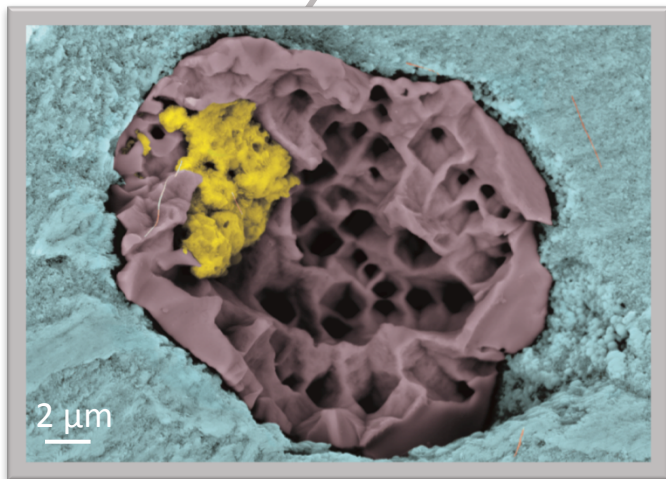
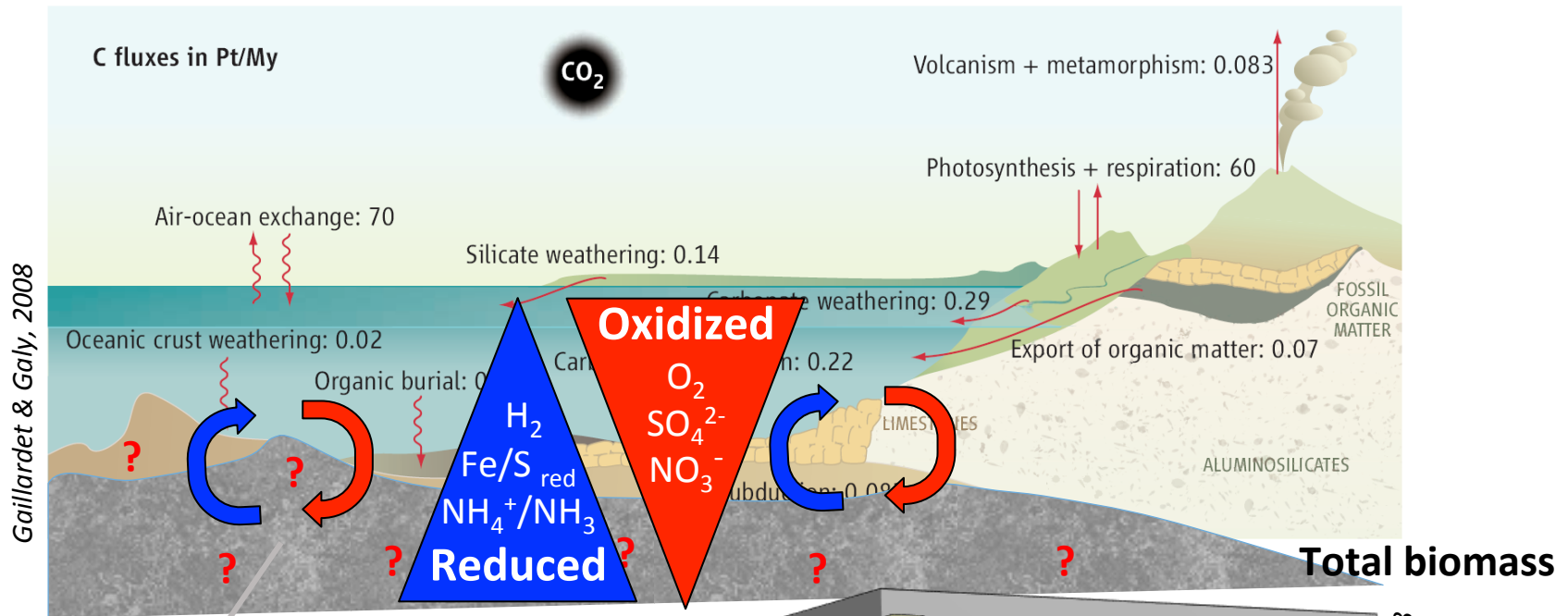
U^S-PC Université Sorbonne
Paris Cité



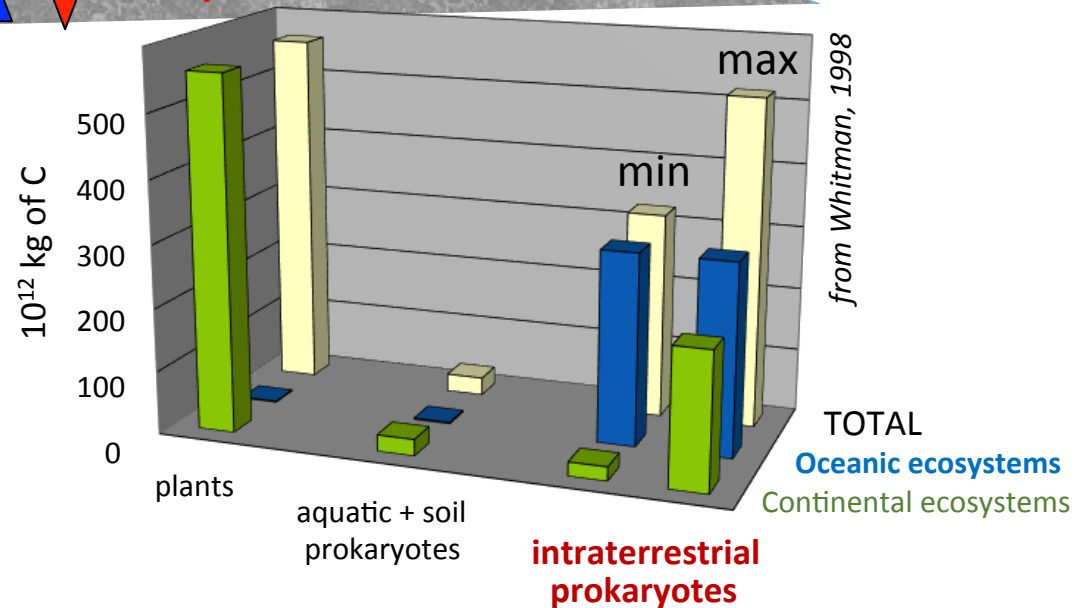
université
**PARIS
DIDEROT**
PARIS 7



Interface Géologie/Vivant à l'échelle du globe

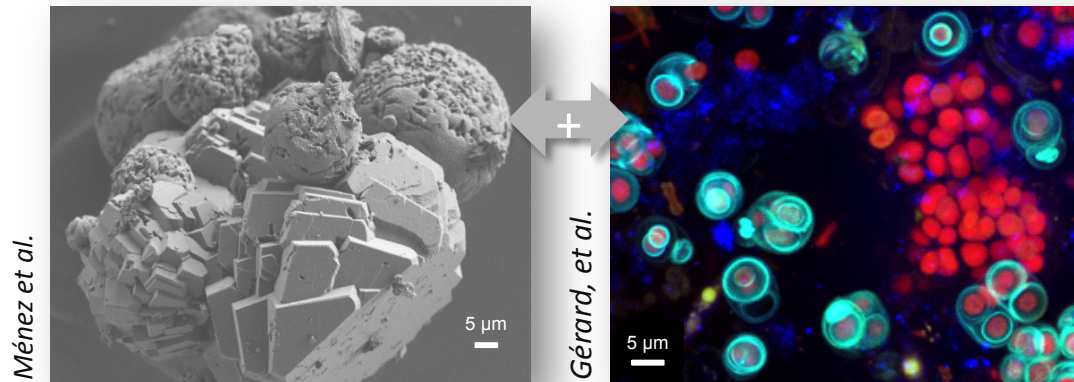


Ménez et al, 2012



Imaging life in rocks @the micrometric level

Mineralogical, genetic and metabolic diversity @ the micrometric level:



The joint characterization at the appropriate scale is mandatory to unravel microbes/minerals interactions , track down traces of microbial life in rocks, characterize their microhabitats and establish new types of biomarkers

Technical and methodological developments:

- @IPGP
 - techniques of molecular biology (OMICS, FISH, immunodetection, ...)
 - electronic microscopy (SEM/TEM)
 - vibrational spectroscopies (Raman, FTIR)
 - *in situ* stable isotopes analysis
- and collaborations
 - Synchrotron μ imaging (μ XRF, XAS, STXM, μ FTIR, SDUV)
 - Tof-SIMS
 - ...

 ***in situ* characterization at high spatial resolution of living and fossil organic matter and biominerals**

Microscope confocal couplé

(Fluorescence/Raman)

Fluorescence

Raman

Lasers Raman :

514 nm

785 nm

Lasers fluorescence :

405 nm

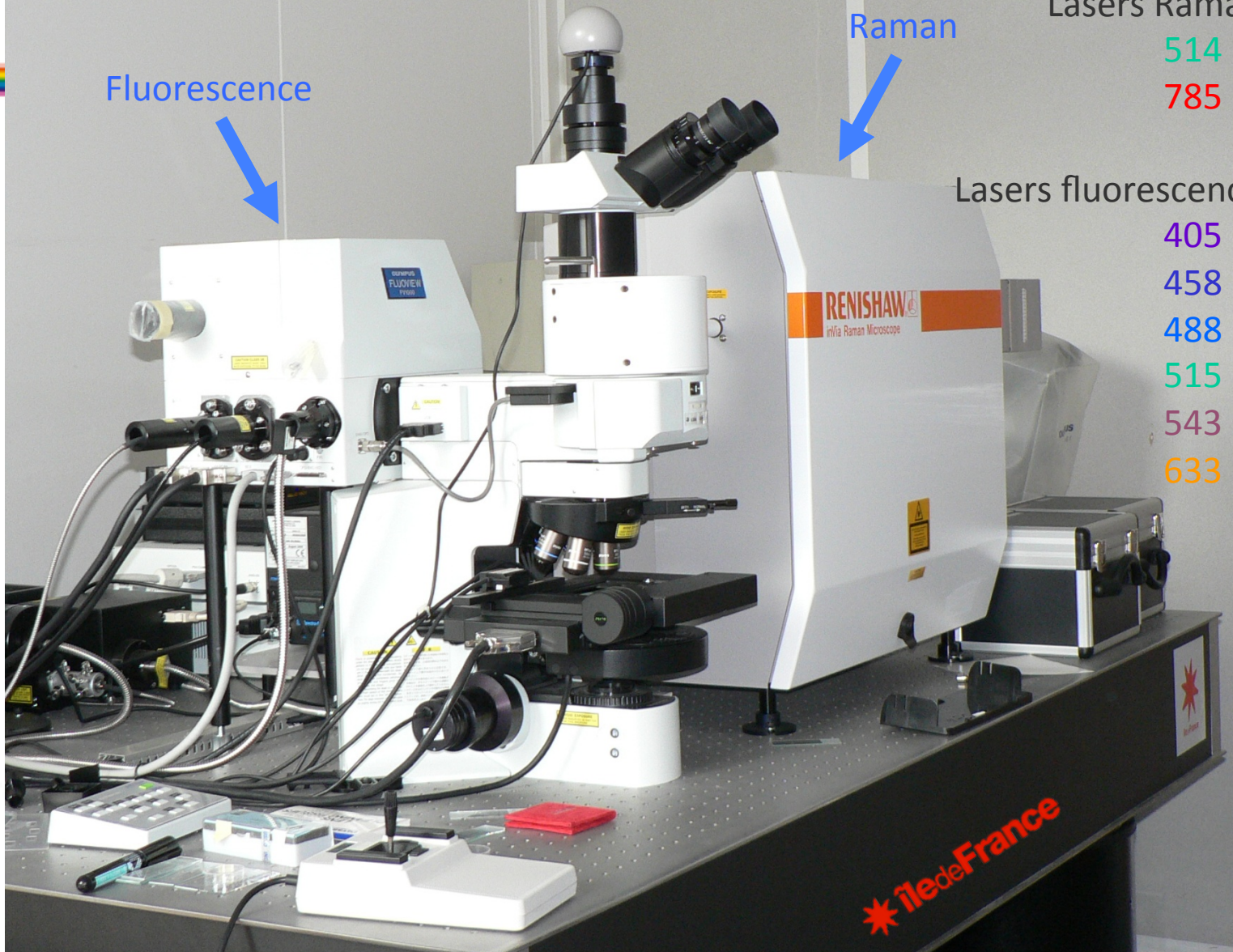
458 nm

488 nm

515 nm

543 nm

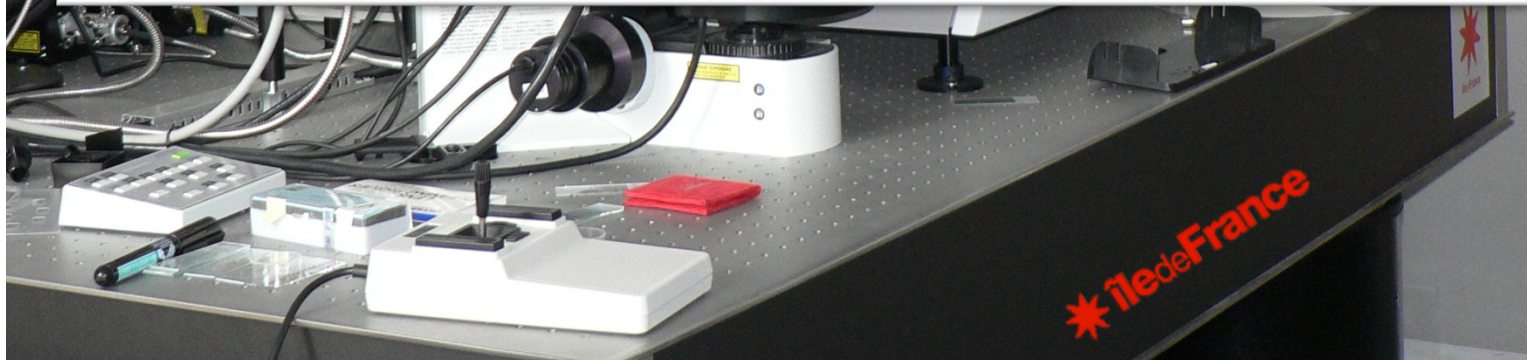
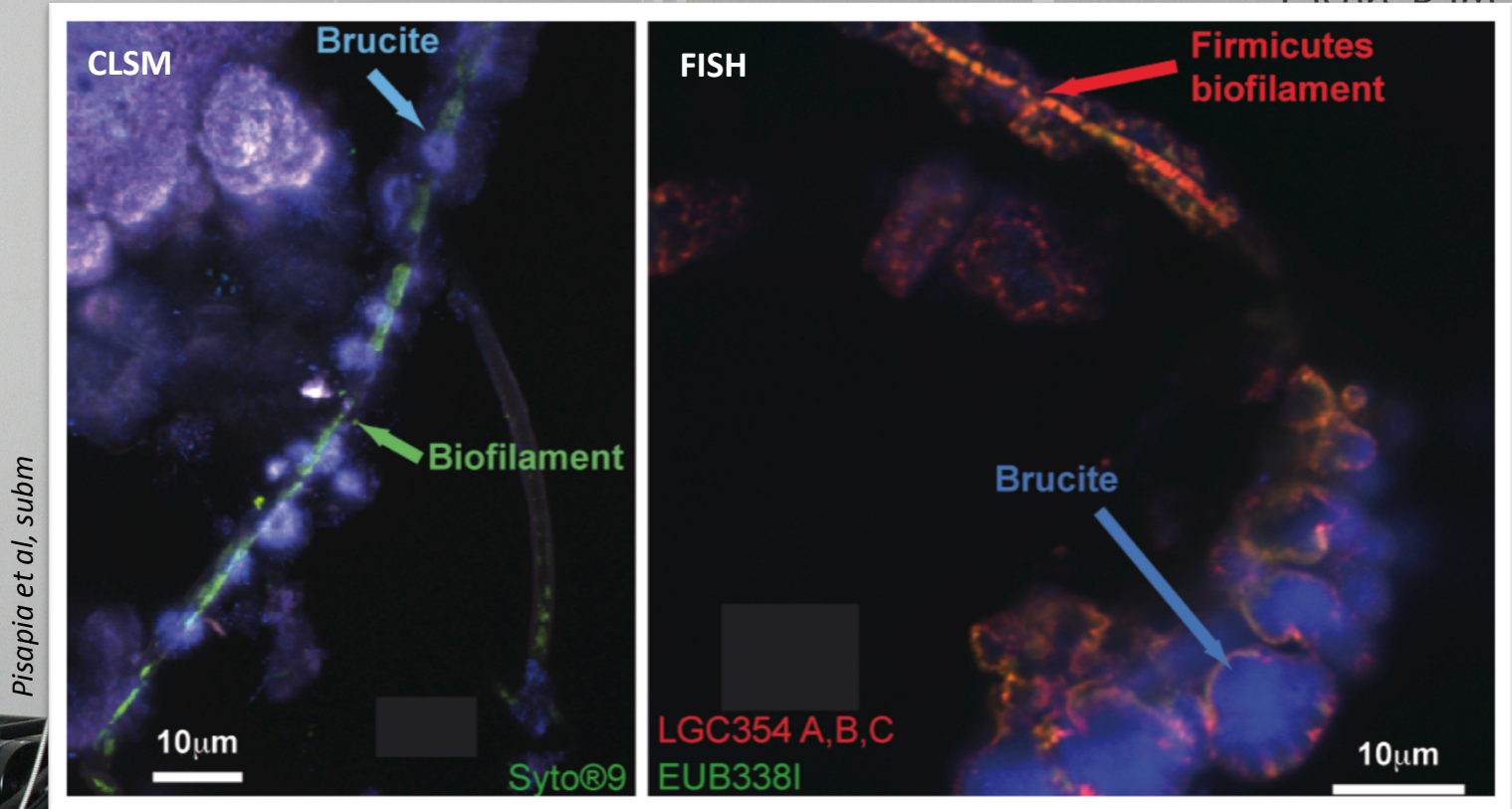
633 nm



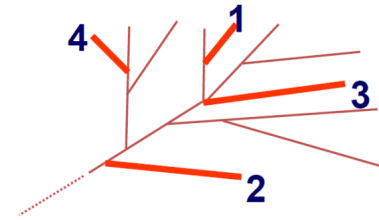
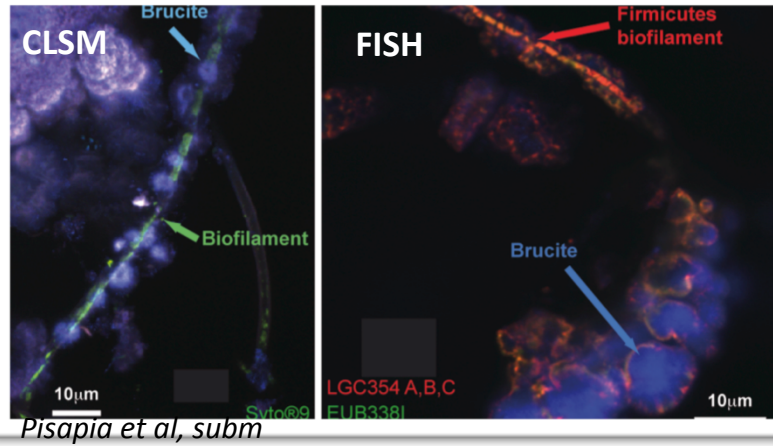
* île de France

Microscope confocal couplé

(Fluorescence/Raman)

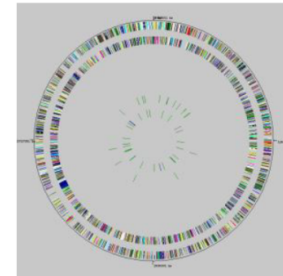


FISH guided Laser Microdissection and full genome amplification



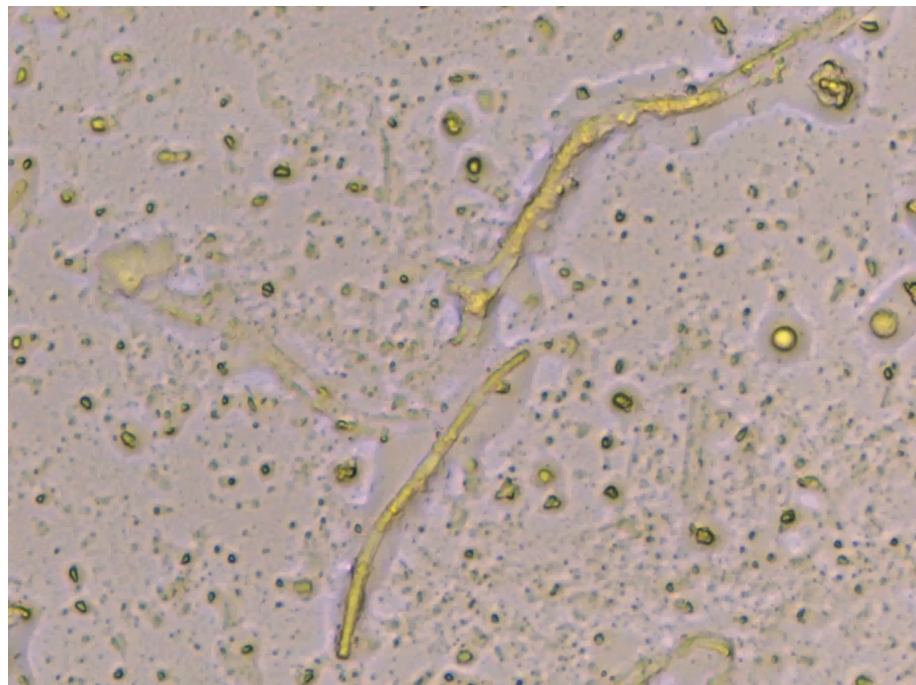
Phylogeny (identity)

→ single cell genomics



Genomes(function)

→ metabolic potential
and carbon sources

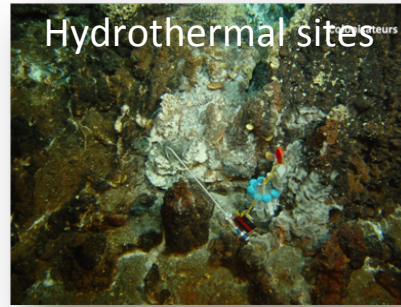


Imaging life in rocks through time

Field work



Archean drillings



Hydrothermal sites



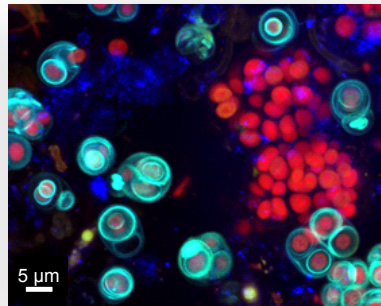
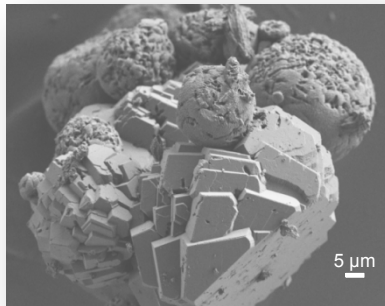
CCS pilote sites

Past

Present

Future

Microimaging & microanalyses (chemical, isotopic & OMICS)



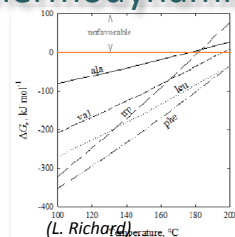
search for traces of life in active or ancient systems

Analogical and numerical modelling

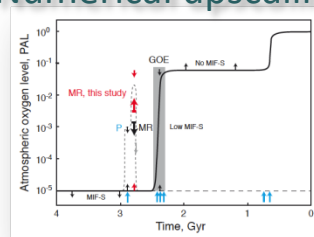
Cultivable models



Thermodynamics

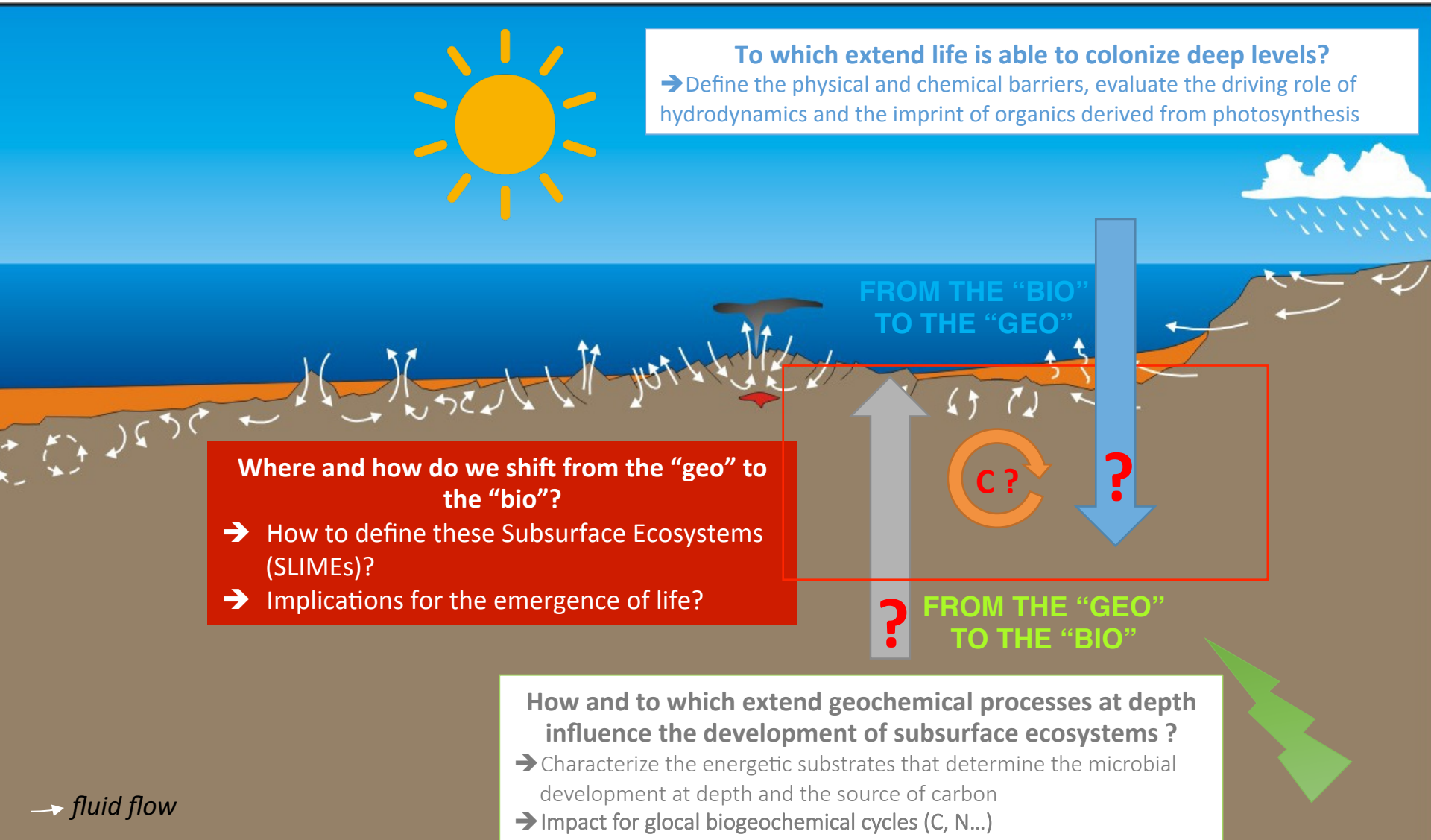


Numerical upscaling



Understanding of their functioning and their overall impact

The biotic/abiotic interface



BIOSPHERE

GEOSPHERE

