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EUROPEAN ASSOCIATION OF GEOCHEMISTRY

"Distinguished Lecture Program"

"Microorganisms – a crossing of biology and (bio)geochemistry"

Lecture 1:

Iron biomineralization by neutrophilic anaerobic Fe- oxidizing bacteria: a nanoscale perspective

Lecture 2:

Biomineralogical study of stromatolites at the nanoscale

Conferința va avea loc în ziua de 9 noiembrie 2011, începând cu ora 9:30, în Aula Academiei Române, Calea Victoriei nr. 125, Sector 1, Bucureşti.

dr. Karim Benzerara - Universitatea Pierre et Marie Curie (Paris - Franța)

The European Association of Geochemistry launches its annual Distinguished Lecture Program, starting with a tour across Central Europe in November 2011. This program aims to introduce and motivate scientists and students located in under-represented regions of the world to emerging research areas in geochemistry.

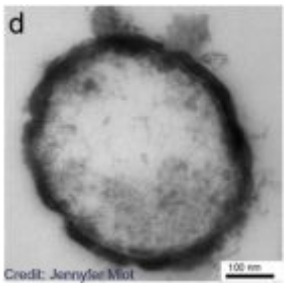
Dr. Karim Benzerara joined the Institute of Mineralogy and Physics of Condensed Matter (IMPMC) at CNRS and University Pierre et Marie Curie in Paris, France, in 2005, where he is currently a CNRS research scientist. His interests are in the fields of geomicrobiology, mineralogy, study of interactions between life and minerals and fossilization.

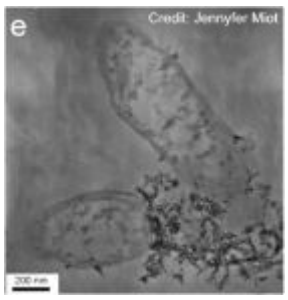
His work has been published in over 46 peer-reviewed articles in Geochimica et Cosmochimica Acta, EPSL, Geobiology, Geomicrobiology Journal, PNAS, Nature Geoscience, Journal of Investigative Medicine and other leading journals in Geosciences and Microbiology.
Since 2010 Karim is an associate editor of the European Journal of Mineralogy and on the Advisory Editorial Board of Geobiology. He is a member of the French Scientific Committee of the CNRS/INSU INTERVIE (interactions between life and Earth) program, of the board of directors at l'Institut de Physique du Globe de Paris and in the scientific committee of the Earth science department at the Museum d'Histoire Naturelle in Paris.

Lecture 1:

Iron biomineralization by neutrophilic anaerobic Fe- oxidizing bacteria: a nanoscale perspective

Iron-oxidizing bacteria can induce the formation of iron minerals by their metabolic activity and by forming nucleation surfaces. This process has diverse implications such as the trapping of inorganic pollutants in soils and rivers or possibly the formation of huge sedimentary iron deposits the Precambrian Earth called Banded Iron formations. The first discovery of bacteria able to oxidize Fe (II) under anoxic and neutrophilic conditions was made only less than 20 years ago. Hence, much remains to be understood on detailed Fe-biomineralization processes. For example among Fe-oxidizing bacteria that can be cultured, some localize mineral precipitation outside the cells while others get encrusted by Fe-mineral formation and we do not know what makes the difference between these strains. Here, I will present results from a combined use of cryo-transmission electron microscopy and synchrotron-based X-ray spectromicroscopy on laboratory cultures of diverse Fe-oxidizing bacteria. With such analyses, it is possible to follow the evolution of Fe redox in these cultures, detect Fe redox heterogeneities at the ~40 nm scale, as well as characterize and image organic molecules associated with these minerals. As a result, it allows to uniquely discussing Fe-oxidation processes mediated by bacteria.





Lecture 2:

Biomineralogical study of stromatolites at the nanoscale

Stromatolites are layered sedimentary structures initiated from a limited surface and forming a variety of morphologies. They are often composed of calcium carbonates and found throughout the geological record back to 3.5 Ga. While they have often been considered as one of the oldest traces of life on Earth, the relative impact of abiotic and biological processes involved in the formation of modern stromatolites is yet poorly known. We believe that a detailed study of mineralogical processes occurring in modern stromatolites would dramatically improve our understanding of ancient samples. In this talk, I will present some of our recent work on Archean stromatolites (from the Tumbiana Formation, Australia, 2.7 Gyr) and modern stromatolites from hyperalkaline lakes. I will discuss the origin of laminations in lake stromatolites; I will show how the combination of microscopy and spectroscopy techniques, including transmission electron microscopy and synchrotron-based x-ray microscopy allow evidencing diverse pools of organic matter in modern and ancient stromatolites. Finally, I will show a preliminary study of the crystallographic texture of minerals in modern stromatolites. Altogether, this information will help discussing existing models for the formation of stromatolites and the way we interpret the geological record.