



Subject offered for a contract starting october 2015

**SUBJECT TITLE: Nanoscale Characterization of Organic Microstructures in Early Archean Hydrothermal Chert Deposits.**

Advisor: **Mark van Zuilen (CR), [vanzuilen@ipgp.fr](mailto:vanzuilen@ipgp.fr)**

Second Advisor/ Supervisor:

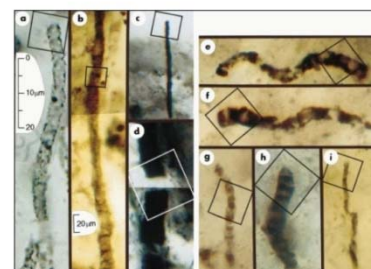
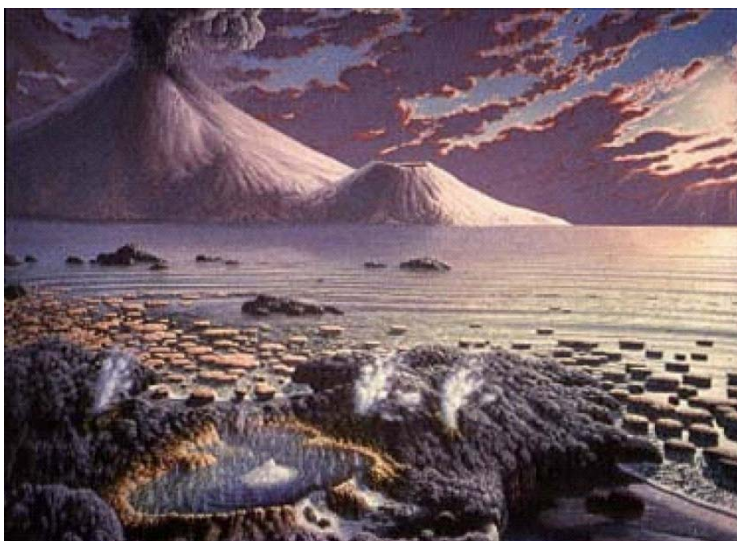
Host lab/ Team : **IPGP- Géobiosphère Actuelle et Primitive – UMR7154**

Financing: Doctoral contract without assignment

*For more information go to <http://ed560.ipgp.fr>, section: Offres de these ( PhD offer), You must apply on the Doctoral School website*

A 3-year PhD position in Geobiology is offered at the Institut de Physique du Globe de Paris (IPGP), that focuses on the study of early traces of life on Earth.

Reconstructing the nature and habitat of early life is a difficult task that strongly depends on the study of rare microfossils in the ancient rock record. The preservation of such organic structures critically depends on rapid entombment in a mineral matrix. Throughout most of Earth's history the oceans were silica-supersaturated, leading to precipitation of opal deposits that incorporated superbly preserved microbial cells. As we trace this record of life back in deep time, however, three important obstacles are encountered; 1) microorganisms lack sufficient morphologic complexity to be easily distinguished from each other and from certain abiologic microstructures, 2) the ancient rock record has been subjected to increased pressures and temperatures causing variable degradation of different types of microorganism, and 3) early habitats of life were dominated by hydrothermal processes that can generate abiologic organic microstructures.



In the current project the critical nano-scale structural differences will be determined between abiologic artefacts and true microfossils in hydrothermal cherts. This study will therefore provide a very important, solid scientific basis for tracing life in the oldest, most altered part of the rock record.

The position will focus on the artificial generation and subsequent experimental high-pressure, high-temperature alteration of organic carbon-enriched silica biomorphs. These are mineral structures with complex life-like features that can spontaneously form in alkaline hydrothermal environments. The candidate will compare the nanoscale fabric and composition of these organic structures with the characteristics of putative organic microfossils from hydrothermal chert deposits in metamorphosed Archean greenstone belts.

The position is funded through ERC Consolidator Grant 'TRACES: Tracing Ancient Microbial Cells Embedded in Silica', and the student will be part of the research team of Dr. Mark van Zuilen in the group 'Early and Present Geobiosphere' (Géobiosphère Actuelle et Primitive, GAP) at IPGP in Paris. Several aspects of crystallization experiments in the project will take place in close collaboration with the research team of Prof. Juan Manuel Garcia-Ruiz, at the Laboratory of Crystal Growth, Andalusian Earth Sciences Institute, Granada, Spain. Fieldwork will mostly take place in Australia in collaboration with the Australian Centre for Astrobiology, University of New South Wales, in Sydney.

The group GAP at IPGP houses a fully equipped microbiology laboratory and a high-pressure, high-temperature experimental laboratory. IPGP has recently created a state of the art analytical platform that includes a Raman spectrometer, FTIR-spectrometer, CLSM, SEM, FIB-SEM, and laser ablation-ICP-MS. Our team also has access to NanoSIMS and TEM facilities at nearby institutes. During the course of this PhD project several of these analytical facilities will be extensively used. Further information about our group is available at our webpage: <http://www.ipgp.fr/en/gap/early-and-present-geobiosphere>.

### **Qualifications:**

The successful candidate is motivated and ambitious, has a Masters degree in Earth Sciences with a strong interdisciplinary background in mineralogy, field geology, and biology. Requirements are a broad interest in the early history of the Earth and the origin and evolution of early life. The candidate should be fluent in English and have a willingness to travel and interact in a strongly interdisciplinary team.