Subject offered for a contract starting october 2017

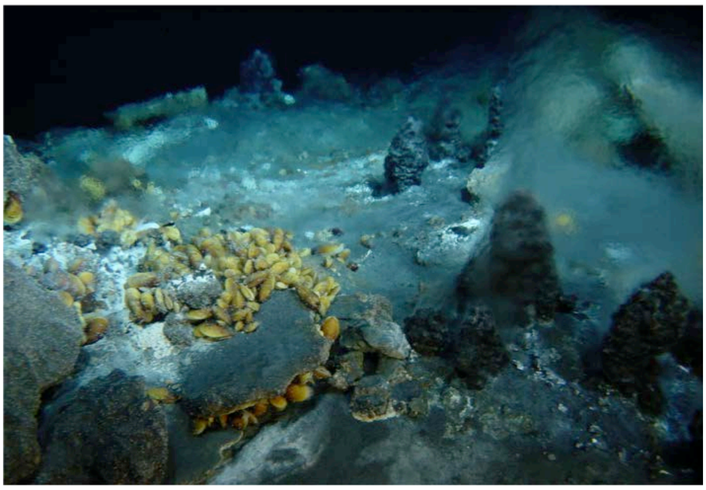
SUBJECT TITLE: Magma chamber to microhabitats : dynamics of diffuse hydrothermal venting at mid-ocean ridges

Advisor: **CANNAT, Mathilde, DR, cannat@ipgp.fr**
Second Advisor/ Supervisor: Fabrice Fontaine fontaine@ipgp.fr
Host lab/ Team : **IPGP – Marine Geosciences Team – UMR7154**
Financing: **Doctoral contract with or without teaching assignment**

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

Hydrothermal circulations at mid-ocean ridges transfer most of the magmatic heat associated with the accretion of new oceanic crust and are one of the main carriers for chemical transfers between the solid Earth and the Ocean. They also host unique ecosystems based on chemosynthetic microorganisms that use the reduced chemical elements contained in the hydrothermal fluids as a source of energy.

There are two types of hydrothermal vents at mid-ocean ridges: focused outflows of high temperature (>200°C) fluids, also called black smokers, and diffuse lower-temperature emissions. Focused high temperature vents result directly from the km-scale fluid convection cells that mine heat and chemical compounds from hot rocks next to axial magma chambers. They expel metal-rich end-member fluids and create sulfide chimneys. Diffuse venting takes place through low mounds and cracks around the hot vents and provides most of the chemical and temperature gradient domains that host biological communities.



Hydrothermal mound at the Lucky Strike vent field, Mid Atlantic Ridge (photo Ifremer-CNRS). Hot fluids are expelled by small sulfide chimneys and are also oozing through the permeable basement. These diffuse outflows host the hydrothermal fauna (here mussels and gasteropodes) and microfauna (white bacterial mats). The objective of this PhD project is to better understand the dynamics of diffuse mid-ocean ridge hydrothermal venting.

Because it occurs over a much wider area than black smokers, diffuse venting is commonly thought to be responsible for over 90% of the mid-ocean ridges hydrothermal heat flux. It also provides the habitat for most hydrothermal animals and microbes. Understanding diffuse hydrothermal emissions, how they form, how much they vary, over what time-scales and under what forcing conditions, is therefore key to understanding both the heat budget of mid-ocean ridge hydrothermal vents, and the functioning and dynamics of the hydrothermal ecosystems.

This PhD project will contribute to this aim by applying an integrated geological and geophysical approach to diffuse venting data primarily from the Lucky Strike vent field, at the Mid Atlantic Ridge. This vent field is part of the European deep sea observatory initiative EMSO (European Multidisciplinary Seafloor and water column Observatory). The candidate will participate to the annual EMSO maintenance cruises. He-she will use geological observations and sampling to constrain the geology of the near vents substratum. He-she will also analyse a 7 years time-record of diffuse vent fluid temperature variations at Lucky Strike, compare with available data from other mid-ocean ridge vent fields (Mid-Atlantic and Juan de Fuca ridges), and help design new seafloor monitoring experiments. He-she will also work with fluid geochemists and with other geophysicists also involved in the EMSO project to address the 4D permeability structure near the vents, the impact of fluid-rock reactions (precipitation, reactions and dissolution) and the dynamics of diffuse hydrothermal circulation. These results will be used to develop new numerical models of near seafloor ridge hydrothermal flow with second advisor Fabrice Fontaine.

The candidate should be ready to participate to seagoing cruises and have a good background in geology and geophysics, as well as an interest for field studies and experimental approaches.