

Subject offered for a contract starting October 2019

SUBJECT TITLE: A seismological study of Lucky Strike volcano, Mid-Atlantic Ridge

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Host lab/ Team : **IPGP – Marine Geosciences Team – UMR7154**

Financing: Doctoral contract with or without teaching assignment

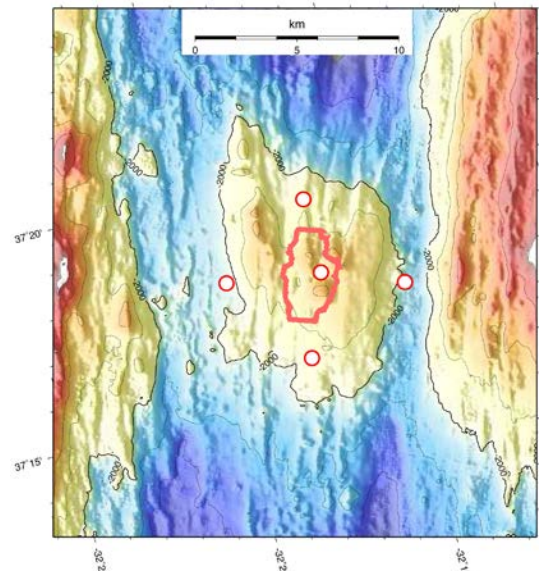
For more information go to <http://ed560.ipgp.fr>, section: Offres de these (PhD offer), You must apply on the Doctoral School website

Presentation of the subject:

Lucky Strike volcano on the Mid-Atlantic Ridge hosts one of the world's most active deep-sea hydrothermal fields, driven by heat from a magma chamber 3 km beneath the seafloor. The volcano is of great interest not only to geophysicists, but also to marine biologists, chemists and oceanographers because of the unique life, heat and chemical fluxes that are found there. A seafloor observatory has been maintained on the volcano since 2007, as part of the pioneering European Multidisciplinary Seafloor Observatory (EMSO) project. Thousands of seismic events have been recorded beneath the volcano summit by the observatory's seismological network, almost all of them associated with the hydrothermal circulation between the surface, the magma chamber, and the fields.

This thesis will use the unique Lucky Strike seafloor seismological dataset to study in detail the relationship between the volcano's structure, magma supply, state of stress and hydrothermal circulation. The student will process the seismological network data to constrain the state and evolution of stresses within the volcano, benefitting from rich complementary information on the volcano's structure and surface processes from recent active seismic studies and concurrent observatory measurements.

The student will use tools such as focal mechanisms, waveform and clustering analysis, as well as correlations between the seismic events and variations in fluid temperatures and chemistry at the hydrothermal vents. He or she will also investigate the role of quantum accretion events such as dike injections and major earthquakes, and will participate in a pilot study of shallow hydrothermal circulation using a novel hydrophone



Bathymetric image of Lucky Strike volcano. Circles indicate seafloor observatory seismometers and the light red outline mark limits of the magma chamber. The central circle also marks the hydrothermal fields.

antenna. The long-term dataset also provides a unique opportunity to compare the magmatic-hydrothermal activity of a seafloor volcano with those observed at subaerial volcanoes.

A strong understanding of plate tectonics and seismic wave propagation (or of physics in general), as well as familiarity with numerical modelling are highly recommended. A strong curiosity for mid-ocean ridge processes and for seafloor exploration is mandatory.

References:

Crawford W. C., A. Rai, S. C. Singh, M. Cannat, J. Escartin, H. Wang, R. Daniel and V. Combiér (2013), Hydrothermal seismicity beneath the summit of Lucky Strike volcano, Mid-Atlantic Ridge, Earth Plan. Sci. Lett., 373, 118-128, doi:10.1016/j.epsl.2013.04.028.