

PhD position at IFP Energies nouvelles (IFPEN)
Earth sciences and Geochemistry

Impact of sulfur and carbon interactions in marine sediments on biogenic and geothermal methane emissions : Application to the case of the Guaymas Basin (Gulf of California)

A better understanding of the processes resulting in geothermal and/or biogenic gas emissions at the seafloor is crucial in order to quantify gas evolution in the deep ocean and better assess its contribution to global warming. The Guaymas Basin in the Gulf of California is delineated by a thick marine sediments layer rich in organic matter (OM) and sulfur. This basin is the site of active rifting, associated with the emission of magmatic intrusions and geothermal activity. This particular configuration, simultaneously presenting hydrothermal sites and cold fluid emission zones a few tens of kilometers away, makes this site favorable to study the redox mechanisms involved in the generation, transformation and coupling of natural gases: CH₄, H₂S and CO₂. One of this couplings is OM natural sulfurization, a process known for the efficient preservation of large amounts of organic carbon over geological timescales, but not taken into account in carbon cycle modeling. The thesis will encompass 3 parts. The analytical item will characterize organic matter and sulfur in sediment cores collected in the Guaymas basin (IODP Expedition 385, 2019) using a geochemical approach. The conceptual item will describe the carbon / sulfur balance in the basin using redox stoichiometric reactions. The last item will apply the hypotheses at basin scale using TemisFlow®. Supervised by Dr. Armelle Riboulleau (UMR 8187 LOG, Lille), the thesis will benefit from the support of the teams involved and the technical platforms available at IFPEN (Rueil-Malmaison-France) and the Oceanology and Geosciences Laboratory at Lille University (France).

Keywords: Guaymas Basin, marine organic matter, microbial degradation, methane, geothermal fluid, H₂S, basin modeling

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PhD location	Université de Lille, Villeneuve d'Ascq and IFP Energies nouvelles, Rueil-Malmaison (France).
Duration and start date	3 years, starting preferably on December 2021.
Employer	IFP Energies nouvelles, Rueil-Malmaison, France
Academic requirements	University Master degree in Geochemistry and inclination to laboratory in relevant disciplines
Language requirements	Fluency in French or English, willingness to learn French
Other requirements	inclination to modelling tools

To apply, please send your cover letter and CV to the IFPEN supervisor indicated here above.

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