Collaborations between NOAA and the UK and France

Contact Information:

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Willing to attend workshop? Yes

Target Name(s)

Mid Atlantic Ridge and areas of submarine volcanism and hydrothermal activity.

Geographic area(s) of interest within the North Atlantic Ocean:

North Central; South Central

Relevant Subject Area: Chemistry

Description of Topic or Region Recommended for Exploration

The resource potential of hydrothermal systems along MAR makes them of significant interest to European nations, most notably England and France. As a result, French and English scientists have conducted many studies along the MAR in recent years and have made numerous discoveries. The Earth Ocean Interactions program at PMEL and in collaboration with OER has been in collaboration with scientists from both countries and together they have worked on understanding the chemical impacts of the MAR on ocean biogeochemical cycles.

While the driving force for much of the European research funding is the presence of mineral deposits, the scientists that we are collaborating with are more interested in hydrothermal sources of iron to the ocean. Hydrothermal vents produce Fe-rich plumes that persist for 1000's of kilometers. We seek to understand how this iron impacts the ocean carbon cycle. This impact depends on the abundance of hydrothermal venting, the lifetime of vented iron, and the mixing of this Fe into surface ocean. These aspects are poorly constrained and thus our understanding the ocean iron cycle is incomplete. This is important, because iron availability over large parts of the ocean controls the biological pump and thus influences oceanic productivity and ocean-atmosphere carbon dioxide exchanges. Our studies suggest that ridge-driven Fe supply can enhance the flux of Fe to surface waters and is a significant contributor to regional Fe budgets and our collaborations look to quantify the lifetime of this Fe and its vertical transport from mid ocean ridges to the ocean surface. Our work suggests that Fe-binding ligands control the longevity of Fe exported from the ridge and thus the ultimate impact on the carbon cycle.

The MAR is a slow-spreading ridge crest with a lower frequency of intense hydrothermal activity compared to the more continuous activity on faster spreading ridge crests like the South East Pacific Rise. Work with UK colleague Tagliabue (University of Liverpool) shows that when we model the impact of hydrothermal activity solely in the light of the primordial tracer ^{3}He, that the model suggests that the MAR is not an important source of Fe to Fe-deplete regions of the ocean. However we think that this model may overlook the importance of both the ambient ligand pool and low-temperature diffuse flow along the ridge crest. We expect diffuse sites to host microbial activity and thus produce organic-rich effluent containing a wide range of organic compounds including Fe-binding ligands. This should result in a greater percentage of Fe being stabilized from diffuse flow than from focused high-temperature flow where most of the Fe is deposited onto the sea-floor close to where it is vented. In fact, our recent OER-EOI-SOI collaborative project to the slow spreading Mariana Back Arc shows this to be true. We suggest that the MAR may have abundant low-temperature venting along most of the Ridge crest which suggests that the MAR might be a more important source of Fe than suggested by the results of our model.

ASPIRE presents a great opportunity for NOAA through Ocean Exploration and Earth Ocean Interactions to continue its leadership in understanding the global impact of hydrothermalism on ocean chemistry and productivity by further extending our collaborations with our French (IFREMER; University of Brest, University of Paris, and LEGOS0) and British (University of Liverpool, Southampton University, University of Plymouth) colleagues on MAR research and exploration. There remain many under-explored regions along the MAR and it is essential to better understand the incidence of hydrothermal activity to inform future research along the MAR and to properly model and understand the impacts of hydrothermal activity on the ocean. Prior to attending the ASPIRE meeting I will discuss unexplored targets with my European colleagues so as to identify sites of interest along the MAR for the ASPIRE campaign. Our collaborations fall within the Aspire goal to leverage international partnerships to conduct coordinated exploration and mapping of priority high-seas areas of the North Atlantic, including the Mid-Atlantic Ridge.

RELEVANT PARTNERSHIPS

IFREMER; University of Brest, LEGOS, University of Liverpool, Southampton University, University of Plymouth