

**ENVEAST Doctoral Training Partnership**



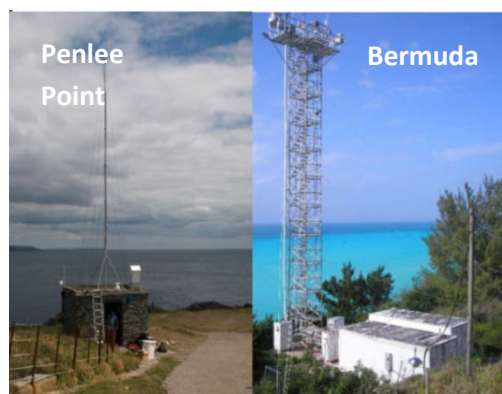
**Investigating the biogeochemistry of trace metals in ship plumes in the marine environment**

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**PML Supervisor:** Dr Tom Bell ([tbe@pml.ac.uk](mailto:tbe@pml.ac.uk))

**Background:** The chemistry of the surface ocean and lower atmosphere are connected by transport pathways that have profound effects on the Earth's climate and the growth of phytoplankton that form the base of the marine food chain. Though certain aerosol particles are natural in origin, there is growing evidence that anthropogenic aerosols significantly influence surface seawater chemistry. These emissions are currently intensifying along with expanding populations, changing land-use and industrial emissions.

In this project you will determine trace elements in ship emissions and aerosol / rainwater samples collected at coastal and open ocean sampling sites in the North Atlantic. Laboratory simulations will be employed to study the dissolution of these trace elements into seawater, using well established techniques. Using these data, you will assess whether current anthropogenic emission associated with maritime shipping perturb pelagic ecosystems either by deposition of nutrient-type trace elements (P, N, Fe) or harmful toxic heavy metals, (e.g. Cu and Sn).



**Research methods and training:** You will become an expert in cutting-edge techniques to sample and analyse marine aerosols and rainwaters. You will conduct fieldwork on ships, collect samples at a coastal atmospheric observatory (Penlee Point, Cornwall) and remote North Atlantic Ocean samples (collected in Bermuda). You will learn how to use advanced chemical analytical techniques and meteorological models to identify the origin of these aerosols and assess their impact on the surface ocean. Training opportunities will be offered in marine atmospheric fieldwork at established study sites in Cornwall (UK) <http://www.westernchannelobservatory.org.uk/penlee> and Bermuda <http://www.bios.edu/research/projects/tudor-hill-marine-atmospheric-observatory>. You will also receive comprehensive, hands-on training in advanced analytical techniques, including mass spectrometry (ICP-MS) and X-ray techniques (XRF and SEM-EDX).

**Supervision and person specification:** You will benefit from a team of experienced and friendly supervisors from Plymouth University, University of East Anglia (UEA), and Plymouth Marine Laboratory (PML) and the scientific networks and career opportunities associated with these institutes. It will also be possible to link your work to a larger, broader scope project that considers atmospheric chemistry and climate (ACSIS; <https://www.ncas.ac.uk/index.php/en/acsis-home>).

We are looking for a student with a 1st class or 2:1 BSc or Masters level degree in Environmental Science, Marine Science or Chemistry (or similar courses) with a genuine passion for marine and atmospheric science. Candidates are encouraged to contact any of the supervisors with any scientific enquiries.

For further information about the application process, please visit [www.enveast.ac.uk/apply](http://www.enveast.ac.uk/apply).

**References:**

- (i) Fishwick, M. P., P. N. Sedwick, M. C. Lohan, P. J. Worsfold, K. N. Buck, T. M. Church, and S. J. Ussher (2014), The impact of changing surface ocean conditions on the dissolution of aerosol iron, *Global Biogeochemical Cycles*, 28, 1235–1250, doi:10.1002/2014GB004921.
- (ii) Baker et al. (2013) Estimation of atmospheric nutrient inputs to the Atlantic Ocean from 50°N to 50°S based on large-scale field sampling: Iron and other dust-associated elements, *Global Biogeochemical Cycles*, 27, 755-767.

