

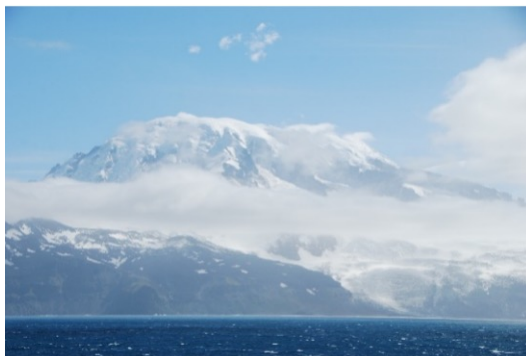
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Searching for Humic Substances on SWINGS GS02

Posted on ~~July 8, 2021~~ ~~July 7, 2021~~ by [challengersoc](#)

by Millie Goddard-Dwyer, PhD student at the University of Liverpool



Heard
Island

In January 2021, I set sail aboard the French vessel N.O. Marion Dufresne to participate in the SWINGS GS02, a GEOTRACES oceanographic research cruise. The aim of this trip was to determine the sources and sinks of trace metals in the Indian Ocean sector of the Southern Ocean (SO). Some trace metals, for example iron, are an essential micronutrient for phytoplankton primary production. However, primary production is limited to low levels in the SO due to scarce terrestrial and atmospheric fluxes of iron to the region. Significant sources include sub-Antarctic island plateaus and hydrothermal vents, which together with internal recycling of existing iron support SO phytoplankton growth. This cruise aimed to quantify and understand these sources and recycling processes whilst crossing the South West Indian Ridge vent system and 'island hopping' across sub-Antarctic islands, including the Crozet, Heard, and Kerguelen islands.



King
penguin
in the
waters off
Possession
Island
(Crozet
Islands)

My role was two-fold, taking samples from surface water across the entire cruise transect for trace metal analysis by other research teams and performing experiments which focus on how bacteria contribute to iron cycling. Surface samples were collected as the ship was transiting between stations using a GEO-FISH system. I was on the night shift, which meant every 2 hours between 00:00 and 04:00 I donned my Tyvek and took samples in the trace metal clean container. Working through the night is definitely not a perk of the job, however it comes hand in hand with a positive of being onboard – work on a ship goes on round the clock, so you're never lonely on a night shift!



My incubation experiments comprised part of my PhD project – I research humic ligands, organic molecules which are thought to play a key role in regulating the concentration of iron in seawater. On this research trip, I focused on humic ligand cycling by bacteria, more specifically, how organic matter nutritional quality and the presence of terrestrial iron from sub-Antarctic islands influences humic ligand cycling by bacteria. The tiny size of bacteria and their (almost) lack of pigments mean that bacterial communities are invisible to the naked eye, which means working with bacterial incubations on a cruise is always nerve wracking unless you have a way of determining on board that the bacteria are alive and well and responding to your treatments. To prevent such angst, I used an oxygen optode system to measure bacterial respiration onboard and almost literally jumped for joy when I saw a response.

A person is shown from the chest up, wearing full personal protective equipment (PPE). They are wearing a white hairnet, a light blue surgical mask covering their nose and mouth, and a white protective gown with blue elastic straps. The background shows a laboratory environment with white walls, a metal mesh barrier, and various lab equipment and supplies.

Inspirational
group of
women
from the
cruise, taken
on the
occasion of
International
Womens
Day

From the ship, we caught glimpses of untamed natural wilderness that made me want to quit my PhD and become a National Geographic photographer (only slightly). We stopped at the Crozet Islands and were greeted by hundreds of king penguins swimming around the ship. We made not one but two passes by Heard Island, saw smoke rising from the volcano Big Ben, and were blown away by the magnificence of the island's glacier. One week before the end of the cruise, we went on shore at Kerguelen island visiting the French research station there. After we had recovered from the shock of seeing new people again after living with the same 100 people for 7 weeks, we enjoyed a guided walk on the island, meeting a group of elephant seals, penguins, and cormorants. After such a long time at sea, walking on land was so physically taxing that even the most fit amongst us had to go for a long nap after a small hike!

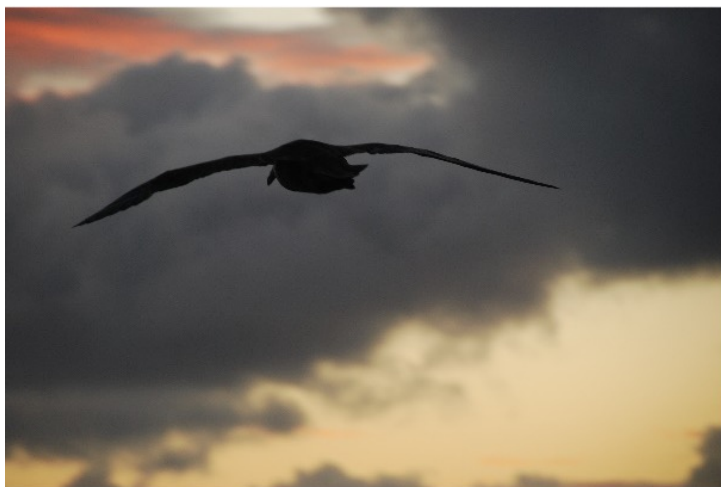


The
unusual
landscape
at
Kerguelen
Island –
tough
going for
our sea-
adjusted
crew



Cormorants
posing for
the camera

The cruise passed through such a breadth of climates, each with its own beauty, however the tropics are unparalleled to the Southern Ocean. Heaving swell with a biting and persistent wind, where we were lucky enough to see one of the wonders of the world – the aurora.



The Southern Ocean is beautiful, but it is its most famous inhabitant that I miss the most. Albatrosses follow the ship for days and seem as common around the ship as pigeons are in a city park. They glide within what seems like an arm's reach of you, sometimes glancing your way but mostly ignoring you. Travelling northwards home at the end of the cruise, every day meant fewer albatrosses. I recall the last albatross I saw, although it will not be my last, as I have 300 blurry pictures of them to remember them by (apart from this one).

My name is Millie Goddard-Dwyer and I'm a PhD researcher at the University of Liverpool. I study a group of carbon molecules called humic substances which act as a fundamental bridge between the biogeochemical cycle of iron and carbon in the ocean. I utilise microbiology and analytical chemistry to try to understand which microorganisms control the cycling of these organic molecules and decipher which mechanisms underpin these processes, so we can hope to understand how the iron and carbon cycle might change in the future.

To hear about more of her adventures, follow Millie at @Phyto_Millie



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