



Mapping an Atlantic Atlantis

Geological Survey Ireland (GSI) is co-leading the TOSCA scientific expedition to the mid-Atlantic ridge, scheduled to sail on Tuesday, May 15th from Galway. TOSCA stands for Tectonic Ocean Spreading at the Charlie-Gibbs Fracture Zone and the expedition's mission is to study a complex part of the Atlantic, 1600km west of Ireland. It is the culmination of three years planning by Maria Judge, marine geoscientist in GSI's Marine Programme, Aggeliki Georgiopoulou from University College Dublin and Bramley Murton from the UK's National Oceanography Centre.

The Atlantic continues to open along the length of its centre, known as the mid-Atlantic ridge, at the rate our fingernails grow. This geological study will focus on a complex region, about the size of Dublin County, at the Charlie Gibbs Fracture Zone. Here, two deep faults which traverse the Atlantic, intersect the mid-Atlantic ridge. Constant tectonic forces have exposed part of the Earth's mantle and ripped it up to an awesome 4km height above the seabed (Ireland's highest mountain, Carrauntoohil, is 'only' 1km above sea level). This extraordinary submarine Alpine-scale mountain in the middle of the Atlantic is known for its biological diversity and seabirds and cetaceans are known to congregate there. Under the water, there is a comparative surprising abundance of life.

During this explorative mission, we will be using sound emitted from the [RV Celtic Explorer](#) to map the seabed in high resolution. In addition, we will use seismic equipment and gravity corers to see what is happening below the seabed. Also in our arsenal of marine equipment is Ireland's Holland I ROV (remotely operated underwater vehicle), a marine robot with high definition cameras which transmit live video feeds to the vessel. As our eyes in the sea, this exceptional piece of equipment is integral to our investigation and understanding of the seabed. Operated by a team of 7 technicians, Holland I also uses manipulator arms to sample the geology and biology at the seabed.

Much of the seabed imagery you see digitally, like on google maps satellite view, uses coarse scale (10km) resolution information from satellites. At this scale, large bulges and variations in Earth's topography are evident. However, multibeam bathymetric mapping from ships is required to visualise the unmapped 90% of our oceans and to allow us to understand more about our planet. The complex fractures and bulging mountains at the Charlie Gibbs fracture zone had previously been predicted by satellite altimetry mapping. In 2015 Ireland's Marine Institute used this information to inspire seabed mapping which in turn gave extraordinary detail of the unnamed 4km mountains. The Marine Institute teamed up with marine geologist colleagues from Geological Survey Ireland in 2016 and conducted further seabed mapping at the Charlie Gibbs Zone. During this mission, seabed samples were retrieved and were used to prove that rocks from deep within the crust and mantle are exposed on the seabed. Chemical interactions with the surrounding oceanic water have resulted in interesting hydrothermal mineralogy. This types of minerals also suggests the presence of chemosynthetic biology, which derives life from Earth's energy rather than the sun's energy.



Maria Judge, GSI, in collaboration with expert marine geologists Aggeliki Georgiopoulou from University College Dublin and Bramley Murton from the UK's National Oceanography Centre in Southampton, have been planning TOSCA for three years. During that time, a team comprising marine scientists from organisations in Ireland, UK, Greece, Germany and Canada has been established. On Monday, 14th May, our TOSCA team of 13 intrepid scientists will join the adept crew of Ireland's largest research vessel the RV Celtic Explorer and begin preparing equipment.

TOSCA takes place from 15 May 2018 - 8 June 2018, for more on the expedition as it happens, see <http://scientistsatsea.blogspot.com/> and <http://moocs.southampton.ac.uk/oceans/>

Check out #expTOSCA or follow Maria at @Maria_MarineGeo on Twitter

The expedition facebook page will host profile information on each of the team members, our equipment and science discussions. <https://www.facebook.com/expTOSCA/>

Participating Organisations.

Geological Survey Ireland, University College Dublin, Marine Institute, National University Ireland Galway, Queens University Belfast, CD, NOC, National Oceanographic Centre, Southampton, Memorial University and Marine Institute Newfoundland, Canada National University of Athens, Greece, and Christian-Albrechts Kiel University, Germany

Supporting organisations, grant aid, data donors

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Financial aid for the transportation and operation of the seismic equipment has come from DFG (Deutsche Forschungsgemeinschaft).

Data acquired by the Marine Institute for the Atlantic Ocean Research Alliance has been interpreted to inform our survey plan.

Seabed mapping equipment, software and expertise has been provided by Ireland marine mapping programme INFOMAR, which is funded by the Department of Communications, Climate Action and the Environment.