Until now, it has been extremely difficult to investigate what actually happens in the extreme deep.

Robots exploring deepest ocean zones

www.uhi.ac.uk

Scientists based at SAMS UHI in Oban are pioneering the use of custom-built robots to discover how life is sustained thousands of metres below the ocean's surface.

The Hades Project, led by Professor Ronnie Glud, is unique in that it aims to study and sample organisms in their own environment, at depths of up to 11 kilometres below sea level. These extreme ocean regions, known as 'hadal zones', occur where one plate of the Earth's geological crust slides underneath a neighbouring plate, forming deep trenchesin the seafloor.

Until now, it has been extremely difficult to investigate what actually happens in the extreme deep. Organisms that are removed from these environments and studied in a laboratory will inevitably be affected – and potentially killed – by extreme changes in pressure which occur during sample recovery. In onboard laboratories, researchers generally only study organisms that can withstand recovery - yet these are not necessarily the most important species in that particular environment.

As part of the five-year project, three purpose-built robots will explore three sites in the Pacific Ocean. These are the Atacama Trench off Chile (with a maximum depth of 8,068 metres), the Japan Trench, south and east of Japan (maximum depth 9,504 metres) and the Kermadec Trench, north of New Zealand (maximum depth 10,047 metres). The trenches were selected as they are expected to receive very different amounts of organic matter due to varying nutrient conditions in the overlying surface waters and different physical-oceanographic conditions.

Previous expeditions led by Professor Glud – most notably to the Mariana Trench, the deepest part of the global ocean – have revealed that such zones concentrate large amounts of sedimentary material and sustain surprisingly high levels of biological activity.

Even though the trenches represent only about two per cent of the world's oceans, they are thought to have a relatively large impact on the marine carbon balance and therefore the global carbon cycle. The aim now is to investigate how life is sustained at these depths and how its activity affects the biogeochemical functioning of the oceans and the Earth.

Professor Ronnie Glud

A highly productive Danish biogeochemist with more than 160 peer-reviewed and widely cited publications, Professor Ronnie Glud investigates how life and chemistry interrelate in the ocean.

His work includes investigations of how climate changes affect the marine Arctic, with special emphasis on ocean productivity and the atmospheric exchange of carbon dioxide. His research explores the cycling of organic matter, nutrients and greenhouse gases in all corners of the aquatic environment.

Developing and deploying novel technologies such as sophisticated in situ seabed landers, microsensors and imaging techniques enables Prof Glud to investigate microbial processes in otherwise inaccessible and hostile surroundings like sea-ice, hot springs and deep-sea environments.

In 2011 Prof Glud led the world's first investigation of the biogeochemistry at the bottom of the Mariana Trench, the deepest part of the global ocean. To explore the role of ocean trenches in carbon cycling, Prof Glud's international team developed instrumentation that could perform autonomous measurements under the enormous pressures exerted by 10.9 kilometres of seawater above.

Prof Glud joined SAMS UHI in 2007 from the University of Copenhagen. He now divides his time between SAMS UHI and the Nordic Center for Earth Evolution at the University of Southern Denmark.

Email: ronnie.glud@sams.ac.uk
Tel: 01631 559000