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Ocean Keepers

The highs of the deep

The Five Deeps Expedition is visiting the Earth's most remote frontier: the deep ocean. It has successfully dived to the previously unvisited bottom of one of the world's five oceans, discovering new hadal-zone species along the way, as Victor Vescovo shares with **Brittany Cooper**.

One cannot hope to protect and nurture the ocean until one understands it. This is one of the motivations behind the Five Deeps Expedition, which aims to reach the most isolated points of the planet – the bottom of the world's five oceans – in a manned submersible vessel, along the way contributing to the fields of ecology, oceanography, marine biology, and geomorphology. Indeed, the expedition's motto is 'In Profundo: Cognitio', which means 'in the deeps: knowledge'. It conveys the mission to build our understanding of the largest, unexplored and most inaccessible places left on Earth.

On 11 April 2019 the Five Deeps team completed its third exploratory mission, to the deepest point of the Java Trench in the Indian Ocean, now measured at 7,192 metres. American former naval officer and undersea explorer Victor Vescovo piloted the DSV *Limiting Factor*, a Triton 36000/2 submersible that is currently the world's deepest diving operational submarine, to the bottom of the trench.

Unlike first-generation deep-water subs, which were filled with lighter-than-water fuel to allow for buoyancy, *Limiting Factor* is constructed with glass bead-based syntactic foam. The material is durable enough to withstand the enormous pressure as the sub descends thousands of metres, and it can do so repeatedly without developing significant deformation or stress fractures over time. The two-person control capsule is constructed in titanium alloy, and has space for a pilot and passenger with three acrylic-lensed viewports.

Along with the pure glory of exploration, the dives have provided the 30-strong team with an unprecedented opportunity to sample life across a gradient of depths, temperatures, salinity, food supply and latitude, and in

SNAPCHAT

Opposite page: The Triton 36000/2 sub, piloted by Vescovo (this page, inset), is enabling the Five Deeps team to visit the deepest parts of the oceans.

Victor, what's it like diving to the very bottom of an ocean trench?
It is an amazing feeling – to visit places that have been undisturbed for hundreds of millions of years. They have existed in complete darkness until briefly illuminated by my submersible. It feels like being a kid again, exploring around my neighbourhood on my first bike, never knowing what is around the next corner. Before a dive, there's a tremendous sense of excitement and some apprehension because of the crushing depth and all the systems that have to work very well to make a dive successful. Afterwards, I am pretty exhausted given the dive duration of up to 11 hours, but it is infused by such a great feeling of happiness and sense of accomplishment.

What has been the highlight to date?
Making it to the bottom of the Atlantic Ocean last December. It was the deepest dive we had yet made. It was also my first solo dive, if you can believe that. Most sub pilots' first solo dives are to a few hundred metres – mine was to more than 8,000.

Why are the expedition's mapping and biology activities important for ocean health?
The most extraordinary thing about the ocean, to me, is just how unknown it is. By some estimates, 90 percent of the ocean floor is completely unexplored. The sea has more biomass than the rest of the world combined and environmental interactions with our atmosphere that we are only now beginning to understand. To protect the health of the ocean and preserve its unique genetic reservoirs, we need to first figure out just what is down there. This expedition, in large part, I designed to build and test a craft that can open – and leave open – the door to exploring this unknown frontier.

places around the world that were formed, split, or conjoined millions of years ago by the shifting of the Earth's tectonic plates.

The hadal zone of the ocean, named after the realm of Greek mythological figure Hades, begins at 6,000 metres deep, and its 46 individual habitats form a cumulative 0.25 percent of the sea floor. Marine life decreases with depth, and studying the trenches' organisms for biological adaptations to extreme environments has until now proven tremendously challenging.

At the bottom of the Java Trench, the team captured footage of what is believed to be a species previously undiscovered by humans. From the sub, a new species of hadal snailfish was observed amongst other bottom dwelling organisms, and the landers observed a gelatinous animal – thought to be a stalked Ascidian, otherwise known as a sea squirt – which does not resemble anything seen before.

"Among many other rare and unique observations, the stalked Ascidian was a really significant moment," comments Dr Alan Jamieson, the expedition's chief scientist. "It's not often we see something that is so extraordinary it leaves us speechless. At this point we are not entirely sure what species it was, but we will find out in due course. This was a big moment for hadal science."

The Five Deeps Expedition has also settled debate about the Indian Ocean's deepest point. "Our Kongsberg EM124 multibeam sonar – the most advanced sonar currently mounted on a civilian vessel – provided detailed maps of the Diamantina Fracture Zone sea floor off the coast of Australia, as well as the deepest parts of the Java Trench," says Vescovo. "We believe we have built the most precise maps possible of the deepest places in the Indian Ocean."

The data generated by the expedition's sonar mapping and sample-collection mission will contribute to the Seabed 2030 Project to map the world's sea floor in detail by the end of the year 2030. In addition, the expedition is collecting biological samples of scavenging crustaceans – known as amphipods – from a depth of 7,010 metres. These will then be genetically analysed at Newcastle University, UK, to examine the role of fracture zones in evolution.

> The next stop on the Five Deeps Expedition is the Challenger Deep within the Mariana Trench, commonly known as the deepest ocean trench on Earth.

The next stop on the Five Deeps Expedition is the Challenger Deep within the Mariana Trench, commonly known as the deepest ocean trench on Earth. Only two other manned submersibles have reached its 10,916-metre depth, once each: James Cameron's *Deepsea Challenger* in 2012, and Don Walsh and Jacques Piccard's bathyscaphe *Trieste* in 1960. The team predicts *Limiting Factor* will be able to reach the Challenger Deep multiple times in one week and remain at the bottom for longer.

The other remaining major dives planned for the Five Deeps Expedition are the Tonga Trench (Pacific Ocean, 10,882 metres) and the Molloy Deep (Arctic Ocean, 5,573 metres). The overall mission is now 60 percent complete, remaining on schedule for completion in September 2019.

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