# Mapping A Submarine Canyon In All Its Facets

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With recent inventories indicating numbers may exceed 9500 world-wide, submarine canyons are some of the most important features of our continental margins. They are considered the main pathways between the shelf and the deep sea, funnelling sediments in sometimes catastrophic flows, while also transporting pollutants and litter from shallow to deep waters. Their steep morphology has a strong influence on the local oceanography and current patterns, causing the formation of large internal tides, upwelling and enhanced surface primary productivity. These processes, together with the high terrain heterogeneity, often result in high biodiversity, which means that submarine canyons are generally considered biodiversity hotspots.

Still, the various processes acting in submarine canyons are poorly understood. Their extreme morphology makes them challenging and inaccessible locations for study. Thanks to recent technological developments, especially in marine robotics, we now can start to build a picture of true canyon morphology, current regimes, sediment transport processes and habitat distribution.

During the recent CODEMAP2015 expedition in Whittard Canyon, NE Atlantic, three different robotic vehicles were deployed simultaneously to image the 3-dimensional structure of this complex environment. In addition to the shipboard multibeam data, recorded at 50 m pixel size, the Autosub6000 Autonomous Underwater Vehicle (AUV) collected bathymetric data at metre-scale resolution. Ultra-high resolution bathymetry ($<$ 0.2 m pixel size) was obtained with the Isis Remotely Operated Vehicle (ROV). At the same time, the water column structure within one of the canyon branches was continuously measured by a Seaglider. Complemented by the Isis HD video records, these nested datasets allowed, for the first time, to image all the processes in a submarine canyon at the scale they occur, in a close to simultaneous manner.

Special emphasis was also given to near-vertical and overhanging canyon walls, which play an important role in canyon formation and habitat creation, through processes that until recently could never be mapped. A new Autosub6000 multibeam set-up, specifically developed to allow side-ways mapping, was successfully tested during the CODEMAP2015 cruise. Together with ROV-based 'forward mapping', the new 3D models provide unique insights in the canyon morphology and habitat distribution.

This work is part of the ERC CODEMAP project (ERC Starting Grant no 258482).