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The use of photo-mosaics, bathymetry and sensor data into geographic information system for site description and faunal distribution analysis at the Menez Gwen Hydrothermal vent field

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The Menez Gwen hydrothermal vent is located on the Mid-Atlantic Ridge at a depth of about 800m. Although it has been the focus of several expeditions and studies, the sites of active venting at Menez Gwen are still under described, and it is not possible to get a global picture of the sites from the published data. Exploration of deep-sea environments is commonly performed using remotely operated vehicles (ROV) equipped with sensors, cameras and powerful lights. But strong attenuation of light in the deep-sea constrains visual surveys to be carried out from a few meters only above the seafloor, thus limiting the extent of the field of view. Moreover, ROV-mounted positioning systems usually lack accuracy and cannot be relied on for accurate relative positioning of sensor measurements, samplings, and features of interest. Such limitations are hindrances for many applications. In particular, site description or mapping of deep-sea benthic fauna over an area of study usually requires lengthy surveys, and reliability of navigation data becomes a major issue. Also, studying small-scale spatial variations of a physico-chemical parameter needs positions of sensor measurements or samplings to be known precisely. To overcome this problem, maps of the seafloor can be generated in the form of geo-referenced video- or photo-mosaics. Mosaics are constructed by assembling overlapping images together into a larger image of the scene. To reduce the effects of drift in the navigation data, the construction of the mosaics uses robust feature detection and mapping capabilities to precisely relate consecutive images together. After geo-referencing in a Geographic Information System (GIS), points of measurements and sampling can be accurately pinpointed onto the mosaics to allow for spatial analyses.

During cruise M82/3 to the Menez Gwen hydrothermal vent system, high-resolution photo-mosaics of several sites of hydrothermal activity were constructed and geo-referenced into GIS systems. The mosaics, together with high-resolution ship-borne bathymetry, allowed unravelling the layout and morphology of the system at different scales. Through GIS analyses, the distribution of the faunal communities in relation to the fluid emission points was mapped and sensor data were integrated to allow describing the spatial variation of water temperature based on CTD measurements. Results include calculation of mussel beds surfaces and inferred estimates of biomass of *Bathymodiolus azoricus*.

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