Megafauna community patterns related to terrain variations in the abyssal North Pacific

Simon-Lledo, Erik[1-2-], Bett, Brian J.[2], Durden, Jennifer M.[2], Huvenne, Veerle A. I.[2], Jones, Daniel O. B.[2]

[1]*University of Southampton, National Oceanography Centre, Southampton, UK.*

[2]*National Oceanography Centre, Southampton, UK*

The ecological characterisation of abyssal plains has been historically limited by their size and remoteness. Nevertheless, the advance of modern underwater technology in the last decades has revealed that abyssal plains are more complex environments than it was traditionally thought. In these areas, oceanic crust spreading processes and fractures often shape the seafloor as a continuous succession of crenulated ridges, low profile valleys, and flat zones. Terrain variations have commonly shown to influence the structure of benthic populations in marine environments, by modulating habitat complexity, local current regimes, and/or nutrient fluxes. However, the influence of macro-habitat morphology on benthic communities living in abyssal plains is largely unexplored, especially below the abyssal hill level (bathymetric range < 400 m).

Here we show differences in benthic megafauna community composition detected amongst three morphologically different areas of the north-western Area of Particular Environmental interest number (APEI) in the CCZ: a flat, a ridge, and a valley zones. These where delineated in accordance to bathymetric derivatives variations (bathymetric position index and terrain ruggedness), mapped from a multibeam dataset obtained at ~100m resolution. A total of 9 seafloor photographic transects (3 per stratum) were assessed for megafauna, enabling the detection of more than 22,000 animals within an area of 15,000 m^2 of seabed (7800 pictures). Community composition, species density, diversity (H'), and evenness (J') indexes showed significant variations between the 3 strata, suggesting that macro-habitat heterogeneity may play an important role in the development of benthic communities below the abyssal hill scale in the CCZ. Our capacity to map biological variations in polymetallic nodule fields, where deep-sea mining exploitation could start in coming years, will ultimately determine the success regulation measures, key for a successful preservation of these habitats in a near future.