Exploring pristine Vulnerable Marine Ecosystem along the MAR in the Azores

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WILLING TO ATTEND WORKSHOP? YES

TARGET NAME: The Mid-Atlantic Ridge, seamounts and valleys between Pico and the Kurchatov fracture zones

GEOGRAPHIC AREA(S) OF INTEREST WITHIN THE NORTH ATLANTIC OCEAN: South Central (between 37°N and 41°N)

RELEVANT SUBJECT AREAS: Biology, Conservation, Geology, Chemistry, Physical Oceanography

DESCRIPTION OF TOPIC OR REGION RECOMMENDED FOR EXPLORATION

Brief Overview of the Area

The most prominent ocean floor feature in the Atlantic Ocean (AO) is the Mid-Atlantic Ridge (MAR), dividing the ocean into eastern and western deep basins[1]. In the Azores region, the MAR intersects the Terceira Rift, separating three tectonically active plates: the North American plate, the Euro-Asian plate and the African plate (Fig. 1). This unique setting of the Azores at the triple junction of tectonic plates and close proximity to the ridge, offers an exceptional opportunity to survey the role of the MAR in shaping connectivity patterns and assemblages of deep-sea megafauna communities in the East and West Atlantic. The diverse geomorphology surrounding the Azores (island slopes, seamounts, hydrothermal vents, and abyssal plains exceeding 5,000m depth) hold an extraordinary diversity of benthic organisms, making this area a cold-water coral hotspot in the NE Atlantic[2].

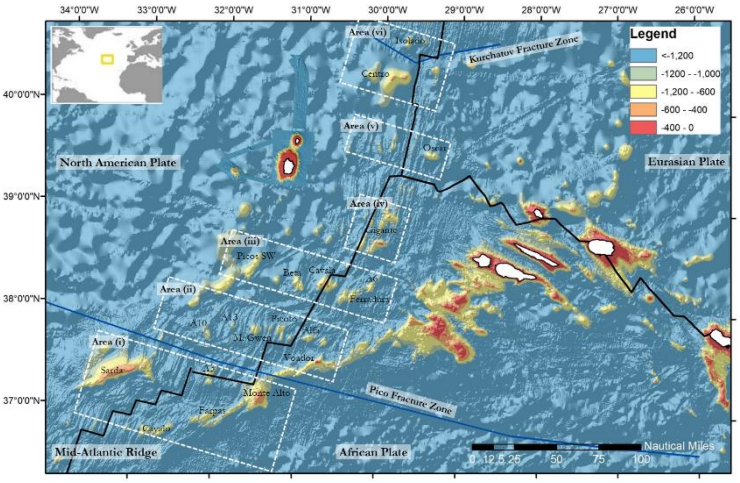

Fig.1 Targeted geographical region and exploration locations on the MAR

Tentative areas to explore (Fig. 1) include from S to N: (i) Monte Alto, Farpas, Espadarte, Cavalo, A3 and Sarda seamounts and ridges; (ii) Voador, Alfa, Picoto, MenezGwen, A13, and A10; (iii) A6, Ferradura, Cavala, Beta, and Picos SW Flores; (iv) Gigante Seamount Complex; (v) Oscar, and 3 unnamed features, and (vi) Centro, Isolado, 4 unnamed features, and the Hard-Rock Café seamount.

Brief Summary of Current State of Knowledge

Biogeographic studies indicate that deep-sea coral species in the Azores region showed mixed biogeographic affinities; greater to the Lusitanian-Mediterranean biogeographic region than to the NW Atlantic[2]. Dissimilarities between the deep-water coral fauna on both sides of the MAR were noted at local and wider scale studies[3], raising the question on whether the Mid Atlantic Ridge can effectively represent a boundary for the genetic connectivity between the east and west Atlantic[4]. However, there has been considerably few explorations on seamounts, ridges and other topographic features along the MAR, since most scientific research in the region has focused on known hydrothermal vent field such as Lucky Strike, Rainbow, or Menez Gwen. The recent Blue Azores deep-sea explorations to the MAR around the Azores led by Telmo Morato and Marina Carreiro-Silva have discovered many new deep-sea coral and sponge areas that fit the FAO vulnerable marine ecosystems (VME) definition, a new hydrothermal vent[5] (Fig. 2), and many new species, biotopes and habitats.

Fig 2. The new hydrothermal vent field discovered on June 16th 2018; named "Luso" and the new VME area discovered in Gigante area with exuberant Paragorgia johnsoni which forming dense coral gardens.

Rationale for Future Exploration

Future exploration in the MAR will aim to use the most recent technology to understand the role of the MAR in shaping trans-Atlantic deep-sea biogeography, connectivity patterns and assemblages of deep-sea megafauna. Additionally, the exploration strategy aimed to (i) map, locate and characterize deep-sea coral and sponge communities inhabiting unexplored seamounts and ridges in the MAR in the Azores Region, (ii) explore new hydrothermal vent fields in the Gigante seamount complex area, (iii) identify new areas that fit the FAO vulnerable marine ecosystems definition; and (iii) determine distribution patterns of deep-sea benthic biodiversity in the Azores. The results of this explorations will also contribute to identify the environmental drivers that determine the spatial distribution of deep-sea benthic biodiversity in the Azores region, evaluating at the same time the role played by the Mid-Atlantic Ridge as a barrier between the western and the eastern parts. It will also provide valuable information to enhance the predictive capabilities for VMEs, and to inform Good Environmental Status (GES), Marine Spatial Planning (MSP) and provide new insights on how to sustainably manage deep-sea ecosystems.

Comparative exploration could be conducted on both sides of the MAR, and along its fault scarps and rift valleys of such as those close to the Pico Fracture Zone, and the Kurchatov fracture zone (Fig. 1), where plume signals have been detected, potentially indicating the presence of active hydrothermal fields[6]. Here, we suggest to explore under-visited portions of the MAR and associated seamounts between 400 and 1200m deep. Exploration could focused both potentially pristine and non-pristine areas as evaluated by local Vessel Monitoring System data that holds much better resolution than the recently launched Global Fishing Watch dataset[7]. On each sampling location we suggest to collect multibeam data for seabed mapping and ROV dive planning, fishery research ecosounding transects for detection of fish aggregations, ROV transects to survey deep-sea coral and sponges megafauna communities and to collect biological, water and sediment samples for biodiversity analyses, metagenomics and connectivity studies. Water masses properties could also be characterized by sampling seawater and measuring physical-chemical parameters.

RELEVANT PARTNERSHIPS

This white paper is presented under IMAR plans for an improved mapping of vulnerable deep-sea benthic communities in the Azores. This line of research has been developed under relevant partnerships with H2020 international research project ATLAS, SPONGES and MERCES, and Azores funded research projects MapGES. Exploration of the areas proposed here may contribute to the Atlantic project currently submitted to the H2020 program. This white paper was also developed in close collaboration with papers being developed in the context of ATKAS and SPONGES projects.

References: [1] Priede et al. (2013) Mar. Biol. Res. 9: 624–628; [2] Braga-Henriques et al. (2013) Biogeo. Disc. 10; 529–590; [3] Watling & Auster (2005) Cold-water Corals and Ecosystems, Springer, p. 279-296; [4] Mironov et al. (2006) KMK Scientific Press, Moscow; [5] https://phys.org/news/2018-06-extraordinary-hydrothermal-vent-discovery-mid-atlantic.html; [6] Chin et al. (1998) Earth Planet. Sci. Lett.162:1-13; [7] Kroodsma et al. (2018) Science, 359: 904-908.