SPOTLIGHT 11 | Dom João de Castro Seamount

38°13.4'N, 26°36.4'W

By Ricardo S. Santos, Fernando Tempera, Ana Colaço, Frederico Cardigos, and Telmo Morato

Dom João de Castro is an isolated seamount located in the Azores archipelago (Northeast Atlantic), between the islands Terceira and São Miguel. The shallower parts of this seamount were formed in 1720, when a volcanic cone emerged from the sea that reached ~ 1-km across and 150-m high (Weston, 1964). This cone was eroded by ocean swells in just four months, and today only a large submerged caldera (300–600 m in diameter) remains whose bottom is at 50-m depth and top is at 13-m depth. Dom João de Castro is an important fishing ground both for demersal fish, such as the black-spot seabream *Pagellus bogaraveo* and the blue-mouth *Helicolenus dactylopterus*, and tuna pelagic visitors.

Dom João de Castro is the only seamount classified as an EU Natura 2000 site (Figure 1), and it is unique in the Atlantic Ocean because of its energetic shallow-water hydrothermal activity (Figure 2). Gas and warm fluids are released in a small area (100 x 50 m) at the bottom (16–45-m depth) of the northwestern sector of the topmost part of the caldera. The source of the gas, mainly CO_2 with lesser H_2S, H_2, and CH_4, is a magma chamber located between 1 and 5 km beneath the seafloor (Cardigos et al., 2005). Filamentous fungi, metal-resistant bacteria, and thraustochytrid protists suggest adaptation to the metal-enriched waters (Colaço et al., 2006; Raghukumar et al., 2008). Marine mollusc assemblages identified around the vents are clearly distinct from those found outside the vent influence (Ávila et al., 2007) but no typical chemosynthetic hydrothermal

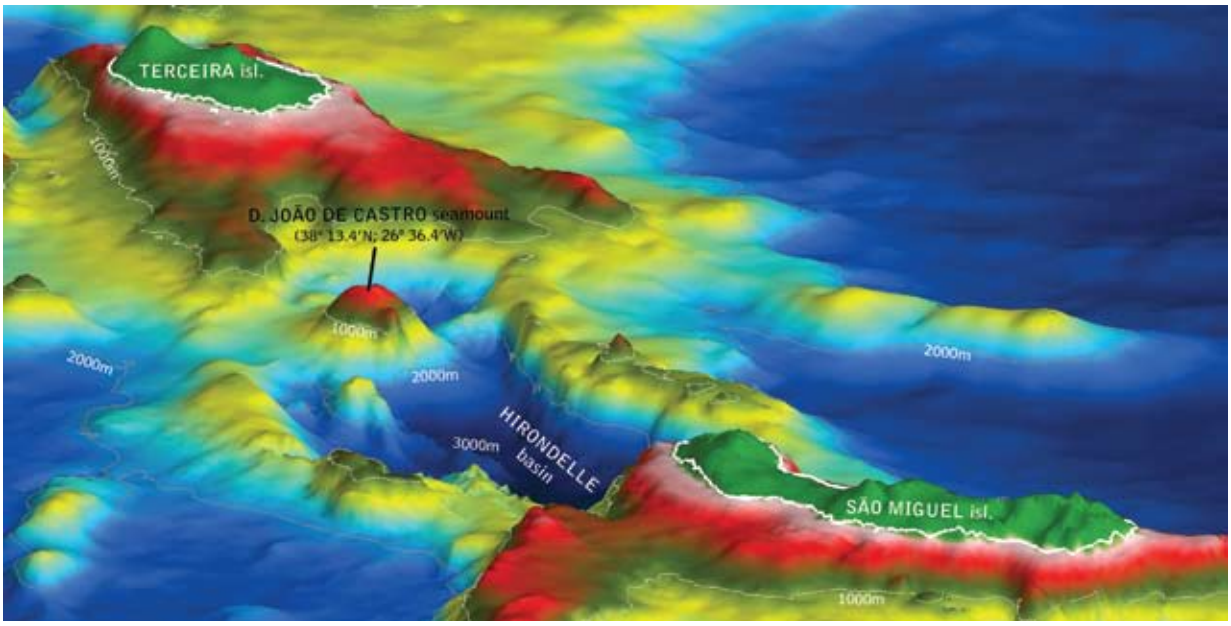

Figure 1. Perspective of Dom João de Castro Seamount (vertical exaggeration: 5X) located on the Terceira Rift, between the Azorean islands of São Miguel and Terceira. *Graphics: F. Tempera ©ImagDOP. Bathymetry data credits: Lourenço et al., 1998*

Ricardo S. Santos *(ricardo@uac.pt) is Professor and Director, Instituto do Mar (IMAR), Instituto de Sistemas e Robótica (ISR), and Department of Oceanography and Fisheries, and Dean, University of the Azores, Horta, Faial, Portugal.* **Fernando Tempera** *is Research Fellow, IMAR, ISR, and Department of Oceanography and Fisheries, University of the Azores, Horta, Faial, Portugal.* **Ana Colaço** *is Research Fellow, IMAR, ISR, and Department of Oceanography and Fisheries, University of the Azores, Horta, Faial, Portugal.* **Frederico Cardigos** *was Assistant Researcher, IMAR, ISR, and Department of Oceanography and Fisheries, University of the Azores, Horta, Faial, Portugal, and is currently Regional Director of Environment of the Azores, Azores, Portugal.* **Telmo Morato** *is Research Fellow, IMAR, ISR, and Department of Oceanography and Fisheries, University of the Azores, Horta, Faial, Portugal, and is also with the Oceanic Fisheries Program, Secretariat of the Pacific Community, Noumea, New Caledonia.*

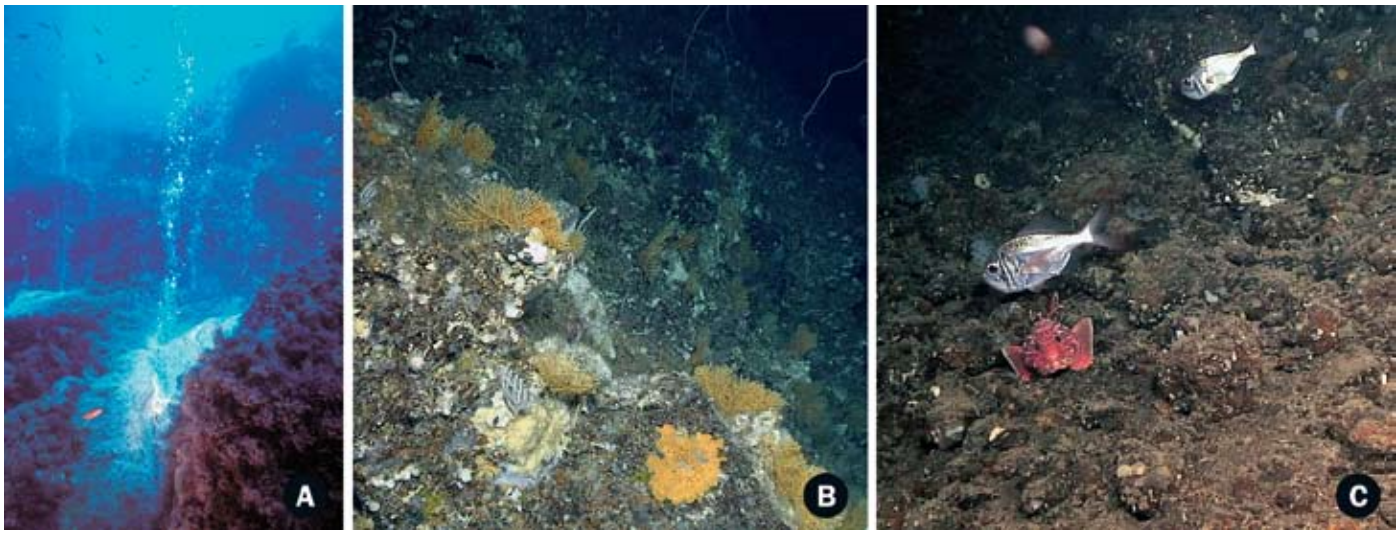

Figure 2. (A) Shallow-water hydrothermal vents at the top of the Dom João de Castro Seamount sustaining bacterial mats of *Beggiatoa* sp. (B) Coral garden dominated by *Acanthogorgia* sp. (C) *Hoplostethus mediterraneus* and *Trachyscorpia cristulata echinata*, two typical deep sea fish at this seamount. *Photo credits: (A) L. Quinta ©ImagDOP. (B) and (C) EMEPC*

vent fauna has been found in these areas (Colaço et al., 2006). Areas of brownstained sediment were identified that indicate the presence of oxidized iron. Benthic communities dominated by the whip coral *Viminella flagellum* were found between 180- and 510-m depth on the seamount's flanks. Stands of *Acanthogorgia* and deep-sea oysters were recently discovered in areas 500–600-m deeper during dives with the remotely operated vehicle *Luso*.

Plankton hauls, down to 100-m depth and covering different distances to the crown, revealed the presence of 35 fish larvae taxa, belonging to seven families. The community was largely dominated by the mesopelagic Myctophidae *Ceratoscopelus maderensis* and some Gonostomatidae, which are typical of the oceanic environment. Mesozooplankton gradients, with an evident "biomass hole" in the proximity of the summit, may be related to the "seamount effect" (Sobrinho-Gonçalves and Cardigos, 2006).

Furthermore, Dom João de Castro Seamount may provide a scenario for studying the influence of depth on the presence of endemic chemosynthetic hydrothermal vent fauna. Evidence of mid-depth hydrothermal vent activity has been reported on its southeastern flank, where gas bubble plumes and positive anomalies of CH_4 and H_2 were found in the seawater between 150- and 350-m depth (Cardigos et al., 2005). The first attempts to visually survey the area using an ROV failed in locating the vents, but local hydrothermal activity at 182–193-m depth was indicated by the brown staining of sediments caused by iron oxidation and white patches resembling the *Beggiatoa* mats found in the shallow hydrothermal area (Cardigos et al., 2005). Because vents were not yet observed at these depths, it is unknown whether or not they host chemosynthetic vent fauna.

REFERENCES

Ávila, S.P., F. Cardigos, and R.S. Santos 2007. Comparison of the community structure of the marine mollusks of the "Banco D. João de Castro" seamount (Azores, Portugal) with that of typical inshore habitats on the Azores archipelago. *Helgoland Marine Research* 61(1):43–53.

Cardigos, F., A. Colaço, P.R. Dando, S.P. Ávila, P.-M. Sarradin, F. Tempera, P. Conceição, A. Pascoal, and R.S. Santos. 2005. Shallow water hydrothermal vent field fluids and communities of the D. João de Castro Seamount (Azores). *Chemical Geology* 224(1–3):153–168.

Colaço, A., C. Raghukumar, C. Mohandass, F. Cardigos, and R.S. Santos. 2006. Effect of shallow-water venting in Azores on a few marine biota. *Cahiers de Biologie Marine* 47(4):359–364.

Lourenço, N., J.M. Miranda, J.F. Luis, A. Ribeiro, L.A. Mendes Victor, J. Madeira, and H.D. Needham. 1998. Morpho-tectonic analysis of the Azores Volcanic Plateau from a new bathymetric compilation of the area. *Marine Geophysical Researches* 20(3):141–156.

Raghukumar, C., C. Mohandass, F. Cardigos, P.M. DeCosta, R.S. Santos, and A. Colaço. 2008. Assemblage of benthic diatoms and culturable heterotrophs in shallow-water hydrothermal vent of the D. Joao de Castro Seamount, Azores in the Atlantic Ocean. *Current Science* 95:1,715–1,723.

Sobrinho-Gonçalves, L., and F. Cardigos. 2006. Fish larvae around a seamount with shallow hydrothermal vents from the Azores. *Thalassas–An International Journal of Marine Sciences* 22(1):19–28.

Weston, F.S. 1964. List of recorded volcanic eruptions in the Azores with brief reports. *Boletim do Museu e Laboratório Mineralógico e Geológico da Universidade de Lisboa* 10:3–18.