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TITLE: Characterization of Methane-Seep Communities in a Deep-Sea Area Designated for Oil and Natural Gas Exploitation Off Trinidad and Tobago

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ABSTRACT:

Exploration of the deep ocean (>200 m) is taking on added importance as human development encroaches. Despite increasing oil and natural gas exploration and exploitation, the deep ocean of Trinidad and Tobago is almost entirely unknown. The only scientific team to image the deep seafloor within the Trinidad and Tobago Exclusive Economic Zone was from IFREMER in the 1980s. That exploration led to the discovery of the El Pilar methane seeps and associated chemosynthetic communities on the accretionary prism to the east of Trinidad and Tobago. In 2014, the E/V Nautilus, in collaboration with local scientists, visited two previously sampled as well as two unexplored areas of the El Pilar site between 998 and 1629 m depth using remotely operated vehicles. Eighty-three megafaunal morphospecies from extensive chemosynthetic communities surrounding active methane seepage were observed at four sites. These communities were dominated by megafaunal invertebrates including mussels (*Bathymodiolus childressi*), shrimp (*Alvinocaris* cf. *muricola*), *Lamellibrachia* sp. 2 tubeworms, and *Pachycara caribbaeum*. Adjacent to areas of active seepage was an ecotone of suspension feeders including Haplosclerida sponges, stylasterids and *Neovermilia* serpulids on authigenic carbonates. Beyond this were large *Bathymodiolus* shell middens. Finally there was either a zone of sparse octocorals and other non-chemosynthetic species likely benefiting from the carbonate substratum and enriched production within the seep habitat, or sedimented inactive areas. This paper highlights these ecologically significant areas and increases the knowledge of the biodiversity of the Trinidad and Tobago deep ocean. Because methane seepage and chemosynthetic communities are related to the presence of extractable oil and gas resources, development of best practices for the conservation of biodiversity in Trinidad and Tobago waters within the context of energy extraction is critical. Potential impacts on benthic communities during oil and gas activities will likely be long lasting and include physical disturbance during drilling among others. Recommendations for the stewardship of these widespread habitats include: (1) seeking international cooperation; (2) holding wider stakeholder discussions; (3) adopting stringent environmental regulations; and (4) increasing deep-sea research to gather crucial baseline data in order to conduct appropriate marine spatial planning with the creation of marine protected areas.

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