



SBGf Conference

18-20 NOV | Rio'25

Sustainable Geophysics at the Service of Society

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Submission code: 86NW9XVKYP

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Seismic characterization of shallow gas accumulations on the Amapá continental shelf

Maira Santos (Universidade Federal do Rio Grande do Norte)

Seismic Characterization of Shallow Gas Accumulations on the Amapá Continental Shelf

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Introduction

The Amapá Continental Shelf, located along the Brazilian Equatorial Margin, presents sedimentary and geological characteristics that favor the occurrence of shallow gas accumulations, particularly biogenic methane. Although these accumulations are generally non-commercial, they hold significant scientific and environmental importance, as they may indicate hydrocarbon generation and migration processes and pose geotechnical risks for offshore infrastructure and environmental interventions. Shallow gas accumulations, typically found at depths of less than 1,000 meters below the seafloor, may be of biogenic or thermogenic origin and are identified through features such as bright spots, flat spots, blanking zones, pull-downs, and chaotic zones. This study aims to conduct a preliminary seismic characterization of potential shallow gas accumulations on the Amapá Continental Shelf, focusing on the spatial distribution of sediments that may act as reservoirs or natural seals. To achieve this, high-resolution seismic reflection data are used in conjunction with sedimentological information derived from geological maps, lithological profiles, and regional depositional models, as well as the interpretation of seismic attributes and anomalies.

Method and/or Theory

This study utilizes seismic data acquired in July 2016 in the Varador Channel, near Varador Island, in the state of Amapá, Brazil. The Varador Channel is considered a favorable environment for gas occurrence due to the high concentration of organic matter in the area and the presence of muddy sediments from the Amazon River. The seismic profiles were collected parallel to the channel, with the aim of intersecting paleodrainage features identified on Maracá Island and the adjacent mainland. Data acquisition was conducted using a Sub Bottom Profiler SB512i system coupled with a float system, in accordance with the protocols of NORMAN 25 established by the Brazilian Navy. The equipment was mounted on two floats towed by a vessel, spaced 12 to 16 meters apart. Geolocation was ensured by a Garmin 60CSx GPS integrated with the seismic recording system, while water depths were monitored using a GARMIM echo sounder connected to the SBP. Data interpretation was carried out using ReflexWin 8.1 and SonarWiz 7 software, enabling seismic attribute analysis, the construction of interpreted sections, and the generation of spatial maps.

Results and Conclusions

It is expected to identify seismic features related to shallow gas in the Varador Channel, on the Amapá Continental Shelf, such as bright spots, flat spots, pull-downs, and chaotic zones. The study will also include the development of an initial mapping of regions with a higher likelihood of occurrence, highlighting the influence of sedimentary heterogeneity on the formation and retention of these accumulations. Based on the evaluation of seismic attributes and their corresponding interpretation, the aim is to define the spatial distribution and depth of these accumulations. The results should contribute to the understanding of gas migration and trapping processes along the Brazilian equatorial margin, as well as expand knowledge about the recent geodynamics of the Amapá shelf, also providing support for future environmental, energy, and geotechnical stability investigations.