



SBGf Conference

18-20 NOV | Rio'25

Sustainable Geophysics at the Service of Society

In a world of energy diversification and social justice

Submission code: 56PR7XY069

See this and other abstracts on our website: <https://home.sbgf.org.br/Pages/resumos.php>

A Preliminary Analysis of Distribution and Characteristics of Igneous Intrusions in Offshore Wells of the Potiguar Basin, Equatorial Margin

Linara I. De Castro Rodrigues (Universidade Federal do Ceará), Karen Leopoldino Oliveira (Federal University of Ceará)

A Preliminary Analysis of Distribution and Characteristics of Igneous Intrusions in Offshore Wells of the Potiguar Basin, Equatorial Margin

Copyright 2025, SBGf - Sociedade Brasileira de Geofísica/Society of Exploration Geophysicist.

This paper was prepared for presentation during the 19th International Congress of the Brazilian Geophysical Society held in Rio de Janeiro, Brazil, 18-20 November 2025. Contents of this paper were reviewed by the Technical Committee of the 19th International Congress of the Brazilian Geophysical Society and do not necessarily represent any position of the SBGf, its officers or members. Electronic reproduction or storage of any part of this paper for commercial purposes without the written consent of the Brazilian Geophysical Society is prohibited.

Introduction

Igneous intrusions within sedimentary basins represent key geological features due to their potential to influence petroleum systems by altering thermal maturity, fluid migration, and trap development. Identifying and understanding the distribution and seismic response of these features is important not only for seismic interpretation but also for operational safety. The Potiguar Basin, located on the eastern part of the Brazilian Equatorial Margin is a strategic target for deepwater hydrocarbon exploration, following successful discoveries along its conjugate margin in Africa and in neighboring areas such as Suriname and the Guianas.

Method and/or Theory

This research utilizes well and seismic data to characterize the spatial distribution of igneous intrusions. According to the ANP's (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis) public well database, 388 offshore public wells are registered in the Potiguar Basin but only 198 have composite logs available. Seismic data from 2D and 3D surveys were interpreted to investigate the morphology and reflectivity patterns of igneous bodies. Public well data were compiled and filtered based on the availability of composite logs and evidence of igneous rocks. From this subset, 85 igneous rock intersections were identified and analyzed, documenting characteristics such as intruded formation, rock type, intrusion depth and thickness, and associated well information. The spatial distribution of these wells was also analyzed in relation to seismic availability. Additionally, stratigraphic and depth information was cross-referenced with lithological descriptions to identify and classify intrusive events.

Results and Conclusions

The predominant igneous rock is basalt, followed by diabase, with intrusions commonly emplaced within the Macau Formation, and are often interbedded with sandstones, marls, and shales. Intrusion thicknesses vary widely, from thin features (~4 meters) to massive bodies exceeding 1400 meters. Initial intrusion depths range from ~80 m to over 2700 m, with final contacts reaching nearly 3600 m, indicating both shallow sills and deeper dike systems. Of the 85 igneous intersections identified, 36 wells are associated with 2D or 3D seismic surveys. These provide a dataset for recognizing igneous seismic facies in areas with limited well control, particularly in deep-water regions of the basin where no igneous rocks have been directly sampled. Seismically, these intrusions include high-amplitude chaotic reflectors, discontinuous geometries, and reflectors that crosscut stratigraphy or generate onlap geometries. Features interpreted as sills are often characterized by high amplitude reflectors due to impedance contrasts, restricted lateral continuity, abrupt terminations, and can exhibit saucer shapes or parallel to bedding. Stratigraphic analysis reveals a strong correlation between igneous intrusions and the drift phase formations, especially the Macau and Ubarana formations. These results align with known magmatic episodes, such as the Macau volcanic event, potentially linked to tectonic reactivation in the region. This analysis provides a characterization of the documented igneous intrusions in offshore Potiguar Basin wells and contributes to the understanding of the Brazilian Equatorial Margin. The compiled information can support future geostatistical, geochemical, seismic modeling, and play de-risking efforts in the region.