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INTEGRAÇÃO DE DADOS SÍSMICOS E GEOQUÍMICOS NA CARACTERIZAÇÃO TECTONO-ESTRATIGRÁFICA DA BACIA DE CAMPOS: UM ESTUDO DOS INTERVALOS TURONIANO AO PALEÓGENO INFERIOR

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Integration of Seismic and Geochemical Data in the Tectono-Stratigraphic Characterization of the Campos Basin: A Study of the Turonian to Lower Paleogene Intervals

Introduction

In the Campos Basin, the intervals corresponding to the Lower Cretaceous–Paleogene boundary are characterized by the presence of rollover anticlines and listric faults, evidencing intense tectonic activity during sediment deposition and structural reorganization. The active tectonic regime, influenced by halokinesis, resulted in complex depositional patterns and marked environmental changes, observable through multiple techniques. In order to understand the paleogeographic and structural evolution of the Turonian, Campanian, and Cretaceous–Paleocene transition intervals, more than 130 drilling cuttings samples from wells 1-DEV-16-RJS and 1-BP-6-RJS were analyzed.

Method and/or Theory

For this purpose, seismic facies analysis was combined with well log interpretation, along with the use of lithogeochemical data, aiming to characterize the main stratigraphic and structural elements of the region. The seismic analysis allowed for the identification of unconformities, maximum flooding surfaces, and parasequence boundaries, as well as the delineation of structural features such as listric faults and tilted blocks of the rollover type. Drilling cuttings samples, after undergoing appropriate laboratory conditioning, were used to generate lithogeochemical data, which were integrated with well log data and correlated with the seismic volume. This integration aimed to ensure a more natural correspondence between the different analytical tools, promoting greater coherence in geological interpretation. Both commercial and free software were employed, operating in an integrated manner within a Python environment, enabling systematic and reproducible data processing, analysis, and visualization.

Results and Conclusions

The integration of seismic data with well information contributed to the refinement of the stratigraphic and structural model of the analyzed seismic volume. This integrated approach enabled the reconstruction of depositional environments, the identification of chemofacies and their relationship with seismic facies, as well as the inference of global anoxic events and water column expansion, based on the geometry and stacking of stratigraphic units. In addition, the chemical identification and characterization of the reflector known as the “Cretaceous seismic marker,” which marks the end of the Cretaceous and the beginning of the Paleocene, was achieved. This horizon, predominantly siliciclastic in composition, was highlighted by higher concentrations of elements such as Si, Fe, and Ti. The Si/Ca and Al/Ca elemental ratios proved to be effective indicators for identifying the Maastrichtian transition and the onset of the prominent Cretaceous reflector.The transition from the Cenomanian to the Turonian was also distinguished and found to converge with another characteristic seismic reflector, reinforcing the stratigraphic interpretation based on geochemical signatures. Similarly, the boundary between the Imbetiba and Ubatuba-Tamoios formations was identified through variations in calcium concentrations, which served as effective geochemical markers to delineate these stratigraphic limits. Thus, the study demonstrated the effectiveness of seismic interpretation as a key tool for paleodepositional reconstruction and for understanding the tectonostratigraphic dynamics of the Campos Basin, fundamentally supported by X-ray fluorescence data obtained in the laboratory from cuttings samples.