Geophysical integrated analysis of carbonate *rafts*, post-salt siliciclastic sediments and salt section supporting 3D seismic velocity models for pre-salt reservoir opportunities: the example of the Jabuti Field in the Marlim Complex of the Campos Basin

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Abstract

The salt section of the Marlim Complex of the Campos Basin, offshore the eastern Brazilian margin, presents large thickness variations. In the region of the Jabuti oil field there are some salt domes that reach thickness of about 1 km, contrasting with the distal salt province, where salt walls are thicker than 3 km, and the proximal margin, where residual salt thickness is below the seismic resolution, *i.e.,* of less than a few meters. This variation is related to salt flow, resulting in development of Albian carbonate blocks that are displaced basinward, forming *rafts* sometimes over a few km in diameter, having thickness around 1 km in the thicker portions, constituting targets for petroleum exploration. The structural interactions of the salt section with the carbonate *rafts* and the post-salt siliciclastic sediments are controlled by the extensional tectonic context. Listric normal faults with large throws generate complex geometries, resulting in large lateral velocities contrasts involving the salt and the overburden. The salt, carbonate and siliciclastic minerals exhibit different seismic velocities: ranging from 3000 m/s (siliciclastic overburden) up to 6000 m/s (the anhydrite layers within the salt section). Such lateral heterogeneity poses challenges in building velocity models, especially for seismic migration and depth positioning. The adoption of methodologies covering the geological characterization of these carbonate and salt bodies, considering their external geometries because of halokinetic processes, has been tested as an approach to enhance the velocity models, indicating reliable trends in terms of geological context. However, even with quality imaging regarding the external geometry, we need to populate and calibrate the model with internal properties such as an equivalent of the well-log sonic velocities. A similar approach applied only to the salt bodies in the Santos Basin, located south of the Campos Basin, delivered enhanced results. However, in the Santos Basin the pre-salt section constitutes the main target for petroleum exploration, and processing is focused on the salt section. In the study area, near the outer high of the Campos Basin, in addition to variations in the salt section we must consider the geometry of the carbonate *rafts* in order to deal with the geological complexity regarding these referred seismic velocities. Therefore, the manipulation of several available wells provided by ANP resulted in a first approach to obtain accurate information for the velocity model building. We discuss two main aspects: the introduction of geological boundaries to build accurate models, and the use of well-log sonic velocity analysis in different provinces, providing feasible information to populate the built models. The combined analyses take into consideration the presence of listric faults with post-salt growth sequences, the presence of carbonate *rafts* and variations in the salt section. This work presents the well-log velocity analysis and the velocity model improvements that have affected the positioning of the pre-salt horizons and reservoirs to allow better project decision.