Geophysical and Log Characterization of Roncador Field , Campos Basin, Brazil

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ABSTRACT

Roncador oil field is a giant accumulation located in the northern area of Campos Basin, Brazil, in a bathymetric contour varying from 1,500 to 1,900m. The reservoirs are maastrichtian turbidites and based upon their distribution, the field may be divided in three areas (SE, SW na N). In the southeastern part five main zones are identified; the sandstones are interbedded with shales and only the upper part may be associated to conventonal sesmic amplitude anomaly. In the southwestern area of the field, the turbidites are amalgamated, indicating incomplete depositional cycles except the highest part of the sequence where interbedding shales are present. The northern area of Roncador acted as a bypassing zone during the lower sandstone deposition time in the southern area of the field and only the the upper reservoirs were deposited. The sandstones are characterized by textural and compositional immaturity. The rate of subsidence associated with halokinesis and the preservation of sediments from erosion control the reservoir distribution differences along the field.

Roncador giant oil field is located in the northern area of Campos Basin, 130 km from the coast in a bathymetric contour from 1,500 to 1,900 m. Campos basin is located in the southeastern coast of Brazil and covers an area of about 100,000 km^2 from the coast to the 3,400 m isobath. It is separated from Espirito Santo basin by the Vitoria High to the north and from Santos basin by the Cabo Frio High to the south. (**Fig. 1)**.

Tectono-sedimentary evolution of Campos basin can be divided into three main stages: rift (source rocks of hydrocarbons) , transitional (siliciclastics, marls, carbonates and evaporite deposition at the top) and a drift stage that started with shallow water carbonate sedimentation which was covered by deep water sediments. (Rangel et al.1).

The discovery well 1-RJS-436A, located in the southeastern part of the field, drilled 153 m of Maastrichtian turbidite reservoirs divided into five main zones, interbedded with shales related to the nanofossils biozones N-290 and N-280. The integrated well and seismic data **(Fig. 2)**, besides additional geological data available for the area, such as biostratigraphic, sandstone reservoir prediction maps, oil migration studies, etc. gave support for the wildcat proposal. Only the upper zones can be associated to amplitude anomaly in the conventional seismic and can be traced laterally on seismic profiles. In the lower zones the reservoirs do not present significant acoustic impedance contrast with encasing shales. (Rangel et al. 2).

In the southwestern part of the field the turbidites reservoirs present a different distribution, which was confirmed by a second well drilled near to the pinch out of the Maastrichtian turbidite sequence that onlaps against an Albian structural high. The sandstones and shales, like in the lower zones of the southeastern part of Roncador, do not present expressive seismic amplitudes. In this area most of the N-290 turbidite sandstone reservoirs are amalgamated, indicating incomplete depositional cycles, without interbedding shale among the cycles. It was drilled a third well in the highest part of this area. Besides the reservoirs sampled in the second well, it preserved depositional cycles in the upper part of the sequence, interbedded with encasing shales. In the basis of the sequence it occured N-280 Maastrichtian turbidite sands, similarly to the eastern area (1-RJS-436A). (Santos et al., 1998)

In the northern area, where it was drilled two other wells, the reservoir distribution is different from the south. The lower sands were not deposited and the reflectors correspondent to the upper reservoirs can be traced on seismic profiles for over 10 km laterally.

Sandstone reservoir is characterized by textural and compositional immaturity. Based upon core and thin sections analysis, sandstone framework is associated with angular grains composed of quartz, potassium and sodium feldspars, volcanic rocks fragments, amphiboles and metamorphic and igneous rocks fragments. Parallel to the basin margin, about 80 km from Roncador field, there is a main structural feature named Campos fault. On the western region of this fault, volcanic and crystalline rocks were exposed until the Early Eocene and they were partially the source for Roncador turbidite reservoirs. Sediments previously deposited within the basin were partially reworked and they also served as source rock for these turbidites.

Reservoir distribution differences in the three areas of Roncador field (SE, SW and N) are controlled essentially by two factors: rate of subsidence related with halokinesis and preservation of sediments from erosion. In areas with more intense subsidence associated with halokinesis, it was possible to deposit and preserve more complete depositional cycles of turbidite sandstones and capping shales, such as in the southeastern area of the field. Where the subsidence was not so intense, there was turbidite sandstone deposition, but each cycle was partially eroded and the sands were amalgamated with the following cycle, not preserving the finer sands and shales, as it occurs in the southwestern part of the field. In the northern area, subsidence occured later than in the other areas, and the turbidites were more regionally distributed, presenting similar thickness of sandstones and capping shales. Older turbidite sandstones present in the southwestern and southeastern areas were not deposited in the northern area which it acted as a bypassing region. The geologic section **(Fig. 3)**, in the southern area of the field illustrates the efect of the halokinesis in the distribution of the turbidites and trap formations in the field. In the eastern area, as previously described, the sand beds are individualized and in the western area they are amalgamated due to the differential intensity of subsidence.

The structural and seismic attribute maps illustrate the depositional pattern of the sands and the effects of the halokinesis in the distribution of the turbidites. Several seismic facies identified in the turbidite sequence are related to Maastrichtian depositional and erosional aspects. (Santos et al., op.cit.)

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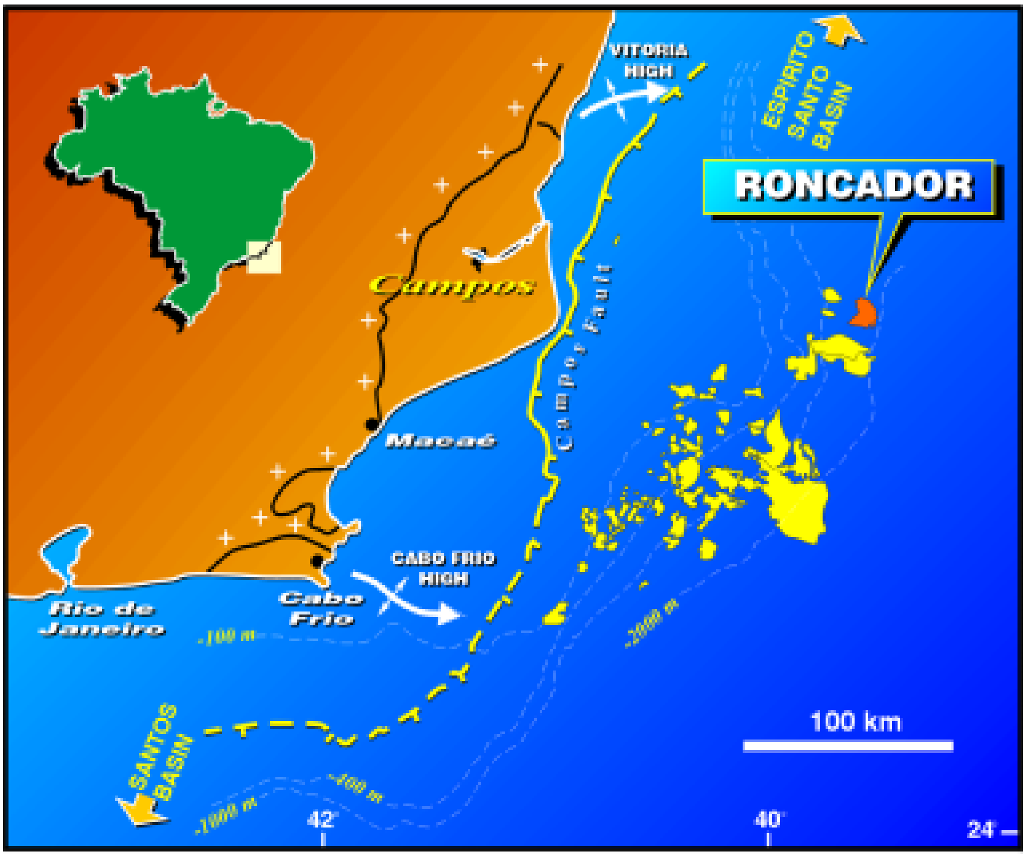

Fig.1: Location Map

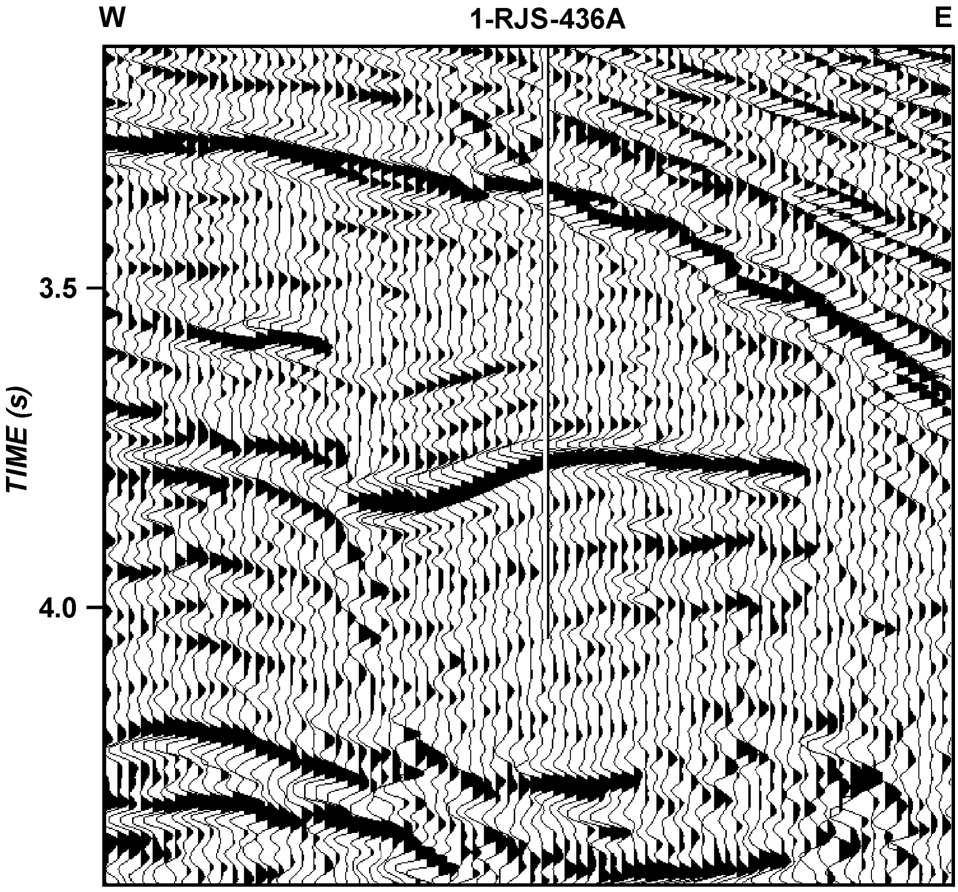

Fig.2 - Seismic Profile at Roncador Field Area

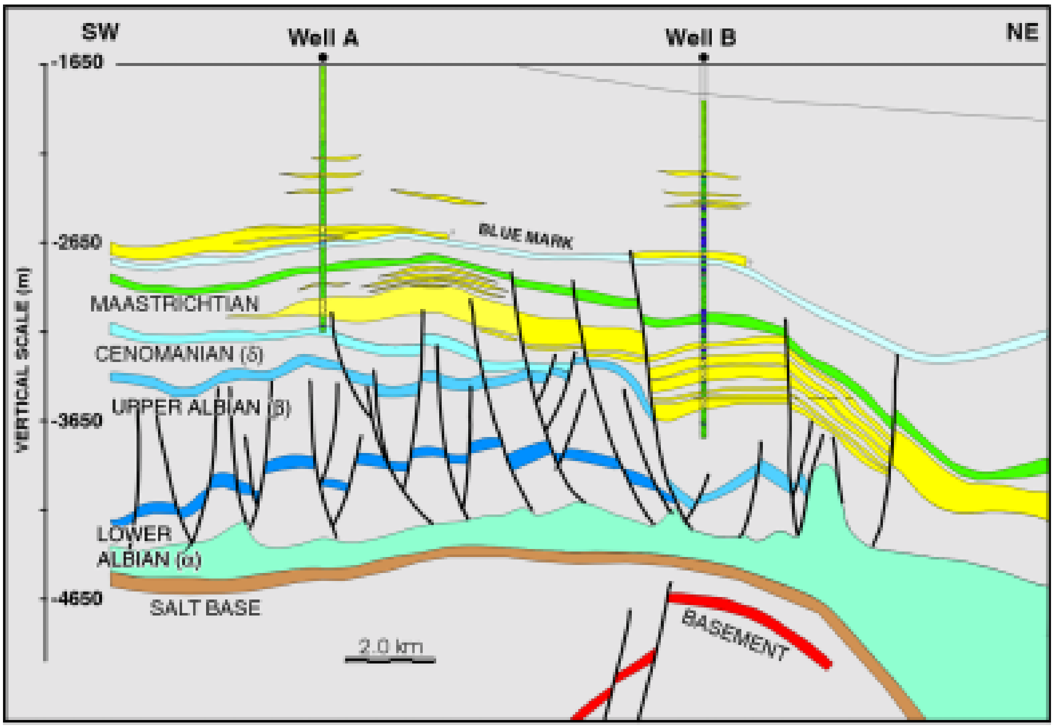

Fig.3: Geologic Structural Section