Distribution Pattern and Sedimentation of the Neogene Deep Water Section in the Campos Basin, Offshore Brazil.

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Abstract

- **The Statement**

The Campos Basin, offshore Rio de Janeiro State, was a deposition site of a thick deep-water sedimentary section (maximum of 2500 meters) on the continental slope and basin during the Neogene (fig.1).
In Campos Basin the cycle boundaries are the key elements of sequence stratigraphy which can be identified in seismic sections by conventional seismostratigraphy methods, well log correlation and biostratigraphy. Several third-order unconformity events were identified in the studied interval (fig.2). Despite the good correspondence of cycle boundaries with the global eustatic lowering, the sequence stratigraphy model does not explain the sequence pattern observed in Campos Basin. This holds true especially with regard to the nature of deep-water wedges and some erosional unconformities associated with them. These wedges consist entirely of deep-water facies with bathyal faunas, differently from the conventional sequence stratigraphy model (fig.2).

- **Description of the majors geological and Seismic caracteristics**

The most representative seismic geometries in the Neogene interval are represented by huge sigmoidal bodies that prograde and climb up toward offshore in dip-oriented sections. Each sigmoidal body is separated vertically from adjoining bodies through an erosional surface, correlative conformities and onlap surface (fig. 2). During the Miocene, these sigmoidal bodies gradually shifted their preferential directions of progradation from southeast to northeast in response to bottom current dynamics. The well-log signature of sigmoidal bodies present a cyclic pattern, with low-frequency cycles in the central portion and high-frequency cycles toward the distal portion. These cycles are easily correlated all along each sigmoidal body. In core analyses they are represented by centimetric to decimetric rhythmic mudstone-marlstone bundles in distal portions, and bioturbated silty-sandy mudstone with metric thickness, in the central portion of the body.

The Miocene sigmoid sets overlap a basal sandy interval interpreted as a mixed deep-water system. This comprises a pile of sedimentary rocks originated by gravitational flow and bottom current reworking processes during the late Oligocene and early Miocene. The seismic facies of the basal sandy interval shows high amplitude reflection due to its very low velocities when compared to relative high velocities of adjacent hemipelagic deposits. It results in excellent impedance anomaly. The well-log signature of these massive sandstone bodies generally presents a box-like pattern, changing to a irregular pattern when associated with sandy mudstone and sandstone interbedded with mudstone.
The deep water sandstone facies range from conglomerate to sandy mudstone deposited as gravitational mass-flows. They have been interpreted as debris flows, high-density turbidity flows, and less commonly graded, fine-grained sediments formed by low-density turbidity flows. Bottom current reworking facies are mainly represented by fine-grained sediments that normally present traction structures or intense bioturbation. Deposition of the hemipelagic facies took place in bathyal environments through slow planktonic 'rainfall' on the sea-floor along with deposition of the terrigenous (silty-clayey) fraction, both subject to bottom current action of variable intensity.

- **Conclusions**

The hemipelagite and bioturbated sandy-silty mudstone facies are the main constituents of deep-water sigmoidal wedges. Because their deposition was submitted to the action of bottom currents, these sigmoids must be considered as contourite drifts.

Although eustatic sea-level changes play a role in this process, the origin of deep water wedges and major erosional unconformities is best explained by changes in oceanic circulation pattern modulated by climatic changes. The Neogene deep-water section of the Campos Basin clearly records some important paleoceanographic events of the South Atlantic. For instance, the Oligocene - Miocene boundary corresponds to a period of intense global deep-water marine circulation brought about by the Circumpolar Antarctic Current, originated by the opening of the Drake Passage.

Coeval events in the Campos Basin include a regional deep-water unconformity and extensive reworking of deep-water sandstones. Two other great deep-water unconformities in the Campos Basin, of middle Miocene (~16.5 Ma) and late Miocene (between 5.5 and 8.2 Ma) ages, correlate respectively with the well known East and West Antarctica glaciations. This demonstrates that Neogene erosional and depositional events in the Campos Basin were controlled by the intensity of bottom currents, the sediment supply/dispersal ratio, and the interaction of bottom currents with the basin morphology.

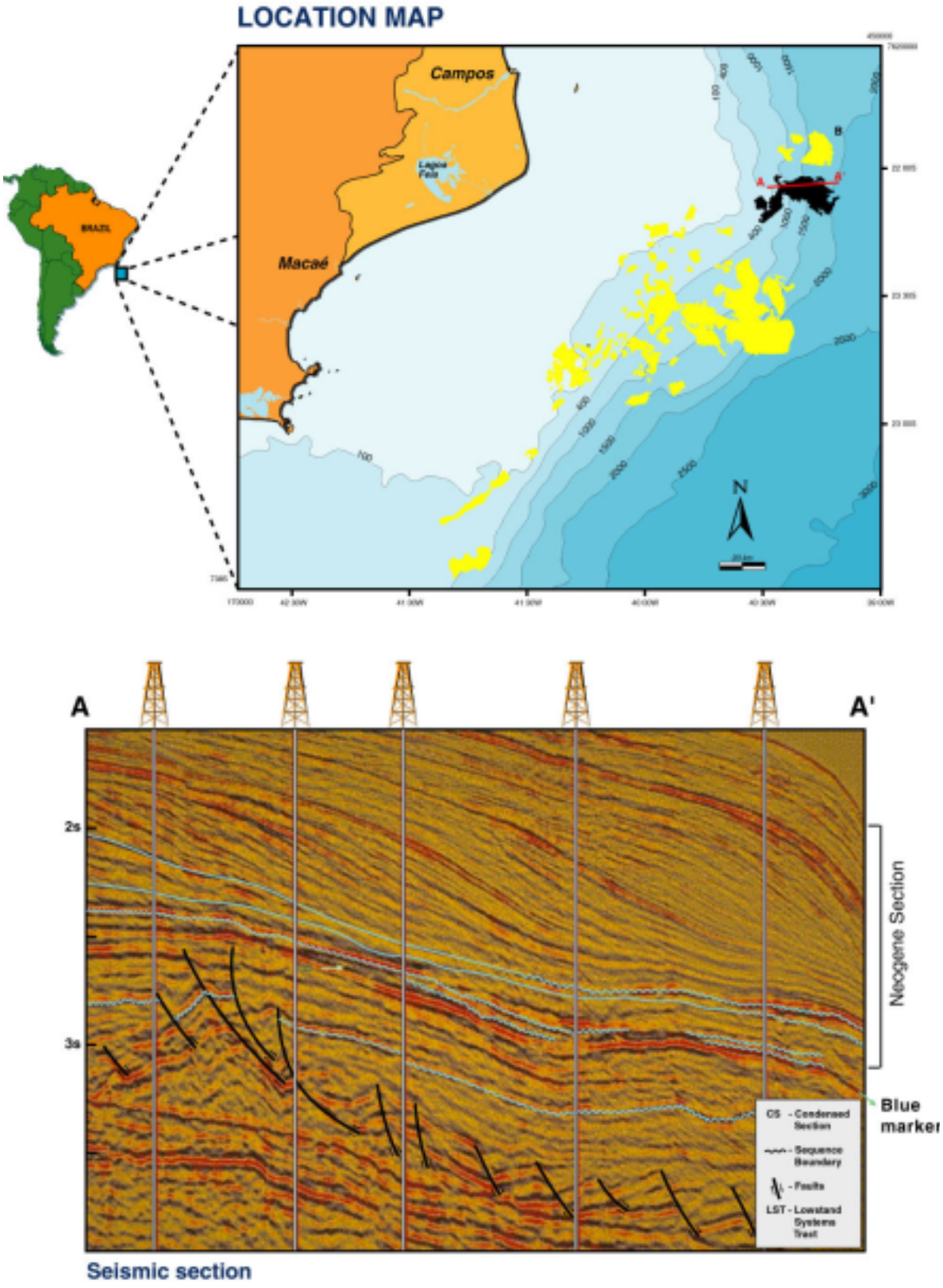

Figure 1 - Location map and seismic section through the Albacora oil fields.

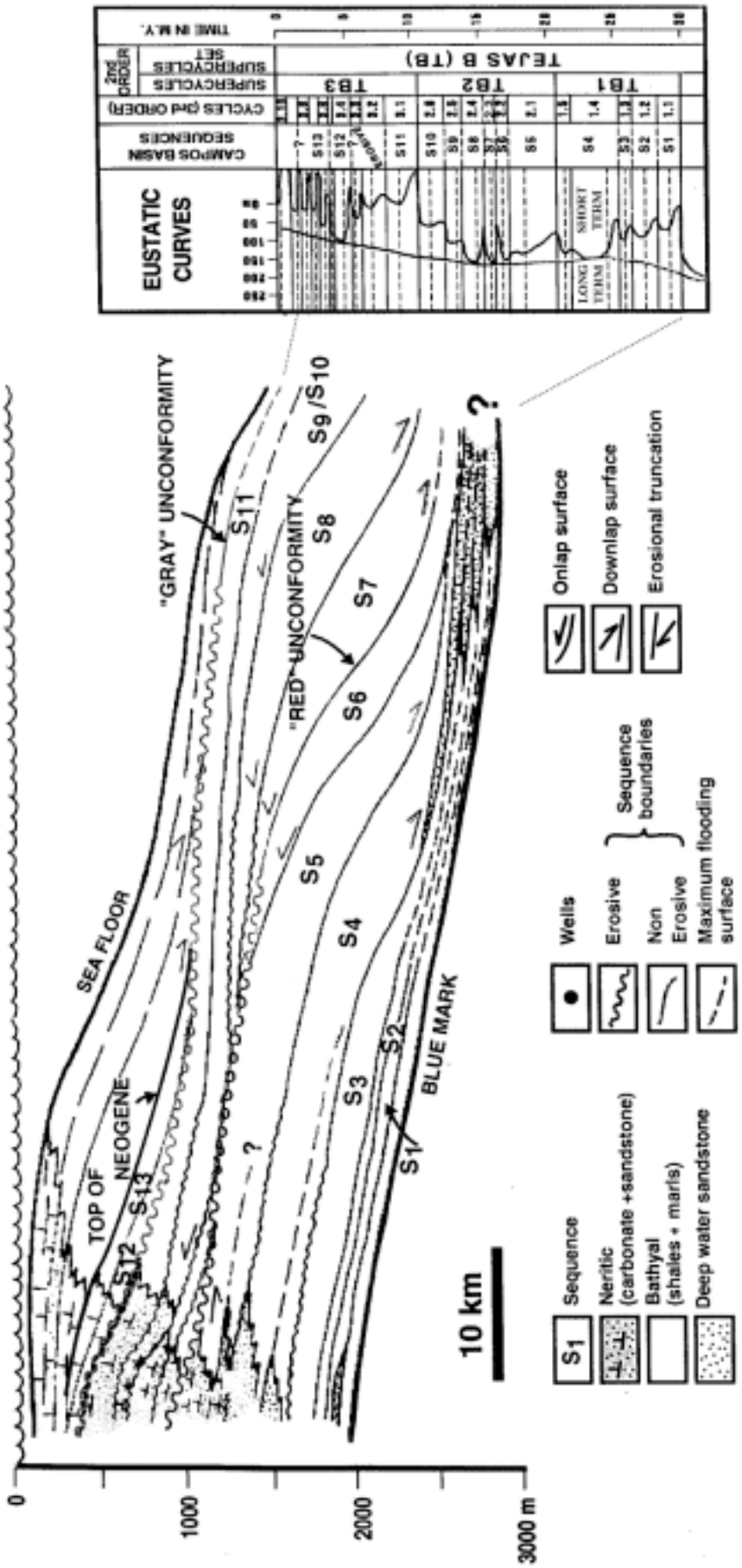

Figure 2 - Neogene deep-water stratigraphic signature of the Campos Basin correlated with eustatic global curve.