3D PETROLEUM SYSTEMS MODELLING AS A CONTRIBUTION TO RISK ASSESSMENT (SOUTHERN ESPIRITO SANTO BASIN, OFFSHORE BRAZIL)

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In order to assess the charge risk for several prospects and leads in the southern Espírito Santo Basin, a petroleum system model was simulated and interpreted (Figures 1, 2). Input data was derived from both 2D and 3D seismic interpretation since the 3D data alone did not cover the entire hydrocarbon kitchen area. Access to geochemical data was limited and because well information is sparse in the area, scenario testing was regarded as the best approach. Qualitative calibration with an existing discovery nearby was achieved; and thermal calibration is according to data that came from a regional dataset thus using an average geothermal gradient.

Model findings helped significantly to define the charge risk for different prospects and leads in the exploration block. Effective charging from the marine Campanian source candidate to the Eocene reservoirs is highly probable in the western part of the area, whereas the gas-prone Palaeocene source candidate most probably charged only the eastern and northeastern part of the study area. Sources older than Campanian show a very low probability of HC charge to the Eocene reservoirs. Qualitative calibration with the Peroa gas-condensate accumulation to the west was achieved by assuming a Campanian source rock. Consequently, charge risking of individual prospects and leads was based on the assumption of such a source rock. However, for the entire study area, the main risk is the presence of this source rock and therefore the timing of hydrocarbon generation and migration. A number of uncertainties remain because well information on source rocks and regional lithofacies was limited and geochemical data from nearby hydrocarbon discoveries were not available. The results, in combination with the assessment of reservoir presence and trap definition, were used to guide further exploration activities in the area.
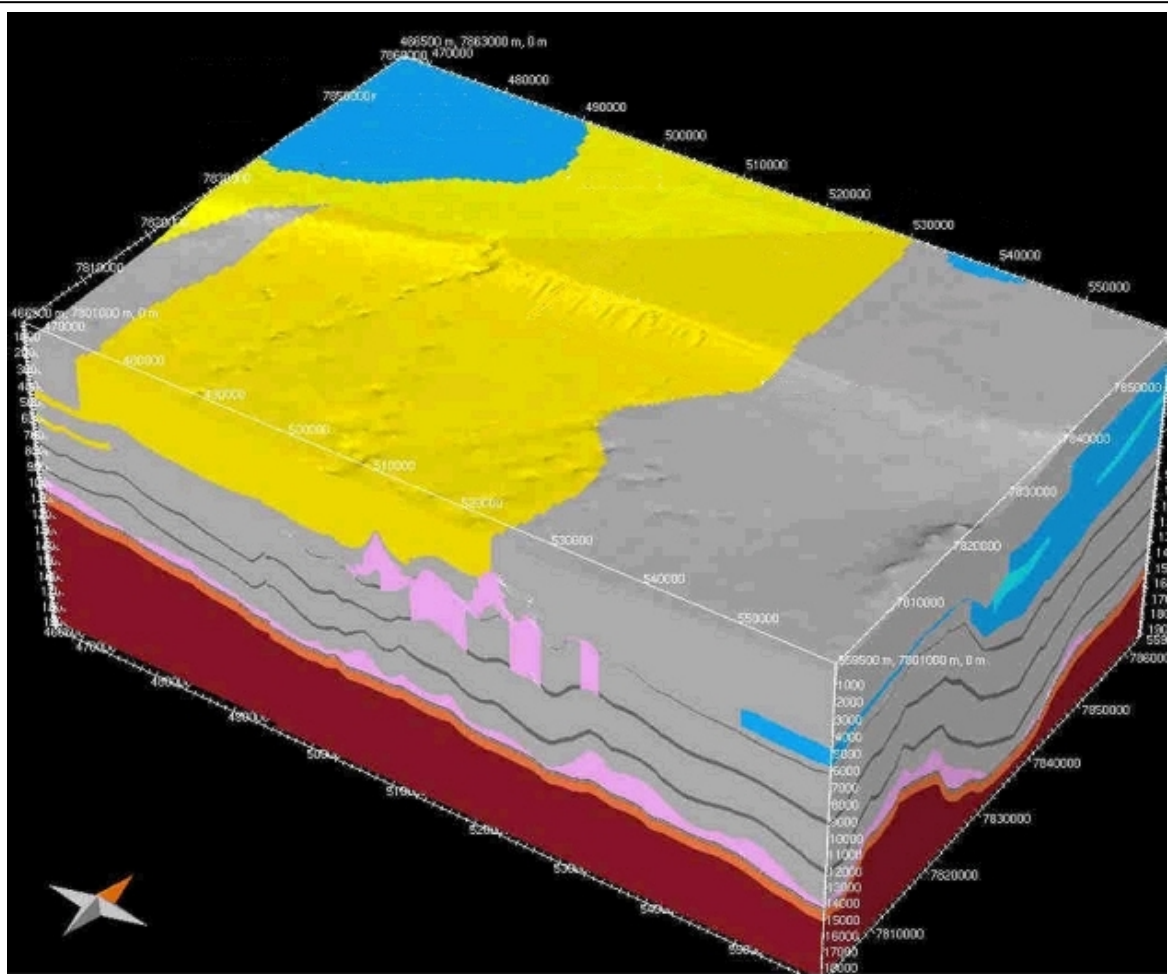
Figure 1: Outline of the 3D model showing the present day geometry and the assigned lithofacies (grey: shale, yellow: sand, blue: limestone, pink: salt, orange; coarse sands, red: basement).
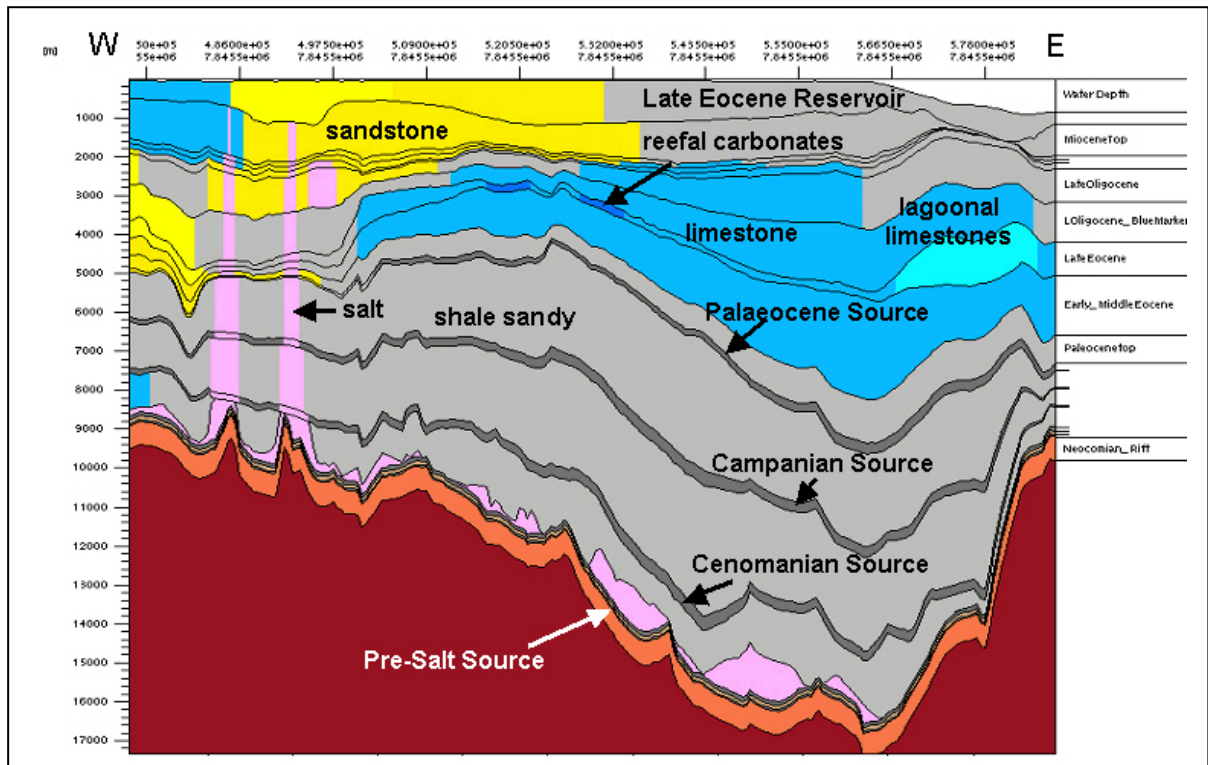
Figure 2: Representative 2D section showing facies assignment and source candidate positions (lithology colours are the same as in Figure 1).