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Seismic Quantitative Evaluation of a Gas Discovery using 3D Elastic Inversion Data and Seismic Forward Modelling: a Deepwater Case History in the East Nile Delta (Egypt)

This paper describes the use of angle-stack 3D seismic data to define lithology and pore-fluid content in the gas-bearing Pleistocene turbiditic channel drilled by a well in the deep-water of the East Nile Delta (Egypt). The well encountered a complex-lithology reservoir characterized by a main gas sands associated to an upper and a lower thin-beds unit.

A complete set of log information was available for AVO and acoustic/elastic cross plot analyses. Both elastic inversion and seismic forward modelling were applied and integrated together starting from conceptual acoustic and elastic models describing different responses to variations in lithology and pore fluid content.

Reservoir seismic interpretation was performed and based on the reference acoustic/elastic model integrated with the AVO analysis. Amplitude and waveform classification maps at the reservoir level were derived and interpreted on the basis of the reference acoustic model. These maps were integrated with the acoustic/elastic attributes information and used for the delineation of the gas-bearing reservoir segments.

The seismic forward modelling demonstrated that only the main gas sand interval is detectable but below seismic resolution. A synthetic pseudo-well database was generated to represent geologically reasonable thickness and petrophysical changes. This made possible to define quantitative reservoir properties (net hydrocarbon in place) for the main gas sand interval. Conversely, elastic attributes maps were used to calibrate (semi-quantitatively) the upper and lower thin-beds units. The final integration of such seismic results enabled to calculate according to a deterministic approach a value of the gas in place (OGIP) associated to the discovery.