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Seismic Attribute-based Litho-facies Mapping in a Late Miocene Atoll Reef Tract Offshore Tunisia by Integration of 3D and Wireline Log Data

Coherence processing focussed on fault plane detection in the Ashtart 3D seismic cube offshore Tunisia revealed a spectacular Upper Miocene atoll reef tract. The pattern of a series of coherence time slices allowed to differentiate carbonate sedimentary environments and reef build-ups, and monitored the evolution of the reef tract through time. In order to evaluate the potential of seismic attributes for litho-facies, porosity and diagenesis analysis in this modern reef environment, the most prominent amplitude was mapped and processed by advanced techniques, and calibrated by wireline log data. Gamma-ray, sonic and density data from selected wells intersecting different coherence facies types were analysed to compare the seismic and log signals from reef build-ups, lagoons and off-reef areas. According to the well data the reef tract has a thickness between 27 and 38 m or about 30 ms. Sonic log shapes of a reef build-up indicate a succession of thick-bedded, massive limestone beds separated by thin shale layers. Sonic log shapes of lagoonal environments are cylindrical and homogenous, indicating the lack of shale. Off-reef environments around the atolls are characterized by limestone-shale intercalations forming 5th-order shallowing-upward cycles. Based on the log interpretations the reflection-strength map highlight acoustic impedance variations due to facies-controlled bedding pattern and cyclicity. Lateral velocity and density contrasts due to compaction, diagenesis and porosity can be picked by amplitude processing. Differences in reef growth controlled by the paleo-environmental conditions are evidenced by the time-dip map reconstructing the relief between atoll reefs, lagoons and off-reef areas.