

# **New Insights on the Cenozoic Carbonates of Northwest Australia from a High-Definition Seismic Attribute Workflow**

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## **Abstract**

A new seismic attribute workflow has been developed to investigate the geomorphology and the sedimentary processes affecting Cenozoic successions in the Northern Carnarvon Basin in Northwest Australia. The Cenozoic sediments started as a non-tropical carbonate ramp in the Late Paleocene but in the Middle Miocene to Pliocene carbonate growth was ceased by siliciclastic influx of shelfal and shelf-edge deltas. The accumulated delta lobes resulted in a topographic high that creates a favourable condition for shallow-water tropical carbonate production in the Late Pliocene. New insights into this unique setting have been fully captured with the application of a high-definition seismic attribute workflow. The newly developed workflow starts with a preconditioned seismic volume using structurally oriented noise removal filters in order to remove random and coherent noise from the input data. It also benefits from a high-definition frequency decomposition that presents high vertical and lateral localisation utilising a frequency-splitting matching pursuit algorithm. A colour blend of different geometrical attributes, such as Tensor and Semblance, has also been employed in the workflow to define edges and discontinuities present in the data. Geomorphological and sedimentological observations have been documented such as an Eocene rounded ramp with evidence of slump blocks and scarps, Middle Miocene accretions generated due to longshore drift, and the presence of Pliocene-Pleistocene patch and barrier reefs. These observations were extracted as geobodies that can be used in an automated facies classification scheme. The new appreciations of the Cenozoic sequences are not only useful for understanding the carbonate evolution in the basin but also for identifying geohazards zones, such as slumps and sinkholes, that can impose challenging drilling behaviour in the Petroleum-rich Northern Carnarvon Basin.