3D seismic interpretation and stratigraphic evolution of the cretaceous Bonaparte basin (Australian NW shelf), implications of the tertiary fault reactivation in the Laminarea area

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The present-day structural style of the Bonaparte Basin area (NW Shelf of Australia) reflects two major extensional events: a late Paleozoic rifting phase related to the opening of the Neotethys and a Mesozoic multiphase extension coeval with the drifting of the so-called Argoland Terrane and the opening of the Argo Abyssal Plain. The study area is located in the Laminarea High area (Bonaparte Basin, Timor Sea). The purpose of this research is to refine the local and regional tectono-stratigraphic framework for the syn-rift and post-rift mega-sequences associated with the Argo Abyssal Plain opening (Late Jurassic and Cretaceous). This work relies on interpretation of 2D and 3D seismic data and analysis of well data all provided by Woodside Energy Ltd.

The analysis of well logging data with the definition and characterization of electrofacies (Strat-Log, GeoFrame) represents the initial part of the research. It is followed by the regional correlation across the Laminaria High and Sahul Syncline. Based on this analysis, three environments of deposition have been identified for the Late Jurassic - Late Cretaceous mega-sequence: open marine to middle; upper bathyal and shelf to open marine. The initialcorrelation highlights a thickening of the mega-sequences in the central and in the southernpart of the Laminarea High area. Subsequently, the results of the well data analysis were used to calibrate the 3D seismic interpretation of the syn-rift and the post-rift mega-sequences. The structure maps and isobaths maps as well as the attributes maps (grid-based and volume-based) confirm this interpretation and give more details on the mega-sequences architecture and development.

The results given by seismic attributes analysis confirm the patchy distribution of synrift and post-rift deposits and identify a series of tilted faults blocks, orientated ENE to WSW and dipping to the south. The patchy distribution of the post-rift is the result of reactivation of underlying faults during the Late Jurassic and Early Cretaceous. This reactivation episode is probably triggered by the opening of the southern Cuvier and Gascoyn Abyssal Plains related to the drifting of greater India during a late stage in the Gondwana break-up.

The development of “relay ramps” systems and conjugate fault systems (anthethic and synthetic) in the syn-rift is related to accidental intersection of opposed-dipping faults in which dimension, location and displacement patterns of the future conjugate-fault pairs were unrelated.