Deep-water Depositional Architecture to the Late Aptian Shiftfrom Carbonate to Siliciclastic Deposition: Offshore Senegal, NW Africa

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Abstract

The Aptian to Albian transition across NW Africa was characterised by a shift from carbonate to silicilastic deposition. It was a time of regional plate tectonic activity and resultant paleoenvironmental responses, characterised by sea-level changes, local faulting and uplift. By evaluating the style and geometry of deep-water depositional elements, we can determine the dominant depositional process and assess the timing of important events and their control on the sedimentary systems. The study area is located in the offshore Senegal Basin, west of the modern Casamance River. The Senegal Basin experienced a typical passive margin development from the Middle Jurassic to Middle Cretaceous, with development of a long lived carbonate platform. The platform has a steep margin and an E-W aligned carbonate ridge is located in the south. In late Aptian to early Albian times, carbonate deposition ceased as the platform was drowned by increasing siliciclastic deposition. Utilising the PGS 3D seismic dataset, a hundred horizons have been analysed, using seismic attribute analysis, as well as geobody evaluation and spectral decomposition techniques, within Aptian-Albian interval imaging a variety of deep-water depositional elements in the basin. On seismic sections, the Aptian-Albian deepwater megasequence includes sheet-like, subparallel to parallel, high to very high continuity reflectors displaying mostly low to moderate amplitude. Some high amplitude reflections (HAR) are observed close to the platform margin at toe of slope (dated as early Aptian) and away from the margin on the deep basin (dated as late Aptian to late Albian). RMS amplitude maps image the steep platform margin and the change in seismic character associated with the carbonate to siliciclastic shift in the basin. In the early Aptian, when the carbonate platform was still growing, the seismic character of the deep-water comprises low amplitude events throughout the basin, except some high amplitude ones located at toe of slope. Tongue-like high amplitude events at toe of slope are interpreted to be carbonate debris flows caused by episodic margin failure. Above this interval, first fan shaped geometries appear in the basin with a limited flow distance of 10 to 12 km from toe of slope. The presence of fan-shaped geometries suggests the first terrigenous influx dates the carbonate to siliciclastic transition and demise of the carbonate factory at late Aptian in the study area. The overlying Early Albian interval is dominated by high amplitude events with a flow distance ranging from 17 to 20 km interpreted as submarine fans, as well as some local high amplitude events close to the margin which suggest the margin failure still continues in that time. During the late Albian, the deep-water submarine fan system reached its most developed stage with high RMS amplitude bodies interpreted to be submarine fans with a length ranging from 15 to 27 km.