Frontal Splay Geometry, Distribution, Connectivity and Reservoir Characterization in a Mid-Slope Environment: The Jubilee Field, Offshore Ghana

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ABSTRACT

Frontal Splay characterisation from subsurface data has not yet been achieved in a fully integrated manner from producing oil fields. Fields reservoired in this type of deep-water system are rarely upscaled from rock facies to log and seismic scale, using analogues to narrow the uncertainty ranges in reservoir presence, quality and connectivity. This paper aims to bridge that gap by going back to basics and incorporating rock facies, and facies associations, as pivotal to developing the static, as well as conceptual, models for field development, by using a spectacular core, wireline, seismic and dynamic dataset from the Jubilee Field. The Jubilee Field is located in the Tano Basin, Offshore Ghana, on the flank of an early Cretaceous extensional fault block known as the Tano Nose. The reservoir sands occur within a system of Cretaceous Turonian to early Coniacian marine-slope turbidites, in sequences up to 250m thick, and contained within a combination of structural and stratigraphic traps. A conceptual geological model was constructed based on core, well-log and seismic and dynamic data. The workflow began with identification of facies types in core, and grouping of these into 12 Facies Associations (FAs) at the wells, which formed the 'building blocks' for the 3D sand body identification. Each of the FAs can be further subdivided into five petrophysically-derived Rock Types, which reflect both original sand bedding textures and diagenetic overprinting. In the workflow, we use these recognisable, repeating packages that define the sand bodies in Jubilee. The facies scheme was applied across the wells to show how the rock properties tie. The Jubilee system is a slope system, that developed basinwards from an erosionally- confined channel system with crevasse splays and master levees, into less confined frontal splay systems. There is considerable variation vertically and laterally, resulting in a complex distribution of reservoir sand bodies, often displaying offset-stacking, erosion of previous sequences, and diachronicity. Some of this complexity appears related to underlying structural controls on sand distribution, both in terms of topographic variation and subsequent compensational (lateral) stacking and migration of the sand bodies away from the main depositional axes. We focus on the development of the conceptual geological model in this paper, to illustrate the nature of frontal splay accumulation in front of a confined slope channel complex system.