Reservoir Distribution on a Salt-Influenced Deep-Water Slope: Santos Basin, Offshore Brazil

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ABSTRACT

Salt tectonics controls reservoir distribution, trapping development and hydrocarbon migration in salt-influenced basins. It is therefore critical for the oil industry to understand how sediment interacts with salt in such basins. Previous studies in the Santos Basin, offshore Brazil suggest that most clastic sediment was trapped behind the 'Albian Gap', a salt-controlled, intra-slope depocentre. As a result, no significant post-salt deep-water exploration has been conducted on the assumption that little or no clastic sediment was dispersed basinward. In this study we challenge this notion by integrating 3D seismic and borehole data to determine the distribution and types of deep-water reservoirs of the previously underexplored post-salt sequence. We identify six main seismic facies types within the post-salt sequence, which we relate to the following deep-water depositional elements; (i) channels, (ii) levees, (iii) lobes, (iv) mass-transport complexes (MTCs) and (v) background deposits. We recognise three main tectono-stratigraphic phases during deposition of the post-salt sequence. During the first phase (Turonian-middle Campanian), channels, lobes and MTCs were confined within proximal minibasins and to the hanging walls of landward-dipping, salt-detached listric faults. During the second phase (middle Campanian-Maastrichtian), channels and lobes eventually filled and bypassed proximal minibasins, with deposition then occurring further downslope in distal minibasins. In these distal minibasins, salt-induced syn-depositional seabed deformation, caused: (i) channel diversion around salt-cored highs; (ii) asymmetric levee deposition, and uplift and rotation of levees on minibasin flanks; (iii) lateral channel migration, expressed in the form of lateral accretion packages (LAPs); and (iv) confinement of lobes. During the final phase (Maastrichtian-to-middle Oligocene), continued rise of proximal salt walls dissected previously deposited deep-water systems. In addition, diapir- and shelf-edge sourced MTCs filled the minibasins, and locally capped and spilled across flanking salt walls. These results have implications for post-salt hydrocarbon prospectivity in the Santos Basin, with a range of reservoir types and trapping styles being developed in this previously underexplored interval. In addition, the results of our study can be applied to other basins, where syn-depositional salt-induced seabed deformation controls reservoir deposition and architecture.