Seismic Characterization of Debris Slopes Around Isolated Carbonate Platforms

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Abstract

Debris slopes that surround isolated carbonate platforms (ICPs) represent volumetrically important portions of many ICPs, and can serve as targets for hydrocarbon production. Despite their economic potential, their expression in seismic data can present marked challenges. The range of reliefs and thicknesses in slope deposits, paired with complex geometric relationships with basinal strata, results in variable seismic character. To reduce uncertainty in interpretations, this project compares forward stratigraphic and seismic models with seismic data of two Miocene ICPs from Central Luconia (CL), Malaysia. By systematically varying controlling parameters (e.g., relative changes in sea level, hydrodynamic processes, sediment properties), forward stratigraphic models (FSM) generate a range of slope stratigraphic scenarios (variable stacking patterns, gradient, thickness, and facies distribution). Forward stratigraphic models are populated with petrophysical attributes (velocity and density) from CL analogs to create impedance profiles. These profiles are convolved with a wavelet derived from CL reservoir data to create models of the seismic response of each stratigraphic framework. Comparing reflector characteristics (angle, amplitude, geometries) of the seismic models and real seismic data from Central Luconia provides a means to constrain the possible range of slope character around each platform. Collectively, integrating the models and real-world seismic data reduces the range of plausible geologic scenarios. This juxtaposition, coupled with the FSM, also improves understanding of the sedimentological processes that influence slope character. These outcomes in turn facilitate assessment of debris slopes

as hydrocarbon reservoirs, particularly as secondary drilling targets in regions with proven hydrocarbon systems.