Seismic Geomorphology and Evolution of the Early-Mid Miocene Isolated Carbonate Build-Ups, North West Shelf of Australia

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ABSTRACT

Almost half of the world's petroleum production is from carbonate reservoirs, with many discoveries in isolated platforms. Although major discoveries continue to be made in these play types, many areas remain understudied. Analysis of extensive 2D and 3D seismic data reveals the presence of about sixty isolated carbonate build-ups (ICBs) of early-mid Miocene age spreading over a wide area of the north-western Bonaparte Basin. Individual build-ups are ~ 100 m thick, with an average diameter of 3 km. Integration of full-volume 3D seismic attribute analysis with extensive biostratigraphic and lithological data from exploration wells allow examining the evolution of ICBs and their associated morphologies at high-resolution. The development of ICBs took place above a seismically flat surface. The stratigraphic architecture of the build-ups typically consists of: (1) mid Burdigalian initiation (Tf1/CN2), (2) lateral expansion during late Burdigalian (CN3), and (3) backstepping and drowning during Langhian (Tf2/CN4). This is followed by a sub-aerial exposure probably corresponding to the major eustatic fall during Serravalian. Only small patch reefs (pinnacles) developed afterwards during the late Miocene. The various growth phases of ICBs correspond to sea level fluctuations, and major changes in global climate and oceanography. The role of local tectonics in the initiation and demise of these carbonate platforms is minimal. Growth of the ICBs is synchronous with establishment of tropical carbonate factories elsewhere along the Australia's North West Shelf that suggest an acme of reef development during the early to middle Miocene.