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The Marion Plateau carbonates (NE-Australia): A platform-slope-shelf edifice shaped by sea level change and ocean currents

A high-resolution multichannel seismic dataset collected offshore the Great Barrier Reef on the Marion Plateau (NE Australia) reveals spectacular geometries of a carbonate dominated platform to shelf edifice, whose growth was controlled by the combined effect of sea level change and ocean currents. The seismic images and seismic stratigraphic analyses were groundtruthed by the drilling of eight deep drilholes (Ocean Drilling Program Leg 194).

Four seismic megasequences (A-D) make up the sedimentary succession overlying acoustic basement. The oldest seismic sequence A (Late Oligocene - Early Miocene) can be recognized as a thin unit infilling basement depressions. Drilling indicates a mostly silicilastic composition for this transgressive unit. The overlying megasequence B includes two carbonate platforms that shed their sediments onto the adjacent slopes where they were mobilized and redistributed by ocean currents. Both platforms were exposed during the Middle-to-Late Miocene sea level lowstand and only the Southern platform reinitiated its growth in the Late Miocene (Megasequence C), while the northern platform drowned upon reflooding. The youngest megasequence, D, infilled topographic depressions between the Miocene platform edifices with thick drift deposits.

Several geometric unconformities, indicating temporary non-deposition due to either sea level drops (exposure) or strong bottom currents can be seismically mapped over the entire shelf transect. These sequence boundaries are groundtruthed by the recovered cores (e.g. hardground and exposure surfaces). Biostratigraphic dating assigns hiatuses to these megasequence boundaries, calibrating the interpretations that were based solely on seismic stratigraphic analyses.