

# Outcrop Analog for Reservoir Facies Architectures of an Albian Reef Margin — El Doctor Platform, Central Mexico

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## Abstract

Carbonate platforms flourished in the Western Gulf of Mexico during the mid-Cretaceous (Albian-Cenomanian 130-90 my), producing deposits of profound scientific and economic value. These shallow water systems record a wealth of paleo-environmental records during one of the warmest periods in the Phanerozoic characteristic of greenhouse earth (Wilson, 1975). The warm greenhouse conditions of the mid-Cretaceous contributed to the proliferation of rudist dominated shelf margins and shoal complexes, which acted as sediment factories producing a plethora of grainy high energy facies across the platform top. Many producing hydrocarbon fields within carbonate platforms around the Gulf of Mexico (e.g., Comanche shelf and Golden Lane platform) are associated with high energy rudist dominated grainstones-rudstones, making them economically important constituents of the shallow water system. The objective of this study is to provide a reservoir-scale outcrop analog for characterizing facies distribution and relationships within high energy grainy shelfal deposits. This objective is achieved by utilizing 8 measured sections from the exhumed El Doctor platform in central Mexico totaling 1,420 m, with 200 thin sections and over 400 polished slabs. This field data is used to calibrate detailed facies analyses with seismic scale stratal architectures observed in high-resolution GigaPan imagery taken along both dip-oriented and strike-oriented exposures of the platform. The lateral facies relationships reveal a reservoir scale outcrop analog for stratigraphic traps associated with high energy grainy backreef and shoal complexes and their equivalent low energy muddy platform interior deposits. The distribution of shelf (El Abra Fm.) facies in

the northern sector of the El Doctor platform suggest the development of a retrograding platform that supported high energy rudist-dominated shoal complexes close to the margin, backed landward by peritidal facies, that eventually transition to deeper platform interior lagoonal assemblages. The lower portion of the studied section is dominated by a shallow subtidal to intertidal lagoon that coarsens upward into a backreef high energy shoal complex indicating a major backstep of the shelf margin. This transgressive pulse may be related to the late Albian early Cenomanian transgression observed in other platforms around the circum Gulf of Mexico (Enos, 1983). Along the Comanche shelf, continued high frequency transgressions near end Albian time resulted in an overall backstepping shelf margin architecture of the Stuart City margin (Phelps et al., 2014). A similar geometric relationship may be the case for the El Doctor platform, leading to a deeper but more aeri ally restricted platform interior in the upper member of the El Abra Fm.