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High Resolution Correlation Framework of the Grayburg Formation-Shattuck Escarpment and Plowman Ridge: Testing Models of Shelf-to-Basin Frameworks

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The Grayburg-Queen interval in the Guadalupe Mountains is one of the least studied of the major formations exposed in this classic outcrop belt and is second only to the San Andres Formation in terms of cumulative hydrocarbon production in the subsurface. Correlation frameworks of the Guadalupe Mountains hinge on the Grayburg-Queen interval as these strata form a transition between the San Andres ramps of the Algerita Escarpment and the reef-rimmed Artesia Group/Capitan system of the southern Guadalupes. Significant discrepancies exist between published models of shelf to basin correlations within this stratigraphic interval. Central to the different interpretations is the nature of correlations of mixed carbonate-siliciclastic cycles between the Shattuck Escarpment and the Plowman Ridge area of the Brokeoff Mountains. This study revisits these contrasting models using high resolution cyclostratigraphy in conjunction with chemostratigraphy to determine a best-fit correlation of the Grayburg Formation mixed carbonate-siliciclastic high-frequency cycles between the Shattuck Escarpment of the Guadalupe Mountains and the Plowman Ridge area of the Brokeoff Mountains.

The G10, G11, and G12 Grayburg high-frequency sequences are mapped at Shattuck Escarpment and Plowman Ridge. Relative to the inferred Grayburg shelf margin, the Shattuck Escarpment section S7 is located 2km seaward of the Plowman Ridge section PR1. One dimensional vertical facies proportion analysis and cycle stacking patterns at Shattuck section S7 and Plowman section PR1 record the overall progradation of the Grayburg Formation during the deposition of high-frequency sequences G10 through G12. A detailed comparison of cycle sets between Shattuck section S7 and Plowman section PR1 shows an excellent match in terms of cycle thickness and number, as well as, facies proportions. These observations support the assertion that Grayburg strata exposed in the Guadalupe Mountains may be correlated to strata exposed in the Brokeoff Mountains at cycle scale resolution. Lateral and vertical facies patterns described in this study may provide a useful guide for reservoir characterization in stratigraphically equivalent subsurface reservoirs, and in other transitional mixed carbonate-siliciclastic shelf reservoir settings.

Keywords: cyclostratigraphy, chemostratigraphy, Grayburg Formation, reservoir characterization