LITHOFACIES AND CHEMOSTRATIGRAPHY OF THE UPPER WOLFCAMP SHALE IN THE SOUTHERN DELAWARE BASIN, PECOS COUNTY, TEXAS

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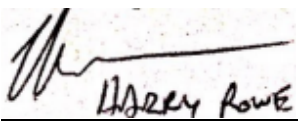
ABSTRACT

During basinal "Wolfcamp" deposition (i.e. upper Pennsylvanian to lower Leonardian time), the southern section of the Delaware basin was subject to tectonic and hydrographic conditions that were less prevalent or entirely absent from other areas of the Permian Basin. These conditions include complex basin hydrography resulting from proximity to the Sheffield Channel, as well as the Hovey Channel; multiple potential sediment sources, including the Central Basin Platform, Diablo Platform, and Marathon orogenic belt; and a highly-recycled sediment source from the uplifted foredeep associated with the Marathon orogenic belt.

High-resolution geochemical data (elemental abundance via X-ray fluorescence, bulk mineralogy via X-ray diffraction, and total organic carbon via LECO) coupled with principal component analysis dimensionality reduction and hierarchical cluster analysis provide a workflow for geoscientists to assign enhanced lithofacies categories in stratigraphic successions. Ultimately the lithofacies are potentially significant with respect to organic carbon production and preservation, as well as geomechanical rock properties relevant to hydraulic fracturing. The lithofacies logs generated from the study were compared with wireline logs in order to define them in a larger stratigraphic context. From this context, paleo-redox conditions and broad eustatic conditions can be inferred.

Study cores reveal substantial lithofacies variability. Cores preserve a record of temporal variability in aqueous, dissolved-oxygen availability in the study area from the lengthy sections of presumably anoxic, nonbioturbated, siliceous mudrock observed in the lowest section of Mendel 36-4 core, upward through the silt and sand turbidites observed in Pecos D Fee 2, and into the more oxic, heavily bioturbated, calcareous and siliceous mudstones in Mendel Estate 1.

Whereas an autogenic delivery of sand turbidites and carbonate sediment to the basin is a reasonable explanation for the observed vertical succession of rocks, an alternate interpretation consists of an early Permian reduction in glaciation, warming climate with rise in eustatic sea level, and moderation of eustatic amplitude enhancing late Wolfcampian and early Leonardian carbonate sediment production. This scenario is compatible with a transgression from lowstand sands to highstand, frequently bioturbated, carbonate sediment delivery. An additional interpretation for the upper carbonate section and associated bioturbated sediments is carbonate platform margin failure. Sediment dilution and mildy oxic water conditions depressed preservation of organic carbon in the study interval making it a marginal exploration target.

Advisor:  **(Signed Name)**
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