Lithofacies and Diagenesis of Pennsylvanian Lower Cisco Shelf Margin Carbonates, Wolf Flat Field, Motley County, Texas

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The Wolf Flat field produces from Pennsylvanian aged shelf margin carbonates that were subaerial exposed to fresh water diagenesis during a major sea level fall in the late Pennsylvanian. 424 feet of cores from five wells were studied to understand the reservoir's lithofacies and diagenesis relationship to porosity. Five major lithofacies were identified: mudstone, pelletal/crinoidal wackestone, bryozoan- crinoidal packstone, oolitic grainstone, and phylloid – fusulinid boundstones. There are two types of mudstone, black thin laminated prodelta shale that was deposited during a major transgression at the end of Pennsylvanian, and light brown colored clastic mud that was transported to the shelf margin by turbid waters during the major Pennsylvanian sea level fall that preceded fresh water diagenesis. There are also two distinct wackestones facies, dark colored deep marine crinoidal wackestone and a lighter colored shallow shelf pelletal wackestone with significant bioturbation. The wackestones and phylloid-fusulinid boundstone facies constitute the bases of shallowing upward cycles that are capped by packstones and/or grainstones facies. The shallowing upward cycles of the Wolf Flat field represent a long term regressive cycle marked by predominantly shallow shelf carbonates. Long term regression contributed to subaerial exposure of the shelf margin carbonates and the precipitation of anhydrite in parts of the reservoir. Freshwater diagenesis resulting from subaerial exposure was typified by karst, carbonate cements and internal sediments, intense leaching and associated cave structures, and collapse breccias. Other diagenetic overprints include fabric destructive, facies selective dolomitization, saddle

dolomite precipitation, fractures, stylolites, and pyrite. Most of the original intergranular porosity related to depositional facies were occluded by carbonate cements. New porosity types associated with the exposure include; cavernous, vuggy, moldic and breccia porosities; that were also partially to completely occluded by cement and sediment infill. The influence of diagenesis on reservoir porosity appear to be facies selective because the highest porosity is in the vuggy dolomitized crinoidal wackestone and moldic oolitic grainstone facies.