Facies Reconstruction of the Casper and Ingleside Formations: A Mixed Carbonate-Siliciclastic System

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ABSTRACT

The mixed carbonate-siliciclastic succession of the Pennsylvanian-Permian Ingleside and Casper Formations were deposited along the flanks of the Ancestral Front Range as a result of Late Paleozoic tectonism and eustatic sea level changes. Extending from central Colorado to southeastern Wyoming, the Ingleside and Casper Formations are composed of carbonate intervals representing relative sea level rises and siliciclastic intervals representing relative sea level falls. Outcrop and drill core data from the Ingleside and Casper Formations were combined to measure fourteen stratigraphic sections. A north-south transect of the measured sections extends from Albany, Wyoming south to Boulder, Colorado. East-west transects extend within Albany, Wyoming and from Larimer, Colorado east to Welds, Colorado. General thickness of the formations increases towards the north and east. Stratigraphic intervals vary laterally from intervening carbonates and siliciclastics in the north to pure sandstones in the south. Deepening upwards carbonate facies transitioning from grainstones to mudstones represent a marine environment. Siliciclastic facies transitioning from shallow-marine massive sandstones to eolian cross-bedded sandstones represent an increasingly arid environment. Laterally continuous shale stringers lie adjacent to shelf carbonates and shoreface cross-bedded sandstones. Pure carbonate or siliciclastic units are rare, with siliciclastic grains observed in carbonate beds and carbonate components observed in siliciclastic beds. Mixing of the two sediment components indicates a constantly active carbonate factory. The model explaining carbonate-siliciclastic mixing in this system therefore differs from the common reciprocal sedimentation model which suggests the complete cutoff of carbonate production during lowstand periods. The results of this study can be used to produce an idealized depositional model to facilitate field recognition of an environment that consists of an eolian dune field extending into a siliciclastic foreshore, a transitional shoreface, and an offshore carbonate ramp. This model will contain regressive siliciclastic facies and transgressive carbonate facies, with eolian sandstones representing maximum regressions and basinal shales representing maximum transgressions. Proximal eolian sandstones have been productive in the Casper Formation and would hold the maximum reservoir potential in such a system because of high intergranular porosities and permeability. The mixed carbonate-siliciclastic succession of the Pennsylvanian-Permian Ingleside and Casper Formations were deposited along the flanks of the Ancestral Front Range as a result of Late Paleozoic tectonism and eustatic sea level changes. Extending from central Colorado to southeastern Wyoming, the Ingleside and Casper Formations are composed of carbonate intervals representing relative sea level rises and siliciclastic intervals representing relative sea level falls. Outcrop and drill core data from the Ingleside and Casper Formations were combined to measure fourteen stratigraphic sections. A north-south transect of the measured sections extends from Albany, Wyoming south to Boulder, Colorado. East-west transects extend within Albany, Wyoming and from Larimer, Colorado east to Welds, Colorado. General thickness of the formations increases towards the north and east. Stratigraphic intervals vary laterally from intervening carbonates and siliciclastics in the north to pure sandstones in the south. Deepening upwards carbonate facies transitioning from grainstones to mudstones represent a marine environment. Siliciclastic facies transitioning from shallow-marine massive sandstones to eolian cross-bedded sandstones represent an increasingly arid environment. Laterally continuous shale stringers lie adjacent to shelf carbonates and shoreface cross-bedded sandstones. Pure carbonate or siliciclastic units are rare, with siliciclastic grains observed in carbonate beds and carbonate

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