Lithospheric Flexure Maps for the Paradox Basin Using Graphic Correlation Data

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[1]Paradox Basin Data

Abstract

The Paradox Basin (PB) was a flexural basin during Late Paleozoic Ancestral Rocky Mountains compressional tectonics. Previous studies resulted in two-dimensional profiles showing the flexural subsidence in front of the rising Uncompahgre Uplift. This study involves a novel method using high-resolution stratigraphic data from hundreds of wells bundled into six Pennsylvanian-Permian chronostratigraphic stages to estimate the foredeep, forebulge, backbulge basin and backbulge areas. By using graphic correlation (GC), where the total thickness of the study interval for wells was set at 100 percent and each stage or partial stage is an incremental thickness percent of the total starting with strata in the oldest stage (Atokan Lower Hermosa), the resulting data for the study wells could then be mapped. A “hinge well” was chosen on the backbulge to correlate percentages with the remaining study wells. Maps of the calculated GC differences with the “hinge well” are independent of measured thickness (isochore) maps, and some study maps were found to be sensitive to the paleotopography of the underlying Mississippian erosional surface and its “paleostructures” and the buried flexural tectonic features. The influence of those features decreases with continued deposition and eventually disappears. Results for the Atokan Lower Hermosa interval were mixed because those strata onlapped and buried the Mississippian topography; better information is through maps of the onlapping Lower Hermosa cycles that reveal drainage patterns on the eroded Mississippian Leadville Fm. Results for the Atokan Alkali Gulch interval were “hazy” because of widespread deposition of thick halite beds during the early stages of tectonic flexure of the PB and the sparsity of data in the Deep Fold and Fault Belt (DFFB) with subsequent massive salt flowage. Results for the Desmoinesian Hatch, Ismay, Desert Creek, Akah and Barker Creek intervals were outstanding and provided considerable detail. The foredeep can now be better defined for the previously mapped DFFB and shows a prominent forebulge that follows much of the outer outline of the DFFB. Importantly, several hydrocarbon-bearing traps are now identified to occur on the flanks of or directly on the forebulge trend. The backbulge basin is large and complex and contains the Blanding Subbasin in the southern PB. More rapid subsidence of the Blanding Subbasin part of the backbulge basin likely preserved porosity in the hydrocarbon-bearing bioherms and carbonate buildups in the Desmoinesian Ismay and Desert Creek strata. The backbulge is gradationally outward from the outer backbulge basin marked by limits of PB halite deposition and includes the “hinge” trend. Results for the Missourian, Virgilian, Wolfcampian, and Leonardian intervals were muted by massive siliciclastic deposition that masked underlying features. This study suggests a new method for the analysis of flexural basins.