Unlocking New Play Types through the Controls of Tectonic History on Lacustrine Depositional Systems in the Uinta Basin, Northeast Utah

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Abstract

The Uinta Basin is an intracratonic foreland basin located in northeastern Utah. The rocks around the Uinta Basin record over three billion years of earth history and provide the setting and foundation for hydrocarbon-bearing Cenozoic lacustrine deposits. The Laramide Orogeny (~70-34 Ma) reactivated and built upon this foundation and caused the lacustrine basin to form and to fill. This paper seeks to highlight significant and relevant tectonic events throughout the history of the Uinta Basin region, focusing on the events of the Laramide Orogeny, in order to understand the effects on Green River Formation depositional systems. Based on net and gross isopach maps of the older freshwater units of the Lower Green River (Flagstaff through Castle Peak [~62-54 Ma]), it can be demonstrated that the western Uinta Mountains began to rise first, creating accommodation space in the adjacent foreland in the northwest. Beginning in the saline phase of the Lower Green River (Black Shale through Garden Gulch [~54-52 Ma]), tectonism largely moved to the eastern Uinta Mountains, and the accommodation space shifted towards the northeast part of the basin. During this time, large volumes of mud, silt and carbonate-rich sediments began to fill the lake basin from the southwest and prograde towards the rising Uinta Mountains in the northeast. Carbonate shoals developed on the topset to foreset positions of the large-scale clinoforms throughout the saline phase of the Lower Green River and into the Lower Middle Green River. These shoals display similar geometries in map view across the western and northern portions of the basin and record evidence of the dynamic tectonic shifts through time. The Middle Green River interval (~52-49 Ma) was a time of re-activation of mountain building in the western Uinta Mountains while the Upper Green River interval (~49-47 Ma) again records a switch back to dominant tectonism in the eastern Uintas. Contextualizing these stratigraphic units and features within the recent tectonic history of the basin allows us to better predict the spatial variability and the economic viability of numerous new horizontal targets within the basin.