

Outcrop Characterization and Depositional Model of the Uteland Butte Member, Green River Formation, Uinta Basin, Utah

Ryan D. Gall¹, Riley Brinkerhoff², Justin E. Birdwell³, and Michael Vanden Berg¹

¹Utah Geological Survey

²Wasatch Energy Management, LLC

³U.S. Geological Survey

Abstract

The informal Uteland Butte member of the Eocene Green River Formation, ranging in thickness from 15 to 65 m, represents the first widespread transgression of Lake Uinta across the Uinta Basin, Utah. This study assesses the outcrop expression of the Uteland Butte member along an 85-km transect in the western and central Uinta Basin, from Soldier Summit to Desolation Canyon, using detailed measured sections, organic and inorganic geochemical data, and outcrop gamma ray logs. Eighteen lithofacies were identified and comprise seven depositional facies associations interpreted to represent lacustrine, palustrine, and deltaic depositional settings. Five 4- to 12-m-thick shallowing upward depositional cycles are identified across the study area. Each depositional cycle is defined by a >1.5-m-thick basal clay-rich interval and is capped by a thicker carbonate-rich interval. Clay-rich intervals consist of finely laminated organic-rich (3%–16% TOC) mudstone (profundal to sublittoral lacustrine) and/or silty mudstone (deltaic). Carbonate-rich intervals are composed of complexly interbedded bivalve wackestone, ostracodal limestone, laminated to massive dolomite, and coal (littoral lacustrine to palustrine). The western outcrop belt correlates to the more distal central Uinta Basin using well logs and cores and to previously published outcrop sections from the far eastern Uinta Basin. Each of the five clay-carbonate shallowing upward cycles identified in outcrops are present across the Uinta Basin, which signifies an allogenic control that resulted in distinct clay- or carbonate-rich lake phases. We interpret climate to be the dominant control and driver of the depositional cyclicity. During relatively humid periods, increased fluvial input of siliciclastic sediment and fresh water into the basin resulted in higher relative lake levels and clay distribution across proximal and distal lake settings. In contrast, more arid periods resulted in decreased fluvial input and evaporative conditions that gradually lowered relative lake levels and favored basin-wide carbonate accumulation and subsequent dolomitization. Climatically driven depositional cycles within the Uteland Butte member likely reflect, to a lesser degree, the climatically driven depositional cycles of fluvial and lacustrine sedimentation observed at broader member and formation levels of Paleocene–Eocene stratigraphy in the Uinta Basin. Importantly, this sub-member-level study showcases how variation of fluvial input can impact lacustrine sediment accumulation at basin scales.

Geological characterization and petroleum targets of the Green River Formation, Uinta Basin Monday, July 25, 2:25 PM