Integrated Sedimentary and Geochemical Investigation of Core from Upper Green River Formation Lacustrine Deposits, Uinta Basin, Utah

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Description of the upper Green River Formation has been largely based on outcrop exposures, but this core-based investigation provides new detailed subsurface data that can be used to examine basin-wide lithologic and geochemical variability of the Parachute Creek Member of the upper Green River Formation in the Uinta Basin, Utah. Such an understanding is integral to potential oil shale development in the region. The 1200-foot EX-1 core captures a complete view of the richest oil shale interval (middle R-4 to middle R-8) near the depo-center of the basin. Because the vast majority of the succession is fine-grained, stratigraphic geochemical characterization has proven key to accurate description and facies delineation within the formation. Qualitative, whole rock X-ray fluorescence (XRF) was performed in order to define intervals as dominantly siliciclastic, calcareous, or dolomitic. This technique is non-destructive, relatively quick, and adequately defines relative elemental abundances in core. The XRF data highlight a major stratigraphic geochemical boundary; beds below the Mahogany oil shale zone are dominately dolomitic, where as beds above are calcareous rich, matching a transition from fluvial-lacustrine to fluctuating profundal lithofacies. Additional stratigraphic bulk organic carbon isotopic analyses provide an independent proxy of organic matter source and paleoenvironmental changes through the succession. This integrated investigation has led to the delineation of ten informal lithostratigraphic units recording three successive phases of lake development in the Uinta Basin, as originally defined by Carroll and Bohacs (1999) from the Green River Basin in Wyoming: 1) fluvial-lacustrine lithofacies (overfilled basin), 2) fluctuating profundal lithofacies (balanced-filled basin), and 3) evaporative lithofacies (underfilled basin). Each of the three lithofacies contains internal stratigraphic changes in lithology, sedimentary structures, and fossil type and occurrence. These changes document both abrupt and gradational paleoenvironmental changes at a more detailed scale within each lithofacies.