A Multi-Proxy Paleoenvironmental Analysis During Deposition of the Mahogany Oil Shale Zone of the Parachute Creek Member, Green River Formation, Utah

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Abstract

The Green River Formation of Utah and Colorado represents a ~15 million-year Lower Eocene record of unusually large, productive lakes which deposited one of the largest oil shales in the world with an estimated 750 billion barrels of oil equivalent. Multiple drill cores through the Mahogany Oil Shale Zone, taken from both the basin margin and centre, offer an excellent opportunity to construct high-resolution records of competing lacustrine and terrestrial sources to explore their influence on organic matter deposition and preservation. In this study, the isotopic expression of mid-latitude hydrological change during an unusually rich TOC (up to 40%) interval is investigated through compound-specific hydrogen isotopic analyses ofn-alkanes extracted from the Mahogany Oil Shale Zone, Uinta basin, Utah. Comparison of this novel record with high-resolution sedimentary logs and traditional petrography work will allow for greater understanding of the hydrological cycle at the time of deposition of this key oil shale. This study seeks to merge a multitude of scales, from field outcrops to microscopic imaging to molecular analysis, to bridge novel proxies with traditional methods in answering fundamental questions about carbon cycling. Variations in organic matter distribution and its interaction with a fluctuating carbonate and siliciclastic matrix should be mirrored in the biomarker records. We would expect variations in key biomarkers (e.g. isoprenoids, n-alkanes, hopanes) at the molecular scale when observing changes in the organic matter at a microscopic scale with detailed thin section imaging and

analysis. As a potential future target for unconventional exploration and the use as a source rock analogue (e.g. Pre-Salt Offshore Brazil plays), disentangling the factors controlling deposition and preservation of organic matter in the Green River Formation through a combination of organic geochemical and sedimentological tools may lead to greater understanding and predictability of the organic-rich layers in the oil shale. This will help improve modelling of lacustrine source rocks and will also support the development of the U.S unconventional hydrocarbon industry, energy security and petroleum independence in the region.

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