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Prospects and Progress in the Green River Formation Oil Shale, Western U.S.

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The Eocene Green River Formation has long been believed to contain the world's largest commercial oil shale deposits; the U.S.G.S. recently reported an *in situ* resource estimate for Colorado, Utah, and Wyoming in excess of 4 trillion barrels of oil. Potentially recoverable reserves are much lower, but impressive nonetheless.

The Green River Formation represents the deposits of long-lived, hydrologically-connected lakes that occupied several intermontane basins within the broken "Laramide" foreland. Oil shale facies consist dominantly of carbonate-rich mudstone, with organic enrichment reaching up to 60 gallons of oil per ton (Fischer Assay). The lithology, stratigraphy, and geochemistry of these deposits record a wide range of depositional conditions that may be cast into three distinctive lake basin types. Volcanic tuff horizons interbedded with lacustrine strata have helped to establish a robust chronostratigraphic framework for much the Green River Formation at resolutions of ~100 ky. Different lake types often occupied adjacent basins at the same time, indicating that fill and spill relationships were as important as climate in determining paleoenvironmental conditions and oil shale quality. Major lake-type transitions appear to have been caused by changes in regional drainage organization. For example, expansion of the famous Mahogany oil shale across the Piceance Creek and Uinta basins appears to have occurred in response to capture of a mountain river in central Idaho. This river flowed into Lake Gosiute in Wyoming, which in turn spilled into Colorado and Utah.

Commercial production of Green River Formation shale oil depends on the simultaneously resolution of two significant problems: production cost, and potential environmental impact. These concerns are currently being addressed through the development of new in situ retort techniques that directly produce high-quality light oil. At least three distinctly different methods are being developed: the Shell In Situ Conversion Process (ICP), ExxonMobil's Electrofrac method, and the American Shale Oil Company (AMSO) Conduction, Convection, Reflux process.

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