Insights into the maturation process from physical and chemical analysis of partially pyrolyzed Green River Formation oil shale

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Oil shale is petroleum source rock that has not yet undergone the maturation needed to convert kerogen into oil and gas. Oil shale is processed at high temperatures (300-500°C) for relatively short periods of time (hours-months) to produce oil and gas, and spent shale. This is in contrast to the relatively mild conditions experienced by sedimentary formations (~100°C) during which petroleum is naturally generated over millions of years. Following expulsion of conventional oil and gas, source rock remains, and constitutes the "shale" or "tight" resources that have begun to be exploited on a large scale in the last few years.

We have partially pyrolyzed replicate samples of Green River oil shale and studied the chemical and physical properties of the spent shales. Probes include wet chemistry separations, Rock Eval, infrared spectroscopy, nuclear magnetic resonance relaxation analysis, and density, surface area and pore volume measurements. Particular attention is paid to the organic matter: kerogen, bitumen, and coke. We find that oil shale artificially matured in a semi-open system has some properties comparable to naturally matured gas shale.