

Basin-Wide Evaluation of the Uppermost Green River Formation's Oil Shale Resource, Uinta Basin, Utah and Colorado

Michael D. Vanden Berg (801-538-5419, michaelvandenberg@utah.gov)

Utah Geological Survey, Salt Lake City, Utah geology.utah.gov

ABSTRACT

Due to the recent increase in crude oil prices and concerns over diminishing conventional reserves, the Utah Geological Survey has reexamined the Uinta Basin's oil shale resource, primarily in the Mahogany zone of the Green River Formation. We created conversion equations by correlating available Fischer assays with corresponding density and sonic measurements as a way to predict oil yield from geophysical logs. In addition to the core-based Fischer assays obtained from 107 wells drilled specifically for oil shale, 186 oil and gas wells with oil yields calculated from digitized bulk density or sonic logs were used to create a basin-wide picture of the oil shale resource in the Uinta Basin. These widespread data were used to map oil shale thickness and richness and create isopach maps delineating oil yields of 15, 25, 35, and 50 gallons of shale oil per ton (GPT) of rock. From these isopach maps, new basin-wide resource numbers were calculated for each richness grade.

A continuous interval of oil shale averaging 50 GPT contains an in-place oil resource of 31 billion barrels in a zone ranging up to 20 feet thick. Where the 50 GPT interval is at least 5 feet thick and less than 3000 feet deep, the in-place resource drops to 26 billion barrels. An interval averaging 35 GPT, with a maximum thickness of 55 feet, contains an in-place oil resource of 76 billion barrels. Where this interval is at least 5 feet thick and less than 3000 feet deep, the total in-place resource drops to 61 billion barrels. The 25 GPT zone and the 15 GPT zone contain unconstrained resources of 147 billion barrels and 292 billion barrels, respectively. The maximum thickness of 25 GPT rock is about 130 feet, whereas the maximum thickness of 15 GPT rock is about 500 feet. Where these two intervals are at least 5 feet thick and less than 3000 feet deep, the 25 GPT resource drops to 111 billion barrels and the 15 GPT resource drops to 228 billion barrels.

After placing several constraints on Utah's total in-place oil shale resource, we determined that approximately 77 billion barrels of oil could be considered as a potential economic resource. This estimate is for deposits that are at least 25 GPT; at least 5 feet thick; under less than 3000 feet of cover; not in conflict with current conventional oil and gas resources; and located only on BLM, state trust, private, and tribal lands.



Uintah County, Utah.

METHODS FOR EVALUATING OIL SHALE RESOURCES



density log



UPPER GREEN RIVER FORMATION STRATIGRAPHY



Stratigraphy of the Parachute Creek Member of the upper Green River Formation illustrated by bulk density and oil yield plots from the USGS Coyote 1 well (U044). "R" refers to a rich oil shale zone and "L" refers to a lean oil shale zone (stratigraphic nomenclature for oil shale zones derived from Donnell and Blair, 1970 and Cashion and Donnell, 1972).







Jintah County, Utah.

Utah oil shale sample from the White River mine.

Compared digitized density and sonic logs to Fischer assay analyses measured on core



Control Derived equations using a reduced major axes fit relating GPT to the sonic or

Digitized density and sonic logs from oil and gas wells throughout the Uinta Basin









Step 7: Created isopach maps in ArcGIS

Calculated resource numbers for each richness zone (15, 25, 35, 50 GPT)

- Calculated volumes in ArcGIS for each richness zone at several thickness intervals Used the density of each richness to convert volume to mass - 50 GPT = 1.90 g/cm^3 - $35 \text{ GPT} = 2.09 \text{ g/cm}^3$

$$25 \text{ GPT} = 2.09 \text{ g/cm}^3$$

- 15 GPT = 2.34 g/cm^3 - Used richness (i.e., 50 gallons per ton) to convert mass to barrels





Continuous interval averaging 25 G

Total in-place resource 147.4 billion barrels



AAPG 2009 - Denver, UT - Panel 1



<u>15.1</u> 7.9 38.8 27.1 31.5 24.7 18.7 14.9

