

Characteristics of Illite-Rich Oil Shale from the Piceance Basin, Colorado

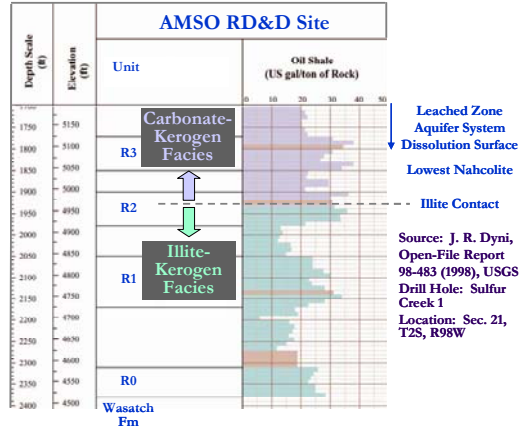
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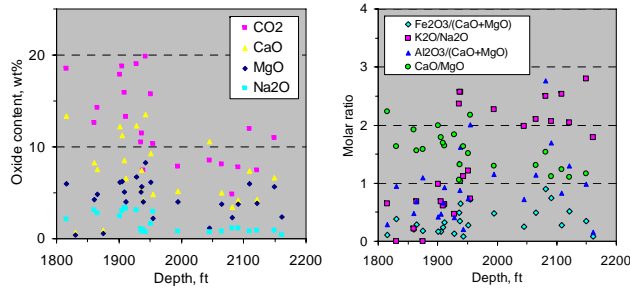
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The base of the Green River Formation in Colorado contains an illite-rich oil shale



A clear change in elemental composition is evident at the marlstone-illite boundary



Minerals in one illite shale determined by XRD

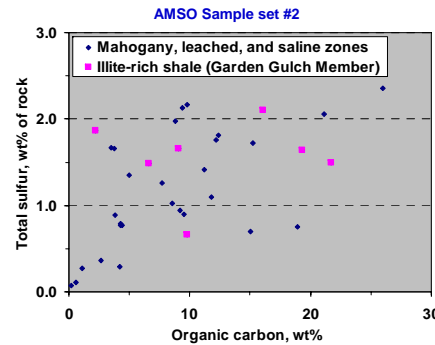
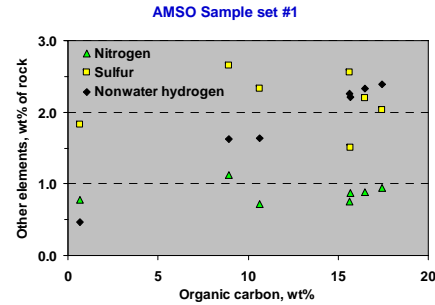
Major: quartz and dolomite (ankerite)
Minor: pyrite, calcite, illite-muscovite, albite, possibly buddingtonite

Minerals in several illite shale samples determined by FTIR (wt%)

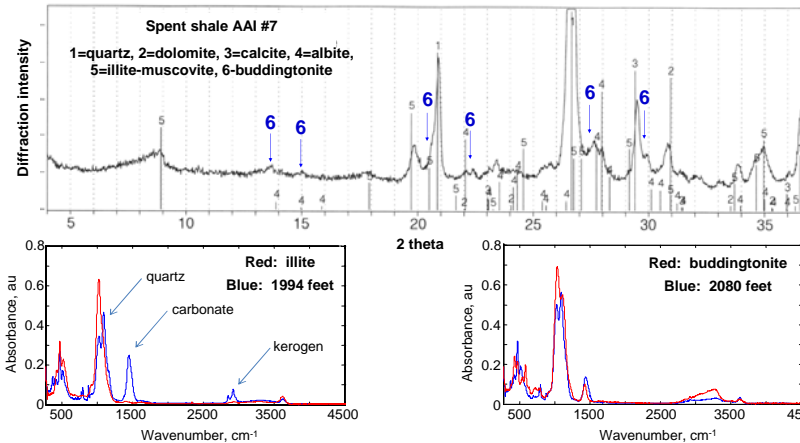
Depth	Illite	Quartz	Dolomite	Ankerite	Nahcolite	Calcite	Buddingtonite	Others
1994	50	20	9	10	2	0	0	9
2044	28	36	0	4	0	16	2	14
2064	47	20	6	13	4	0	0	10
2080	52	20	0	8	0	5	6	13
2090	51	21	4	11	1	1	0	14
2108	48	19	22	6	1	0	0	4
2120	44	19	11	7	3	0	0	16

Most sulfur and nitrogen is inorganic, not organic

Prior work at LLNL on mahogany and leached zone shale indicated that ~25% of the total S is organic and ~50% of the total N is organic. (Burnham and Taylor, 15th O.S. Symp., and Taylor et al., 1985 ACS meeting, Chicago)



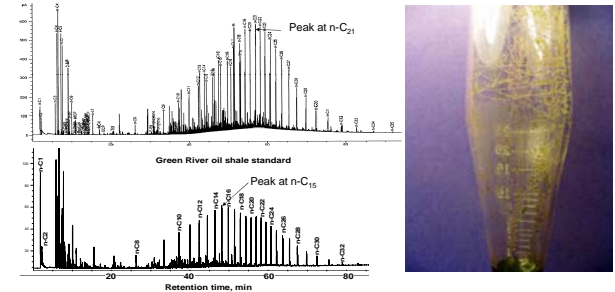
Buddingtonite is indicated by both XRD and FTIR in some samples



Illite shale oil has more wax, more sulfur, and less nitrogen than mahogany zone shale oil

Microscale sealed vessel (MSSV) pyrolysis of an illite shale sample for 72 h at 350°C

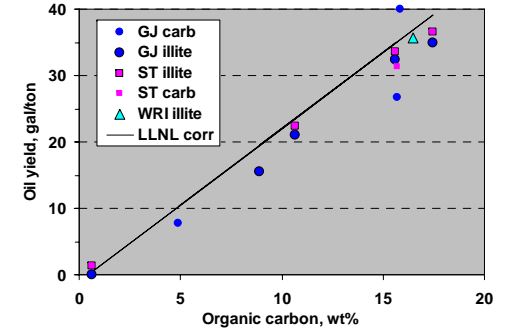
Wax crystals from Fischer Assay of illite shale



FA Oil	Gal/ton	wt% C	wt% H	wt% N	wt% S
Illite #7	21.7	85.15	12.17	1.04	1.46
Illite #6&9	35.7	83.75	11.73	1.12	1.37
LLNL avg	24.6	84.11	11.44	1.85	0.68

Illite shale produces a little less oil per organic carbon than mahogany zone shale

Sample	Minerology	Grade	Spent shale	C5+ Oil	Gas	Balance
AAI #7	Illitic	22.4	28.1	65.5	7.6	101.2
AAI #6&9	Illitic	35.7	27.6	66.1	7.5	101.1
LLNL avg	Marlstone	24.6	22.2	71.6	6.1	99.9



Sulfur and nitrogen fate

From Burnham and Taylor, 15th Oil Shale Symp, 1982			
	wt% S	% in SS	% in gas (by diff)
Anvil Pts	0.8	73	16
Tract C-a	1.4	63	30
Nahcolitic	1.0	65	26
Illitic	2.3	62	31

From Singleton et al, UCRL-53274, 1982			
	wt%N	% in SS	% in gas (by diff)
LLNL avg	0.4	49	9
Illitic	0.8	72	12

