

## Kinetics of Green River Oil Shale and Kerogen



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### Introduction



# Model of Structure

#### Experimental Setup

- 10-30 mg sample suspended in a pressurized reaction vessel
- Helium used to pressurize system
- high thermal conductivity and reduced buoyancy effects
- Experiments performed at 2 pressures and 2-3 heating rates
- (5 to 60 K/min)
- Temperatures to 950°C
- Mass, pressure, temperature recorded at 0.75 s intervals



## **Experimental Results**





Kerogen at 1 Bar and 40 Bar at a Heating Rate of 3.3K/min



Kerogen at 1 Bar and 40 Bar at a Heating Rate of 56.7K/min



Raw Oil Shale at 1 Bar and 40 Bar at a Heating Rate of 3.3K/min



Residual Char from Kerogen at 40 Bar

## Modeling Results

To help to characterize the resource
Multiple parallel global first order reactions used with Arrhenius constants

 d(m/m<sub>0</sub>)/dt = k(m/m<sub>0</sub>)

Curve-fits to mass vs time data

A & E determined for each condition



#### Kerogen Activation Energies

	1 bar 3 3 K/min	1 bar 56 7 K/min	40 bar 56 7 K/min
	0.0.74	0.04	0.74
m <sub>1</sub>	0.74	0.84	0.74
A <sub>1</sub> (1/s)	3.91 × 10 <sup>8</sup>	7.27 × 10 <sup>9</sup>	$3.70\times10^{10}$
E <sub>1</sub> (kJ/mol)	168	157	174
m <sub>2</sub>	0.26	0.16	0.26
A <sub>2</sub> (1/s)	0.07	1.11	574
E <sub>2</sub> (kJ/mol)	35.3	24.0	45.3

Reference	Literature Reported Kinetic Parameters			
	A s <sup>-1</sup>	Ea (kJ/mol)	Туре	
Campbell et al	2.81·10 <sup>13</sup>	219	GROS	
Abu-Qudais	Not Reported	93	Turkish	
Karabakan (Heating Rate Dependent)	Not Reported	264-297	GROS	
Karabakan (Heating Rate Dependent)	Not Reported	158-235	GROS Kerogen	

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