

Comparison of Oil Generation Kinetics for Oil Shales as Determined by Rock-Eval and Hydrous Pyrolysis

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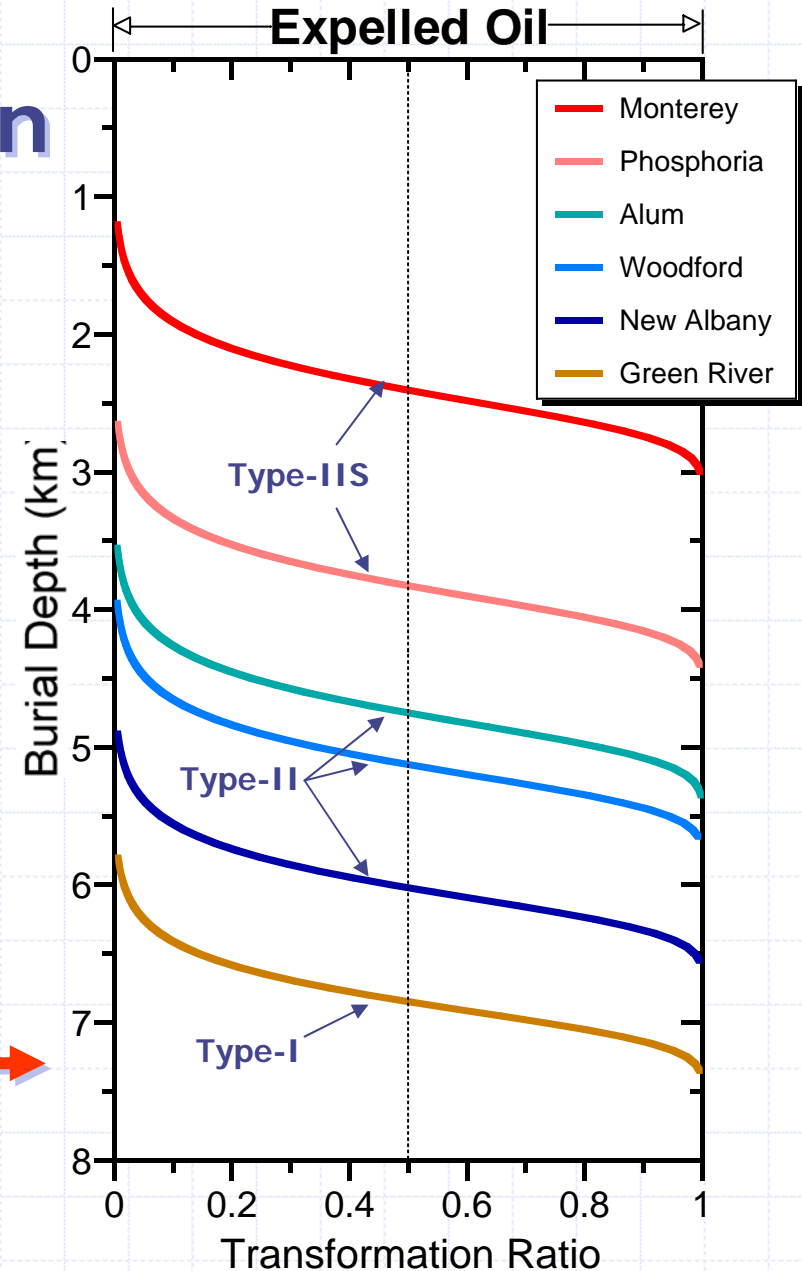
Objective

Determine whether oil-generation kinetics derived by different pyrolysis methods are critical to determining timing and extent of oil generation in surface and *in situ* retorting.

Natural Oil Generation

The laboratory pyrolysis method used to derive oil generation kinetics can have a **significant** effect on determining **timing** and **extent** of **natural** oil generation from source rocks in sedimentary basins

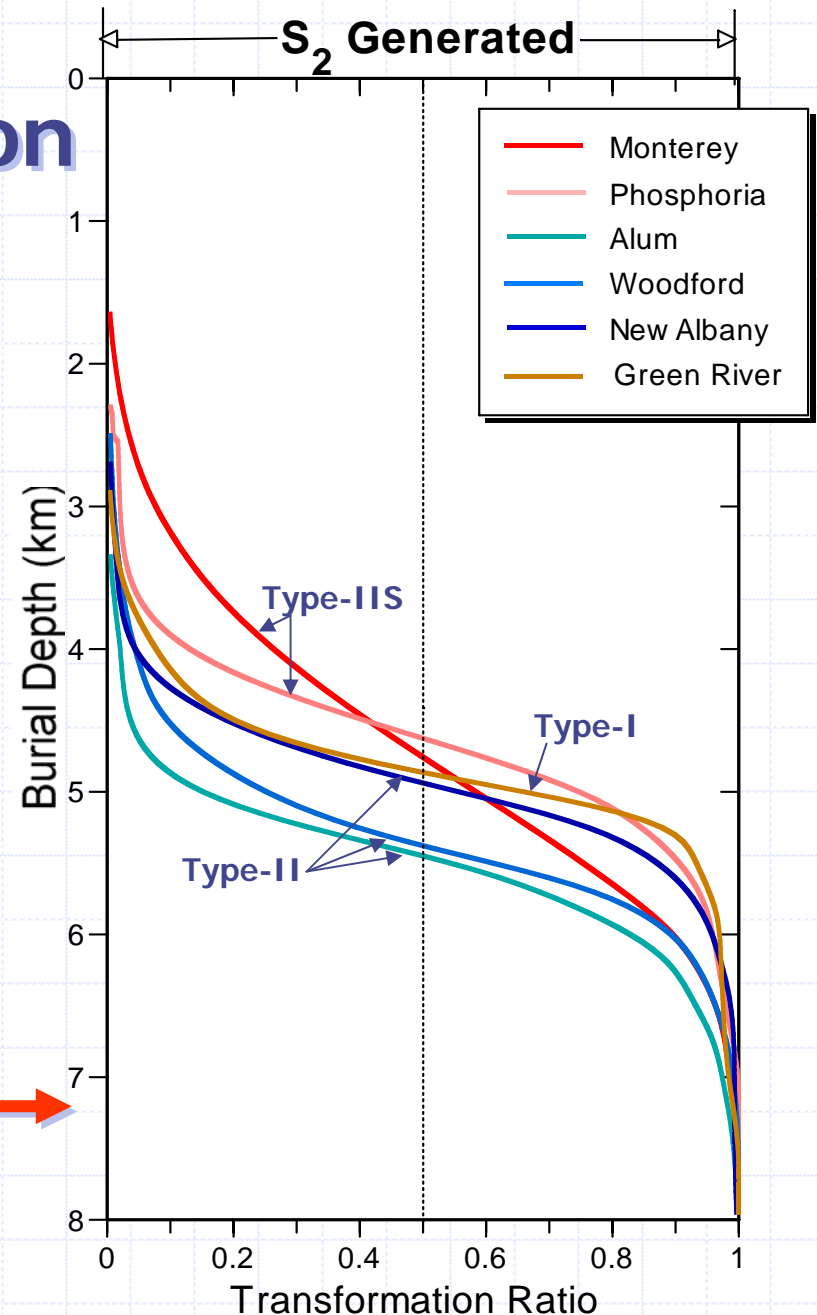
Hydrous Pyrolysis (HP) kinetics for an 80-Ma source rock in a sedimentary basin with a heating rate of 2.5°C/m.y. →



Natural Oil Generation

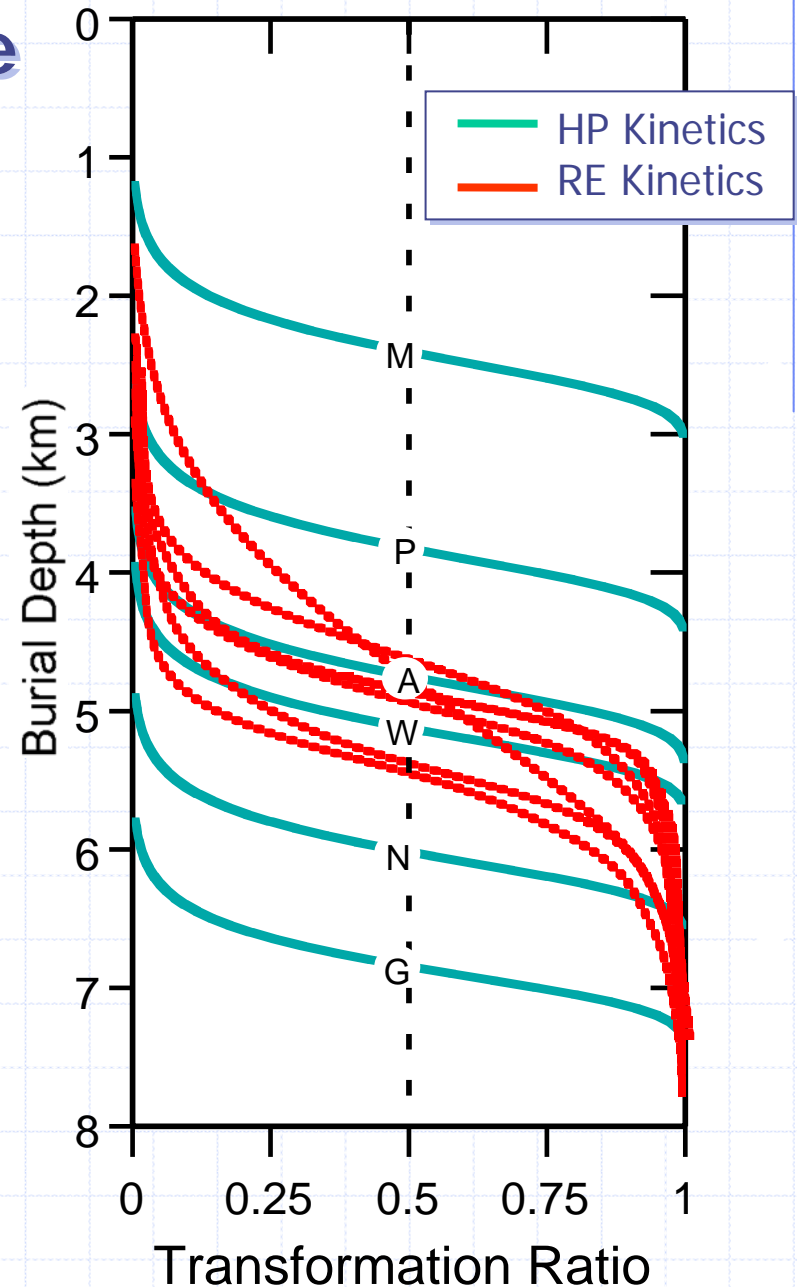
The laboratory pyrolysis method used to derive oil generation kinetics can have a **significant** effect on determining **timing** and **extent** of **natural** oil generation from source rocks in sedimentary basins

Rock Eval Pyrolysis (RE) kinetics for an 80-Ma source rock in a sedimentary basin with a heating rate of 2.5°C/m.y.



Does the same hold true for oil shale retorting?

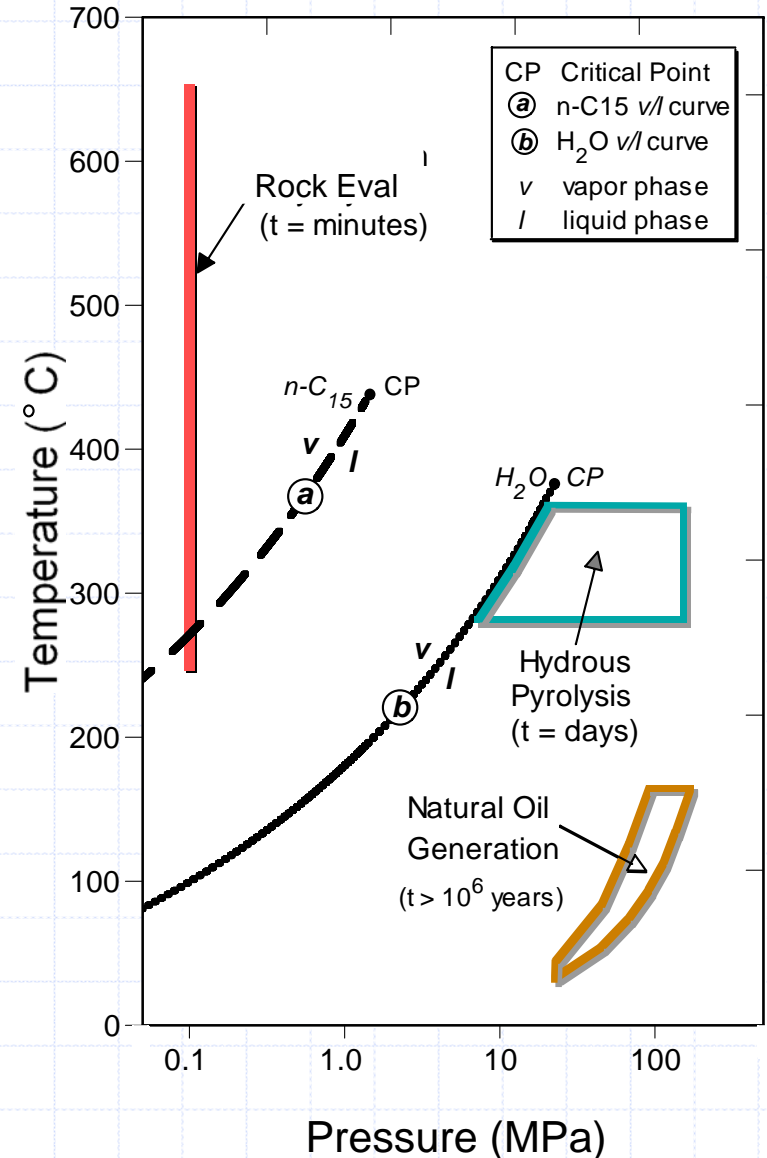
Does the laboratory pyrolysis method used to derive kinetics have a **significant** effect on determining **timing** and **extent** of oil generation in oil-shale **retorting**?



Pyrolysis Methods

Rock-Eval (RE) Kinetics
Bulk (REb)
Compositional (REc)

Hydrous Pyrolysis (HP) Kinetics



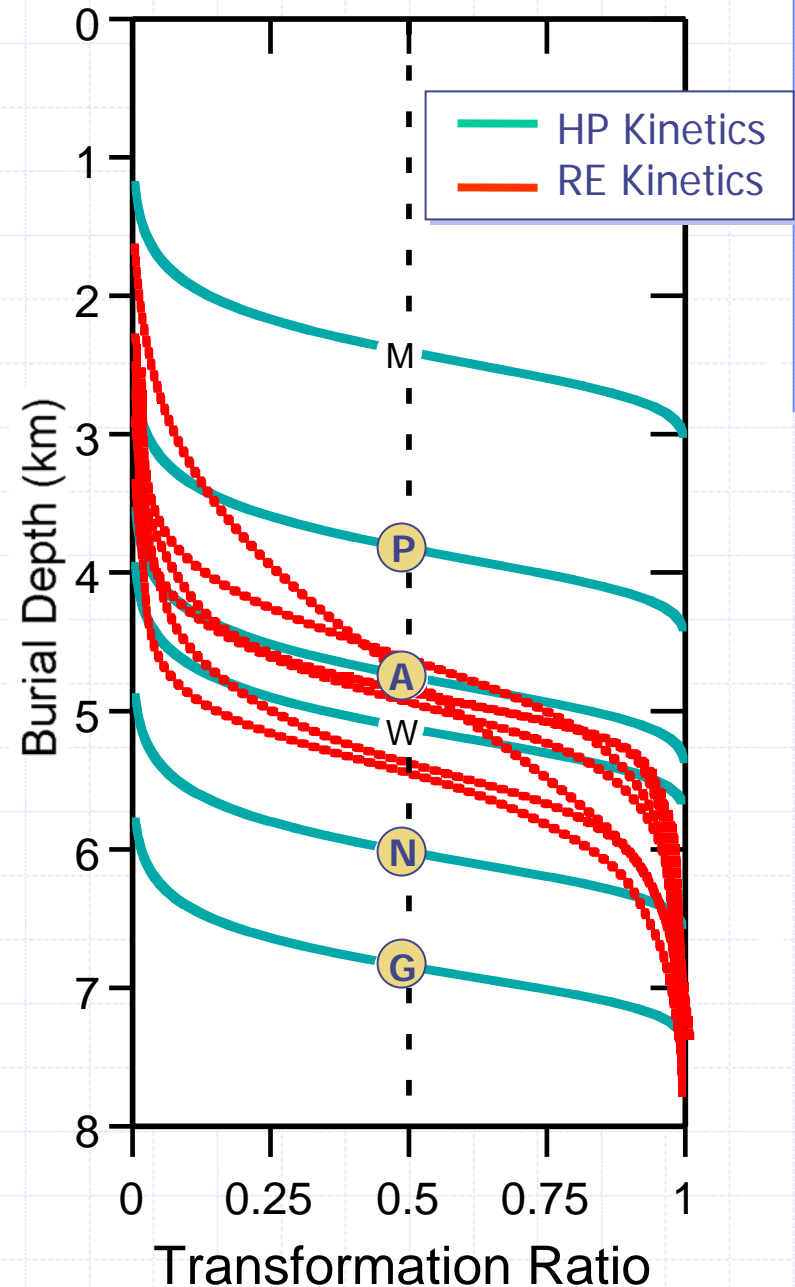
Samples

Ⓟ Phosphoria Retort Shale
23.6 wt%TOC of **Type-IIS**

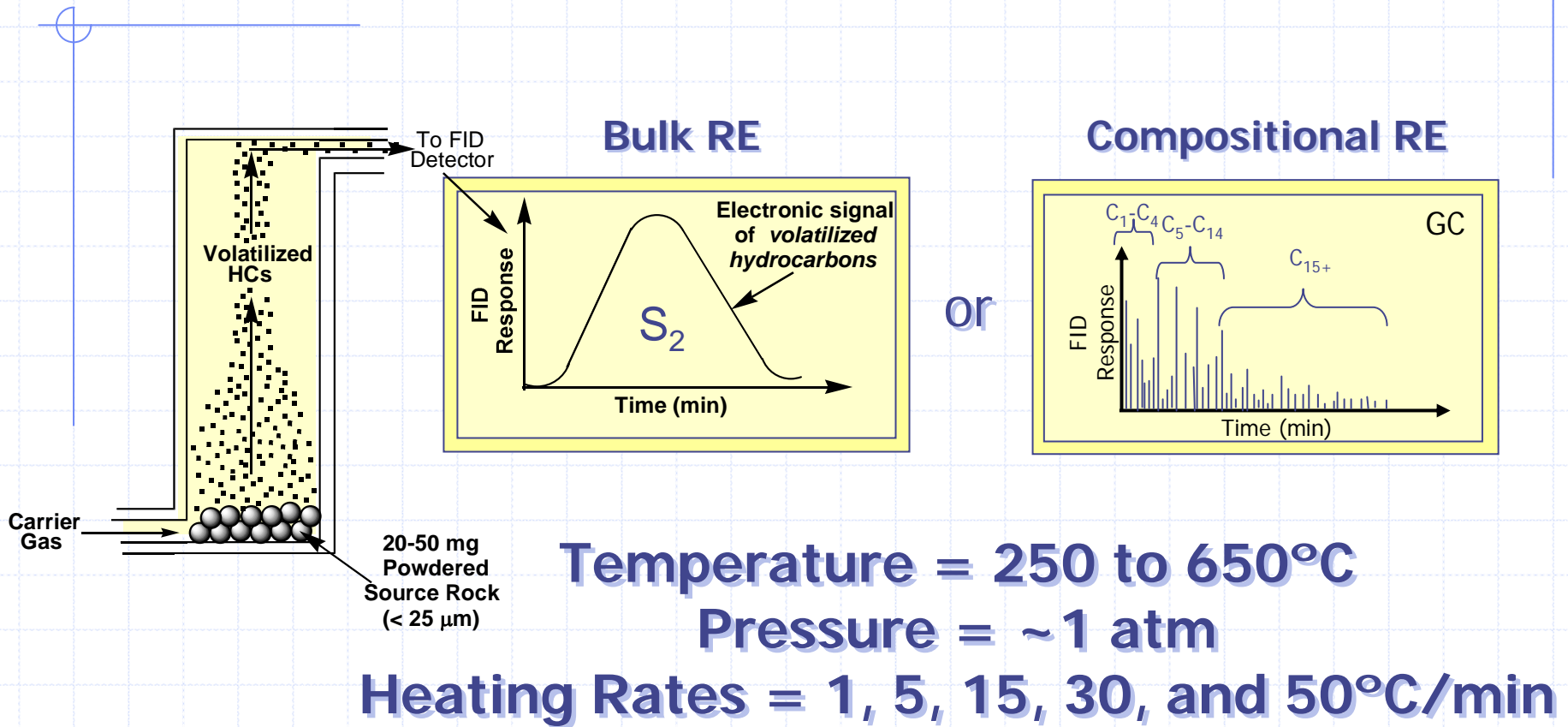
Ⓐ Alum Shale (Sweden)
13.2 wt%TOC of **Type-II**

Ⓝ New Albany Sh. (EOS)
14.3 wt%TOC of **Type-II**

Ⓒ Green River (Mahogany)
15.2 wt%TOC of **Type-I**

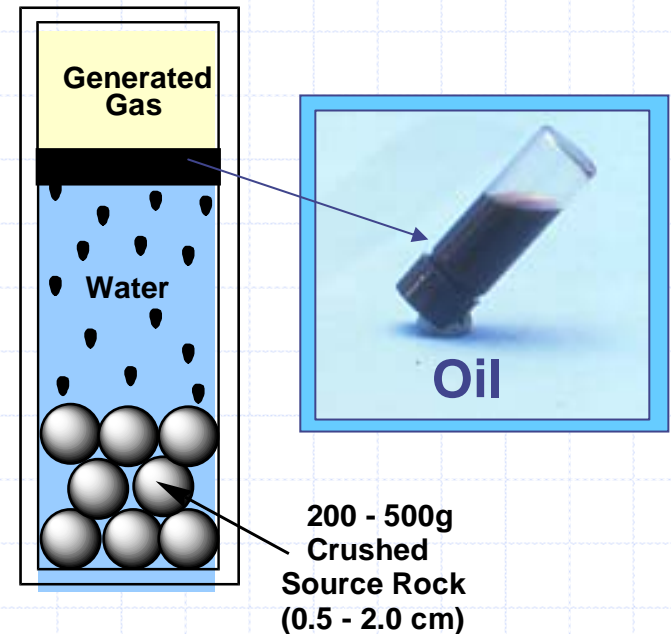


Rock-Eval Pyrolysis Methods

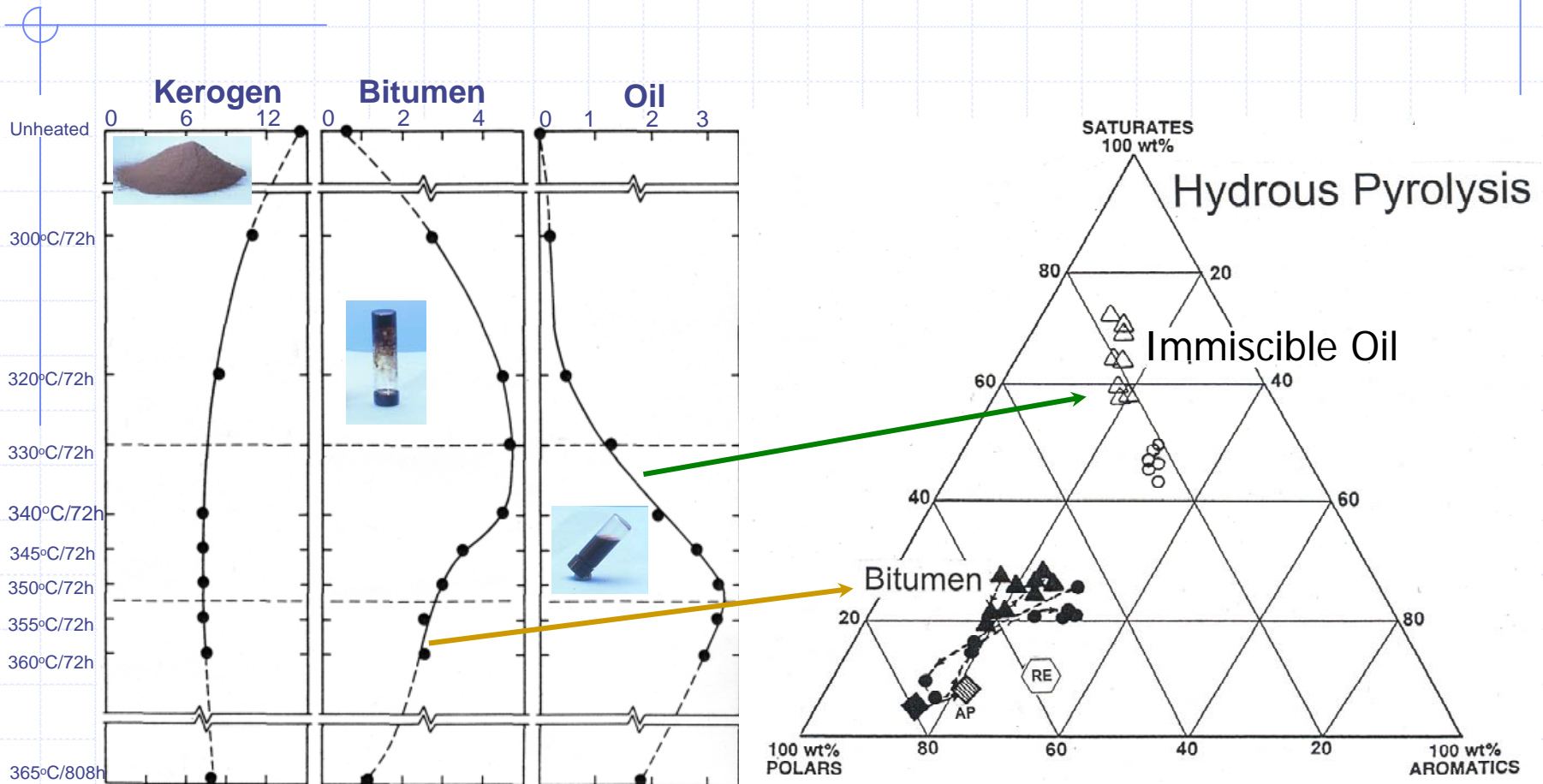


Hydrous Pyrolysis Methods

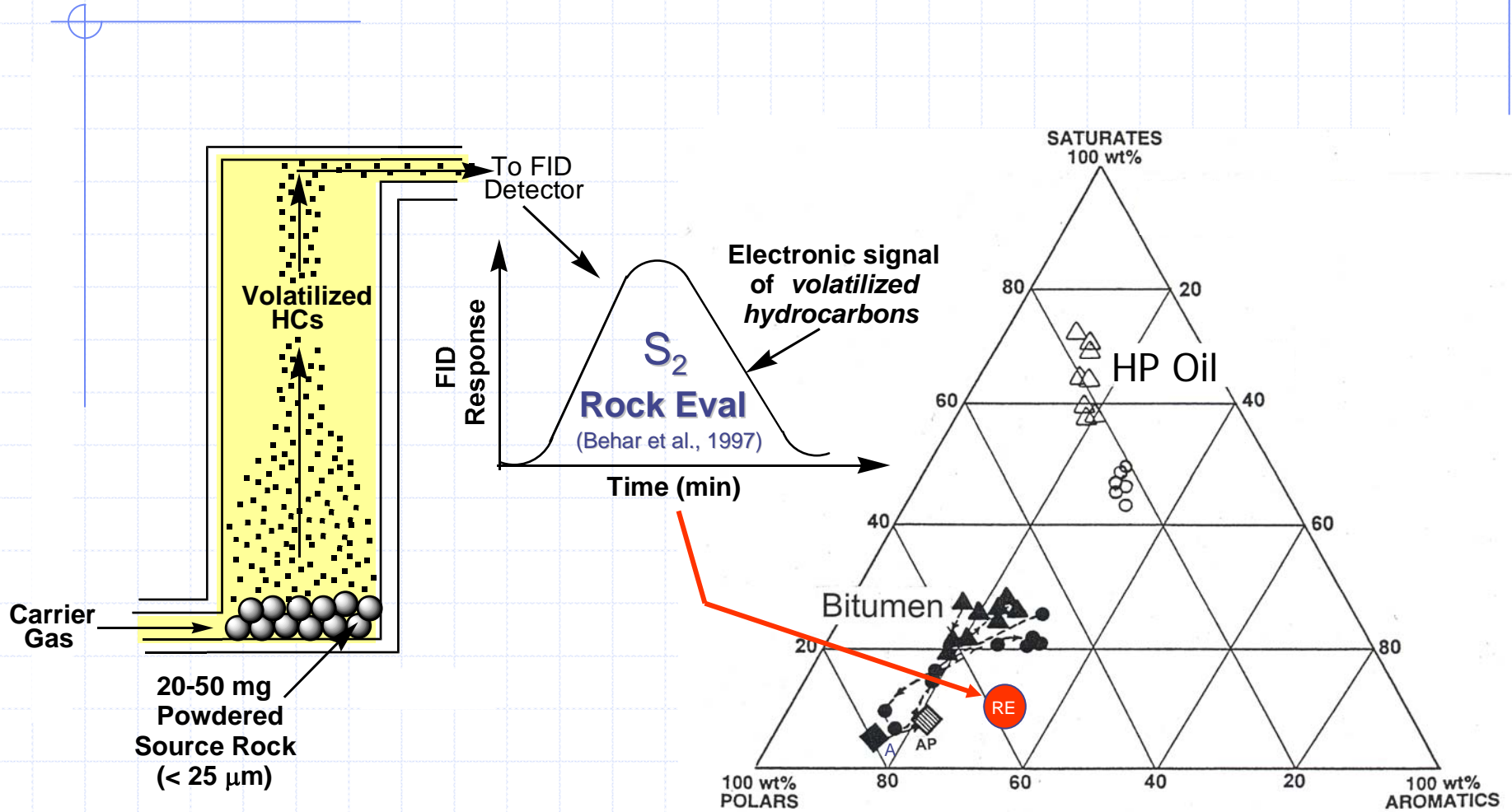
Isothermal Heating at
Temperatures = 250 to 365°C
Times = 12 to 120 hours
Pressures = 600 to 3,000 psia



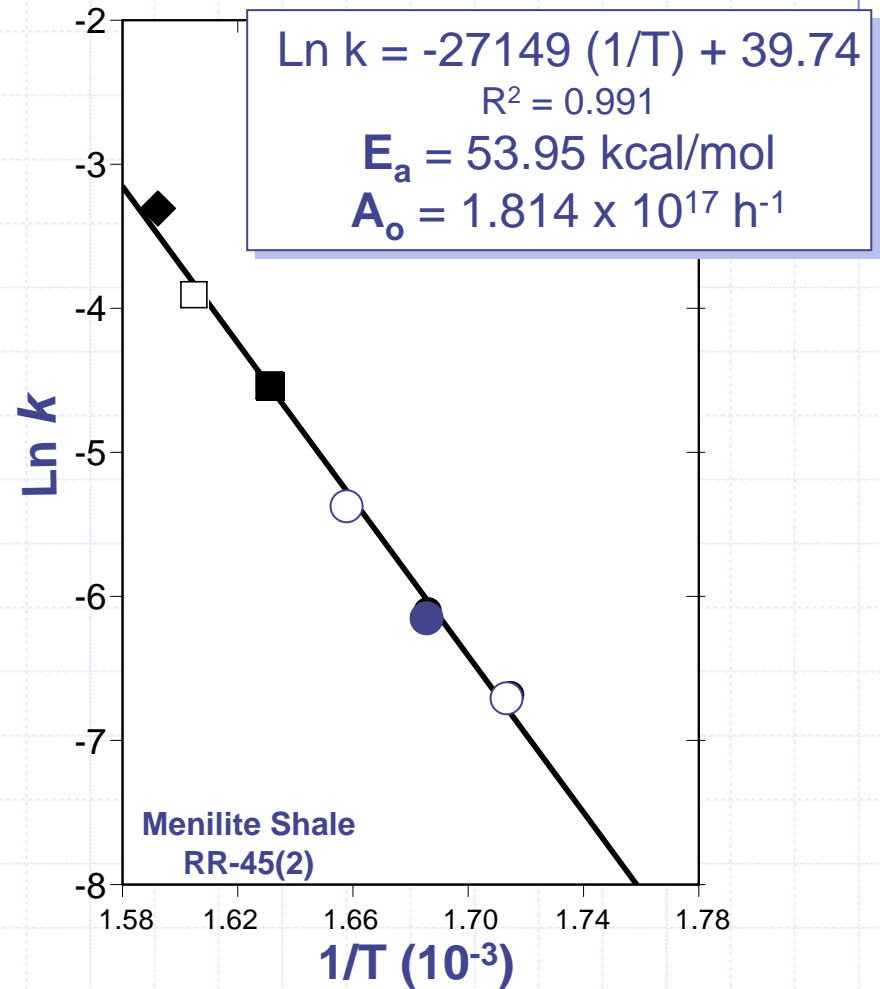
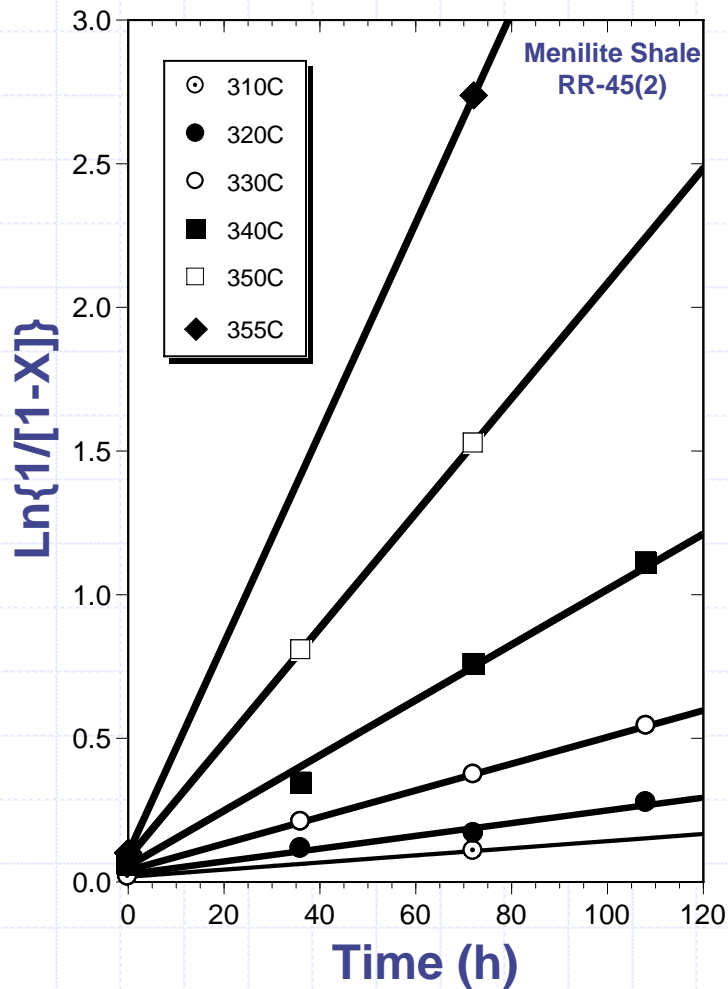
Hydrous Pyrolysis Products



Rock-Eval Products

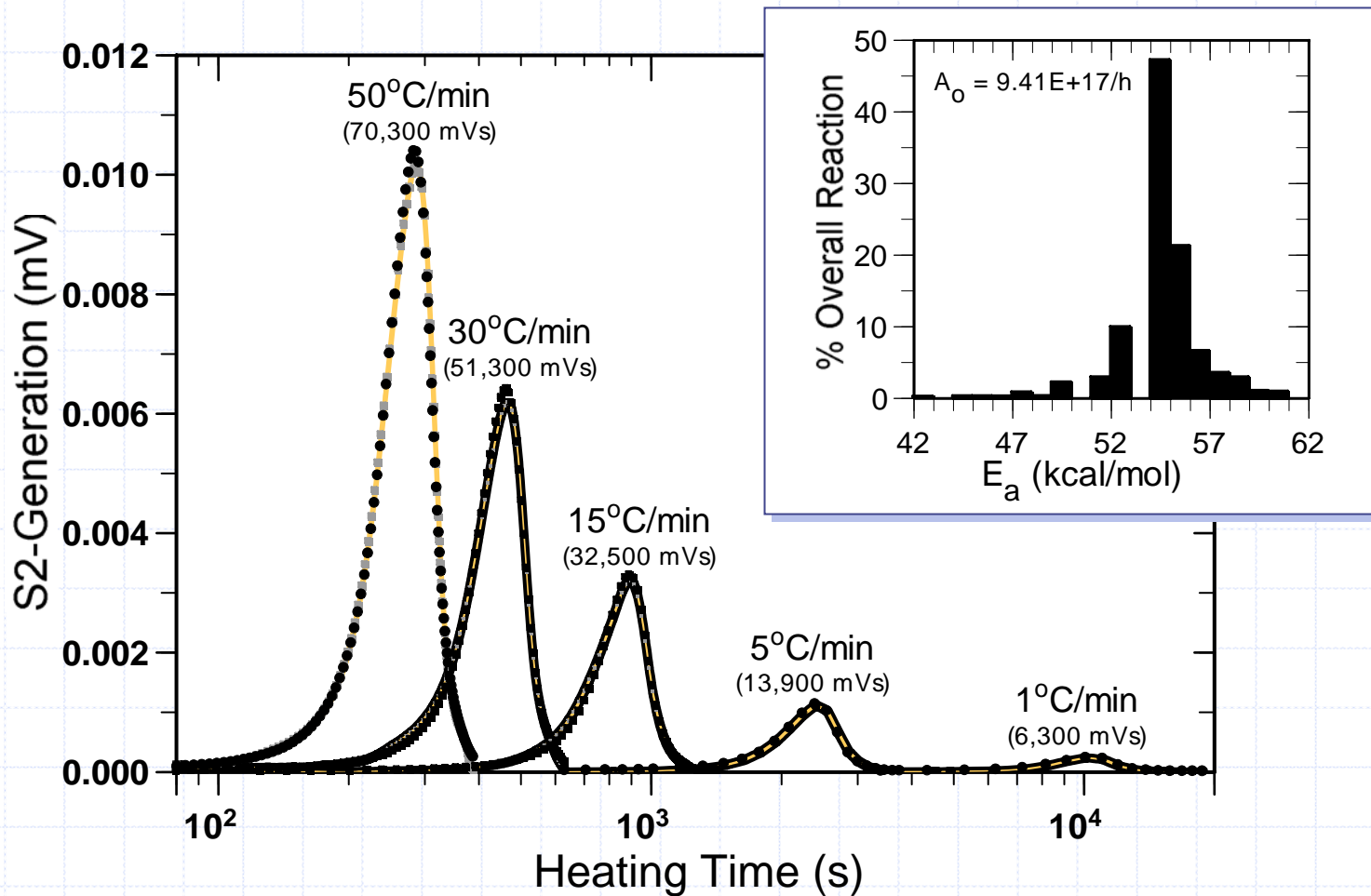


Hydrous Pyrolysis Isothermal Kinetics



Rock-Eval

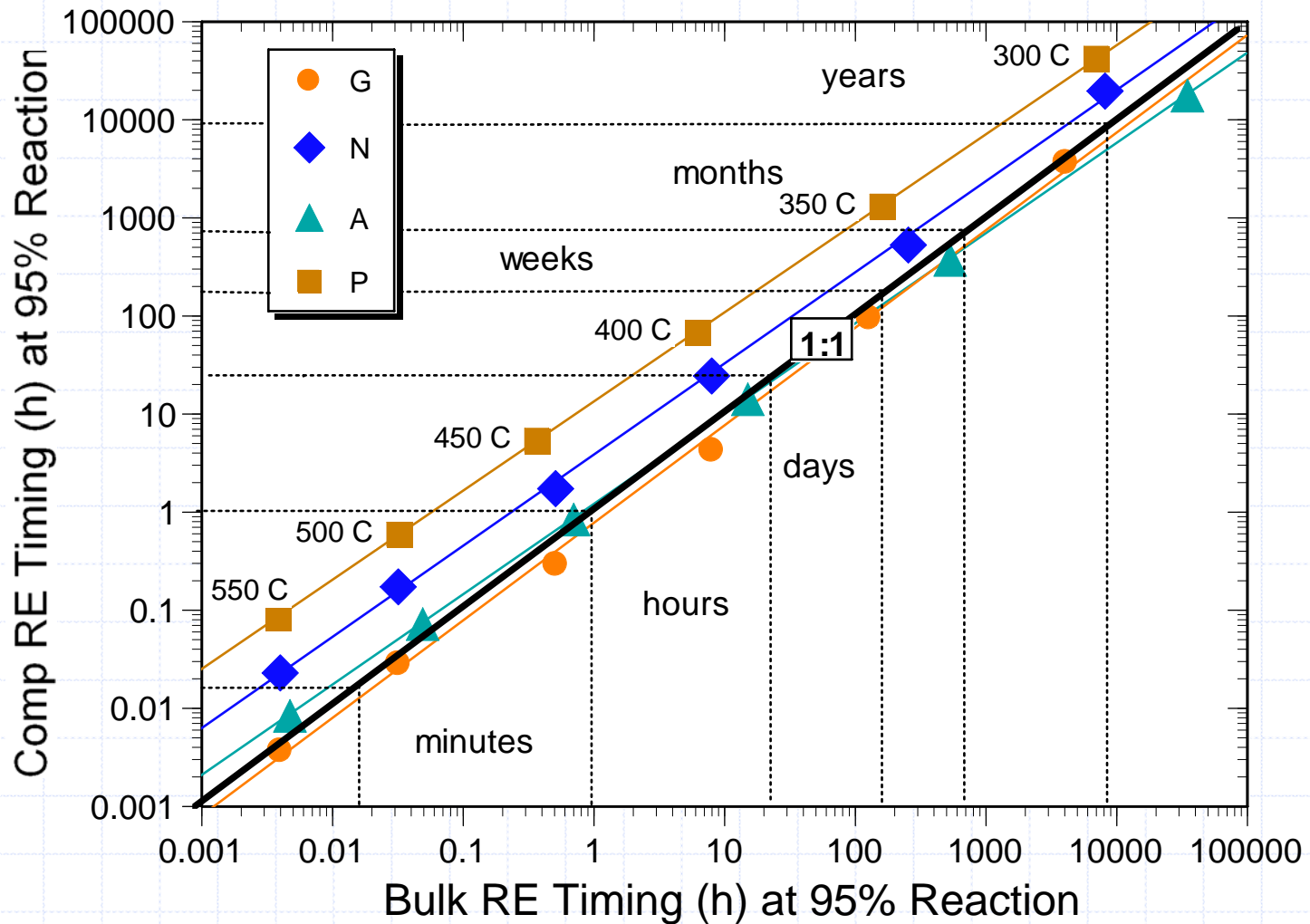
Non-isothermal Kinetics



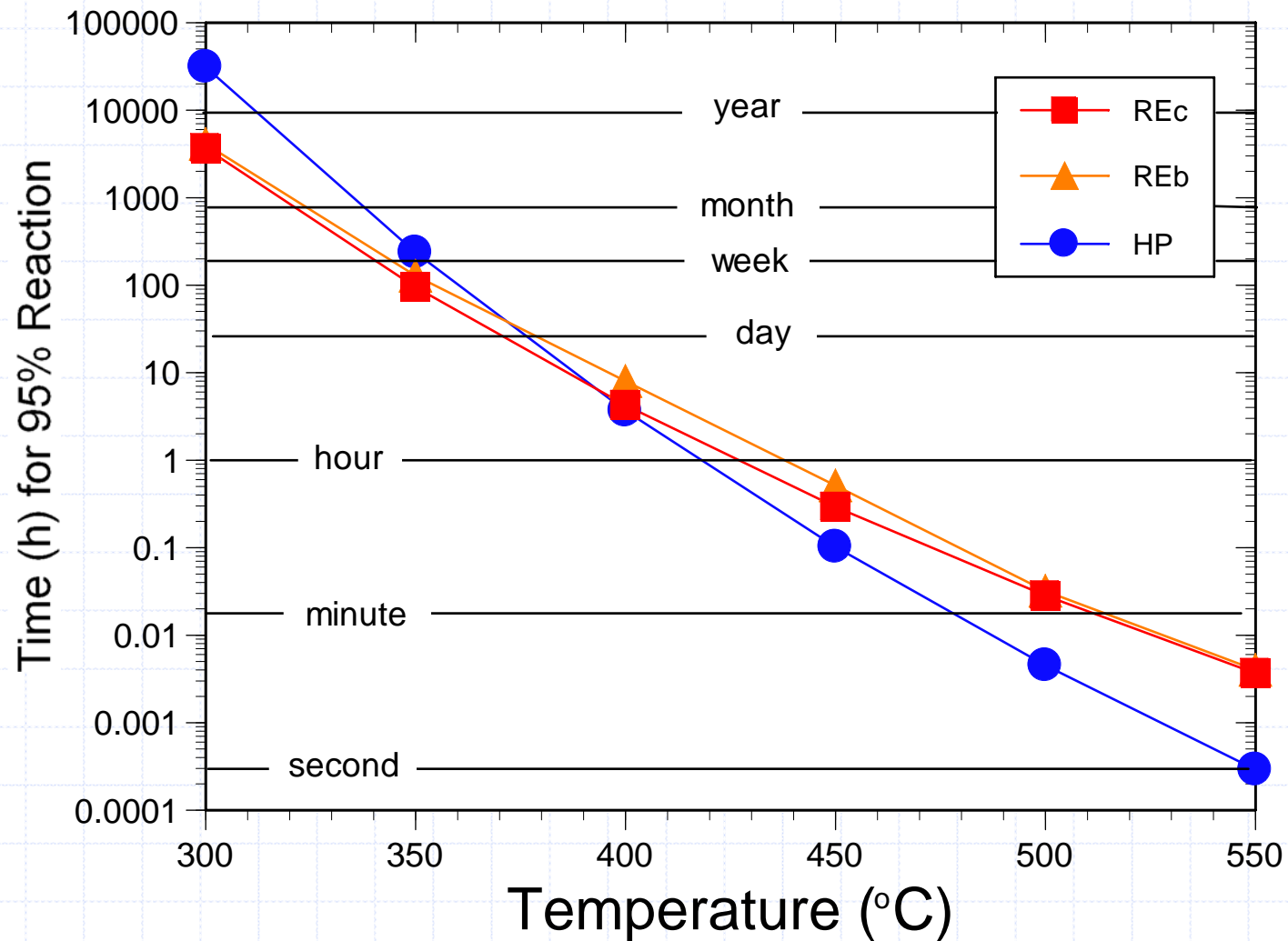
Comparison of Pyrolysis Methods For Deriving Oil Generation Kinetics

Attribute	HP	RE
Heating	Isothermal	Non-isothermal
Temperatures (°C)	250-365	250-650
Times (h)	12-120	0.5-7
Pressures (psia)	600-3000	~15
Products	HC-rich oil	Polar-rich bitumen

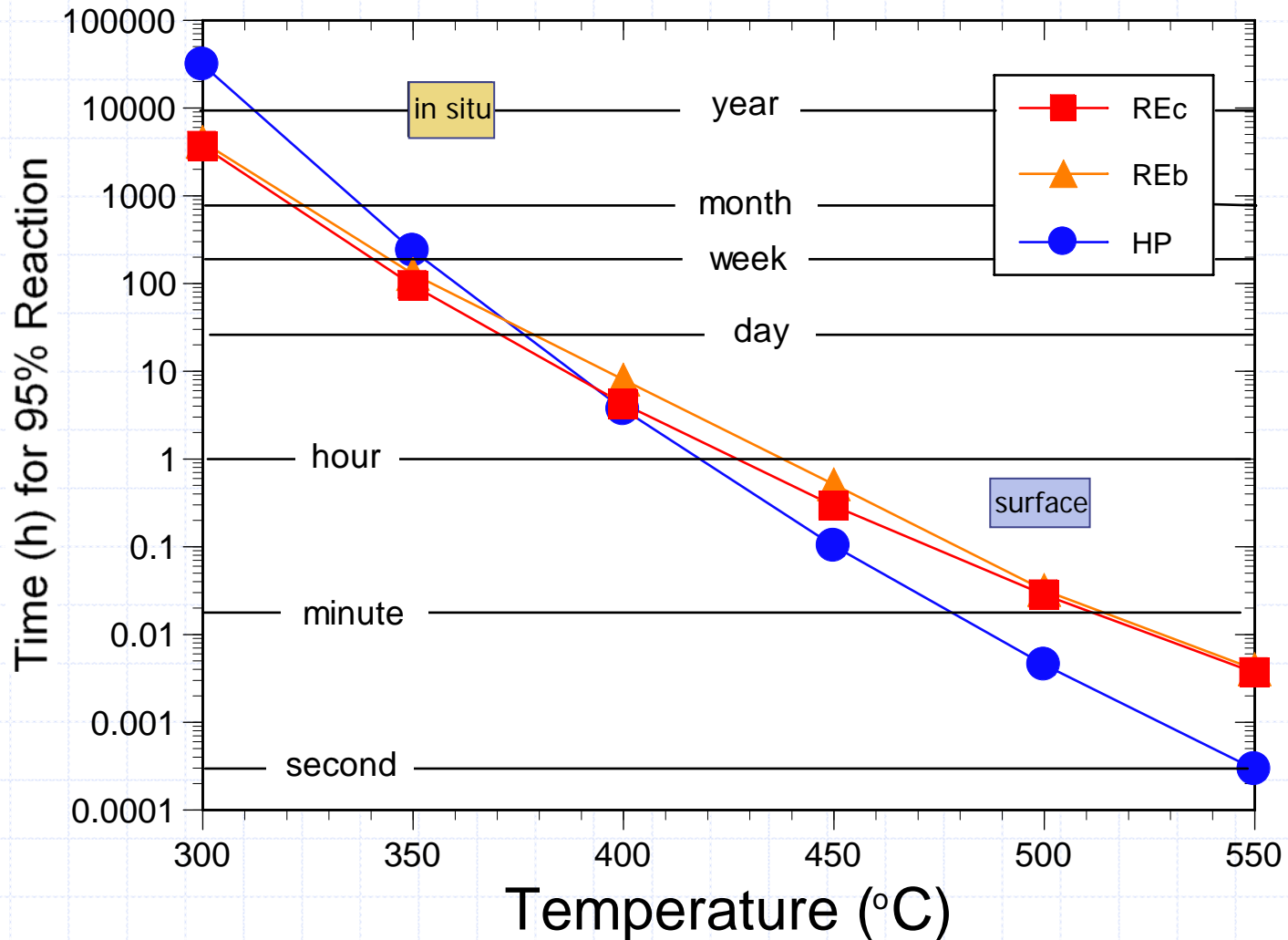
Bulk RE versus Comp RE Timing at 95% Generation



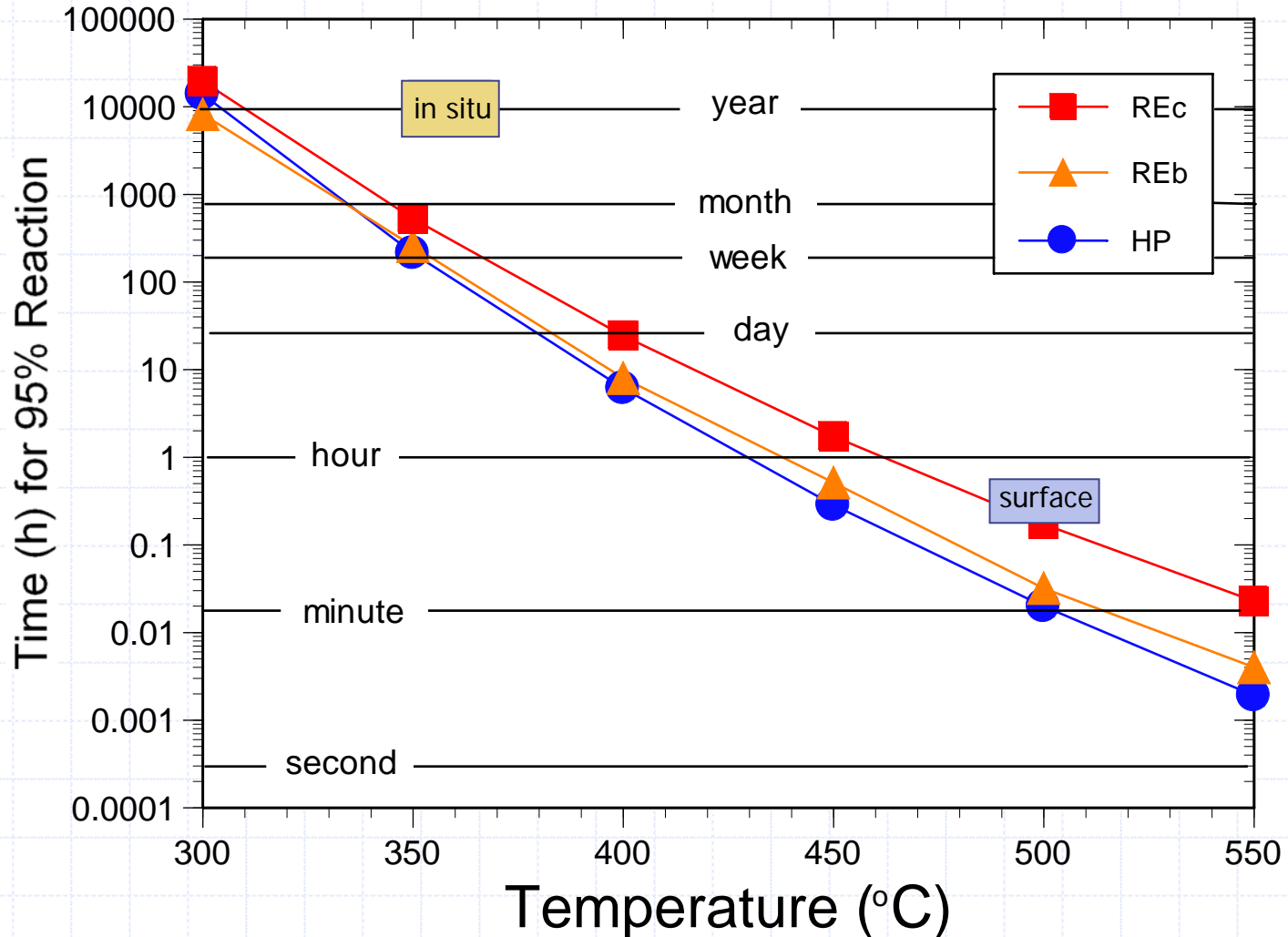
Comparison of Timing at 95% Generation of Green River Shale (Type-I)



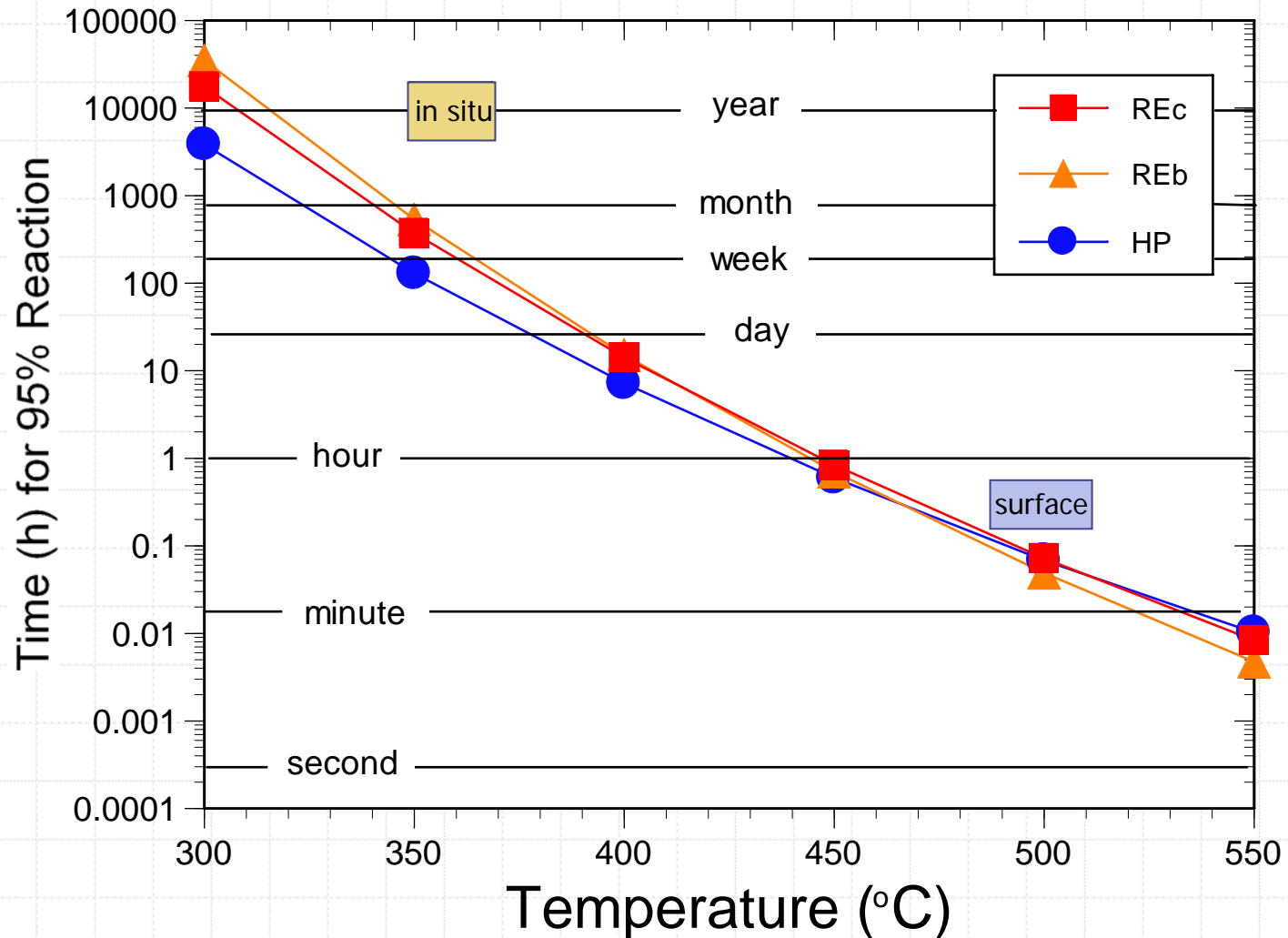
Comparison of Timing at 95% Generation of Green River Shale (Type-I)



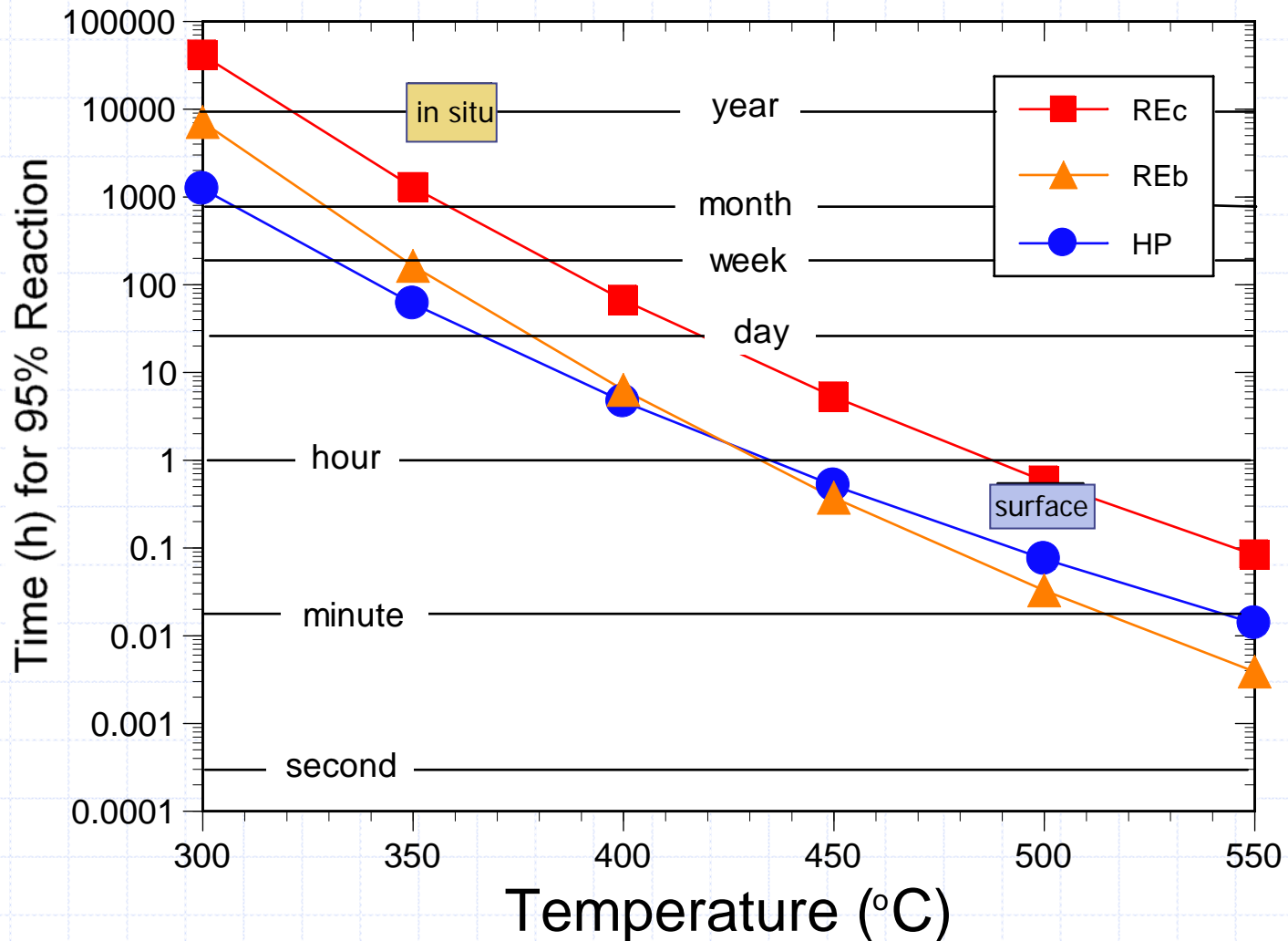
Comparison of Timing at 95% Generation of New Albany Shale (Type-II)



Comparison of Timing at 95% Generation of Alum Shale (Type-II)



Comparison of Timing at 95% Generation of Phosphoria Retort Shale (Type-IIS)



Conclusions

Pyrolysis Methods for determining oil generation

can make a significant difference in determining timing and extent of **natural** petroleum generation.

do not make a significant difference in determining timing and extent of *in situ* oil-shale retorting.

may make a significant difference in determining timing and extent of in **surface** oil-shale retorting (Type-IIS).