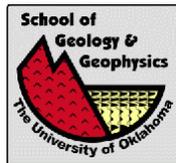


# Geochemical Characterization of Oils from the Granite Wash

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and Geophysics, University of Oklahoma,  
Norman, OK. 73019.



## The Granite Wash Oils

- The Granite Wash Formation is a very productive oil producing formation located in Western Oklahoma/Eastern Texas.
- While many papers discuss the geological characteristics of the producing formation, few data have been published on the geochemical characteristics of the source rocks or potential source rocks.
- This paper focuses on the geochemistry of the oils from Beckham and Wheeler Counties and how this information can be used to infer source rock characteristics.

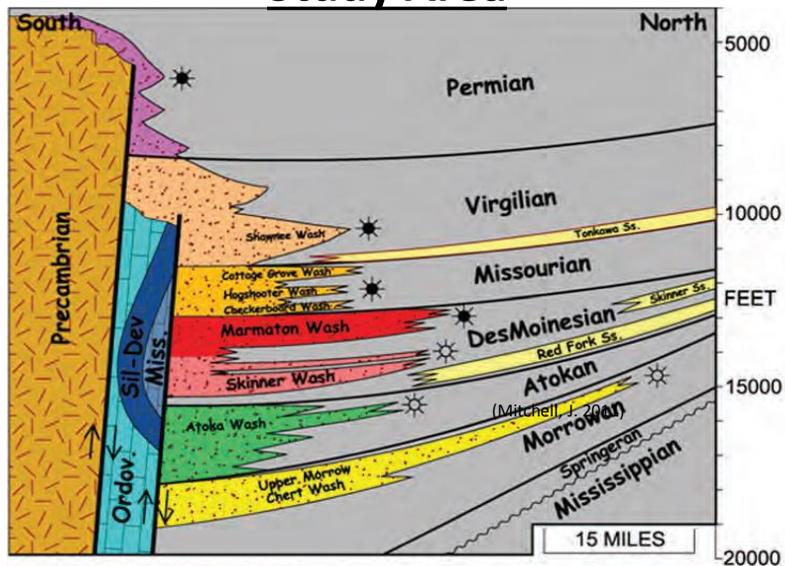
## The Granite Wash Oils

- **14 Oils were provided from Granite Wash horizontal producers from Beckham and Wheeler Counties**
- **These oils were fractionated and characterized by a wide range of geochemical techniques including gas chromatography, gas chromatography-mass spectrometry and stable isotopes.**

## The Granite Wash Oils

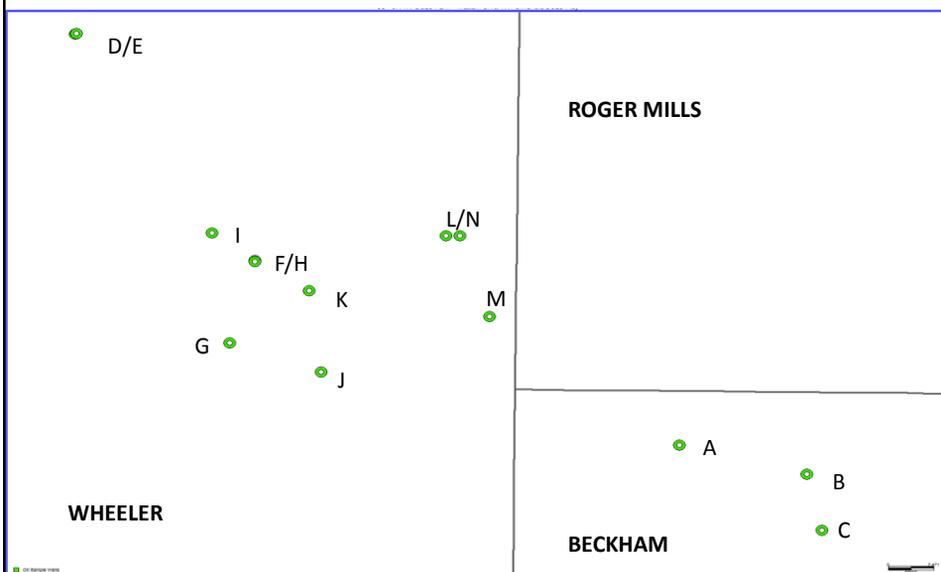
Well Name	State	County	Formation	TVD
A	OK	Beckham	Missourian Granite Wash	11,171
B	OK	Beckham	Missourian Granite Wash	11,545
C*	OK	Beckham	Virgil Granite Wash	8,001
D	TX	Wheeler	Des Moinesian Granite Wash	11,832
E	TX	Wheeler	Des Moinesian Granite Wash	11,999
F*	TX	Wheeler	Missourian Granite Wash	10,788
G*	TX	Wheeler	Missourian Granite Wash	10,691
H	TX	Wheeler	Des Moinesian Granite Wash	12,097
I	TX	Wheeler	Des Moinesian Granite Wash	12,115
J*	TX	Wheeler	Missourian Granite Wash	10,583
K*	TX	Wheeler	Missourian Granite Wash	10,524
L	TX	Wheeler	Des Moinesian Granite Wash	12,649
M	TX	Wheeler	Des Moinesian Granite Wash	13,107
N	TX	Wheeler	Des Moinesian Granite Wash	13,040

## Cross-section of Granite Wash in the Study Area

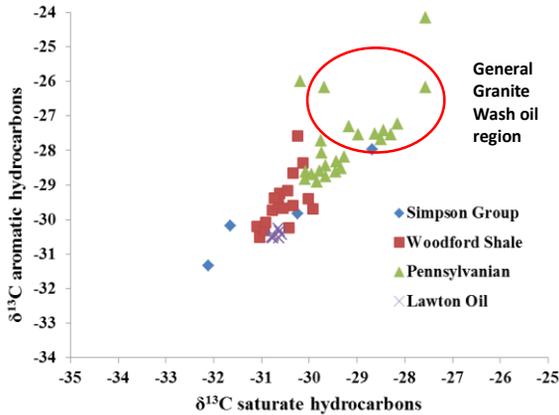


(From Mitchell 2011)

## Location of the Granite Wash Oils



# The Granite Wash Oils-Isotopic Compositions

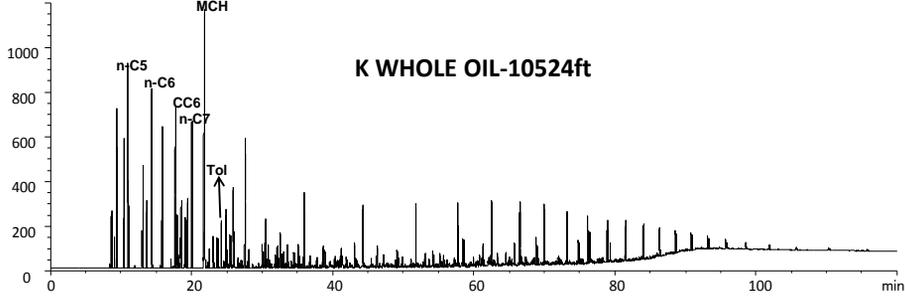
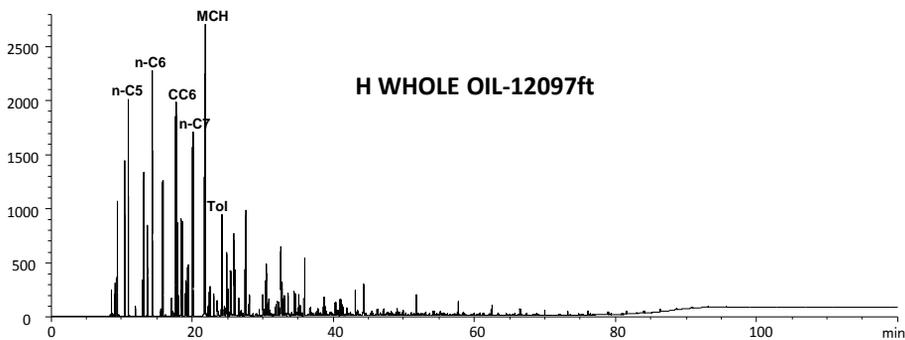


Sample Names	Whole Oil δ <sup>13</sup> C
A	-27.5
B	-26.04
C	-26.65
D	-26.48
E	-27.56
F	-27.65
G	-26.65
H	-26.44
I	-27
J	-25.83
K	-27.67
L	
M	-27.80
N	-28.3
O	-27.60

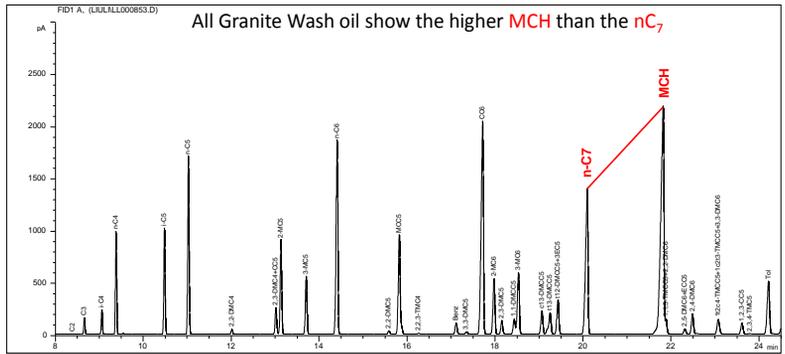
Modified from Burruss, R.C., Hatch, J.R., 1989

Although we only measured the whole oil isotopic composition, we can estimate the general Granite Wash oil region in the cross plot above. It indicates the **source rock(s)** are **Pennsylvanian or possibly younger**.

# The Granite Wash Oils-Gas Chromatography

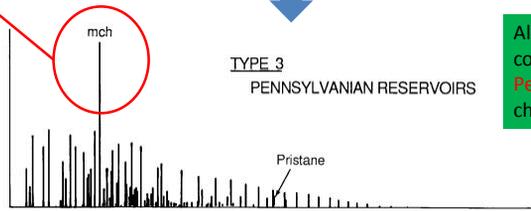


# The Granite Wash Oils-Gas Chromatography



MCH > nC<sub>7</sub>

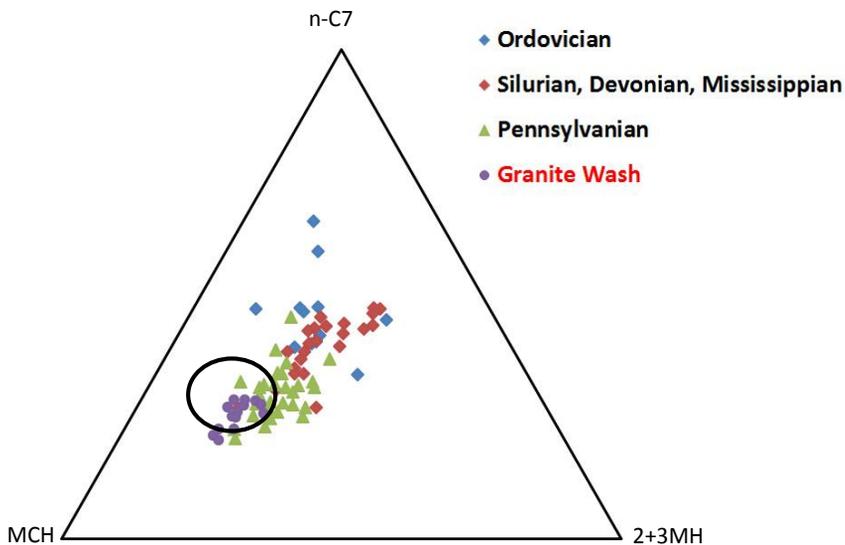
Similar MCH distribution



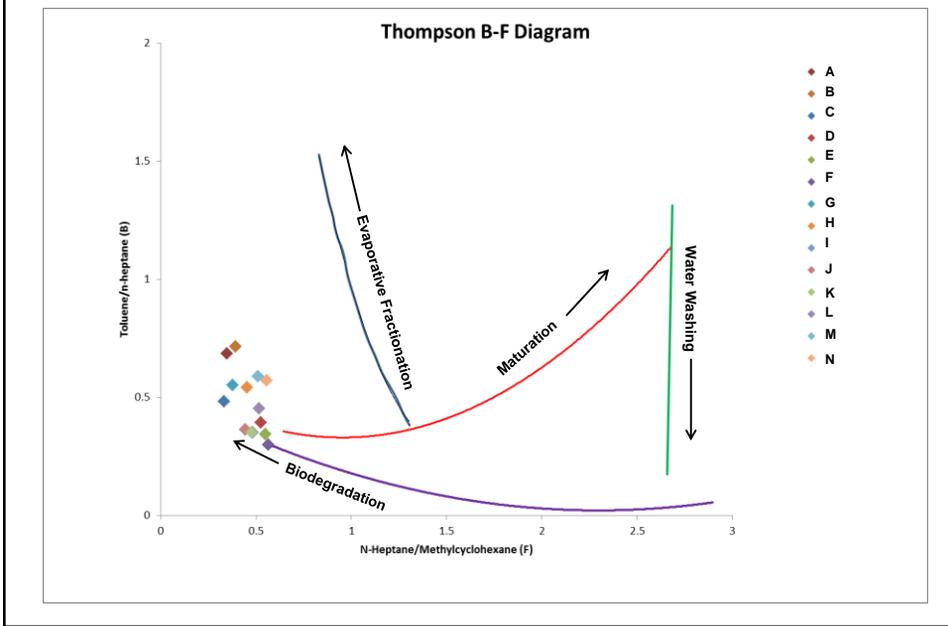
All the Granite Wash oils come from the Pennsylvanian reservoirs, characterized by high MCH

Modified from Burruss, R.C., Hatch, J.R., 1989

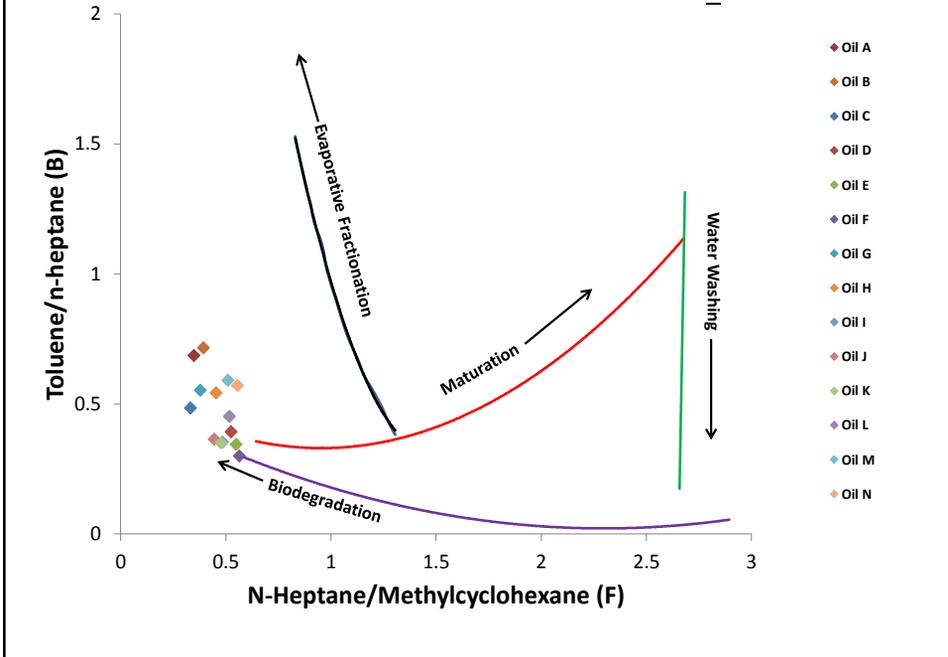
# The Granite Wash Oils-Gas Chromatography



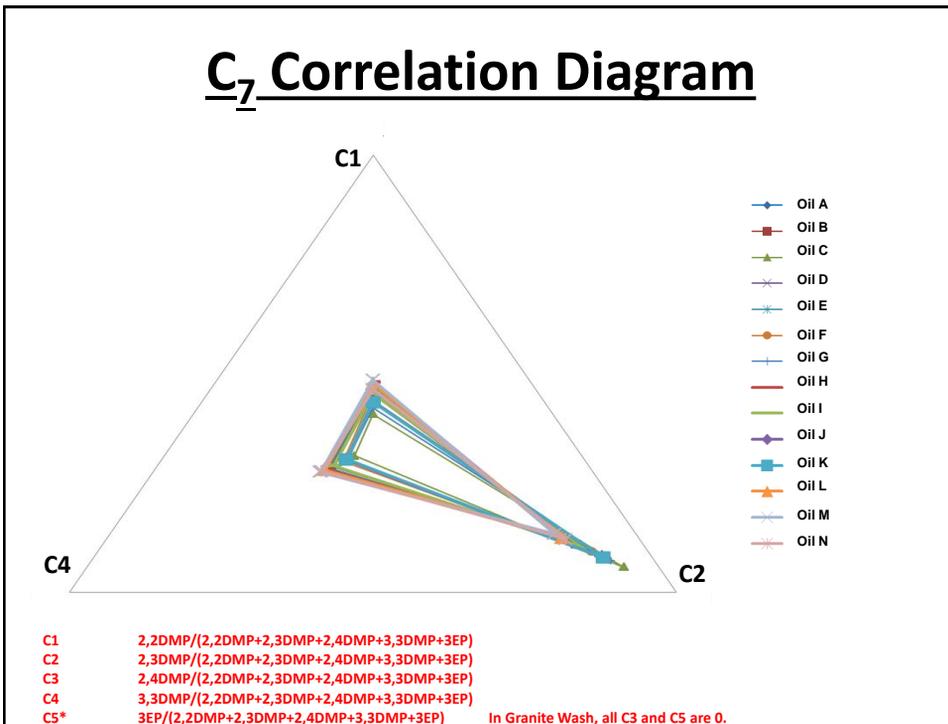
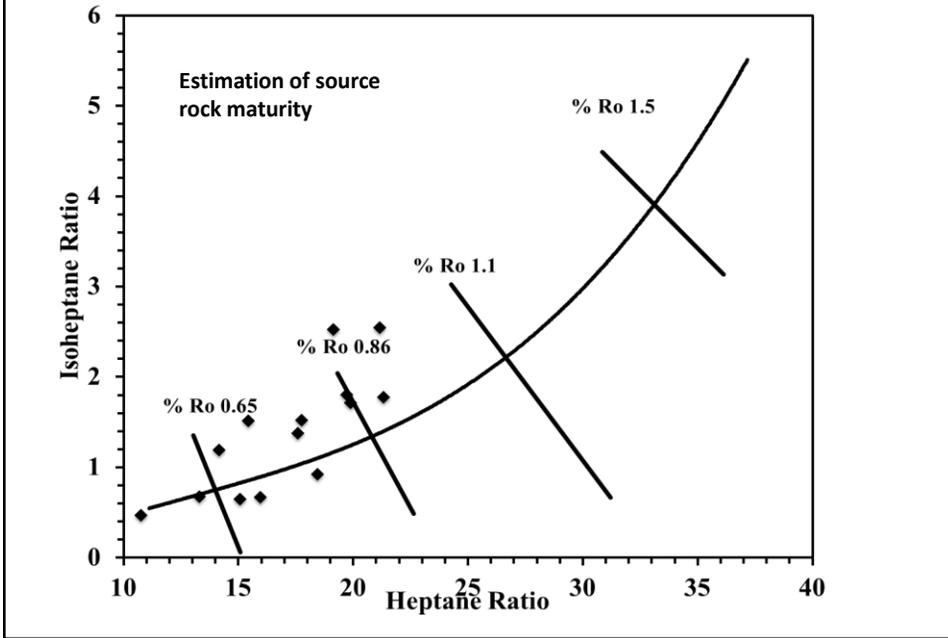
## Characteristics of the Oils based on C<sub>7</sub> Compounds



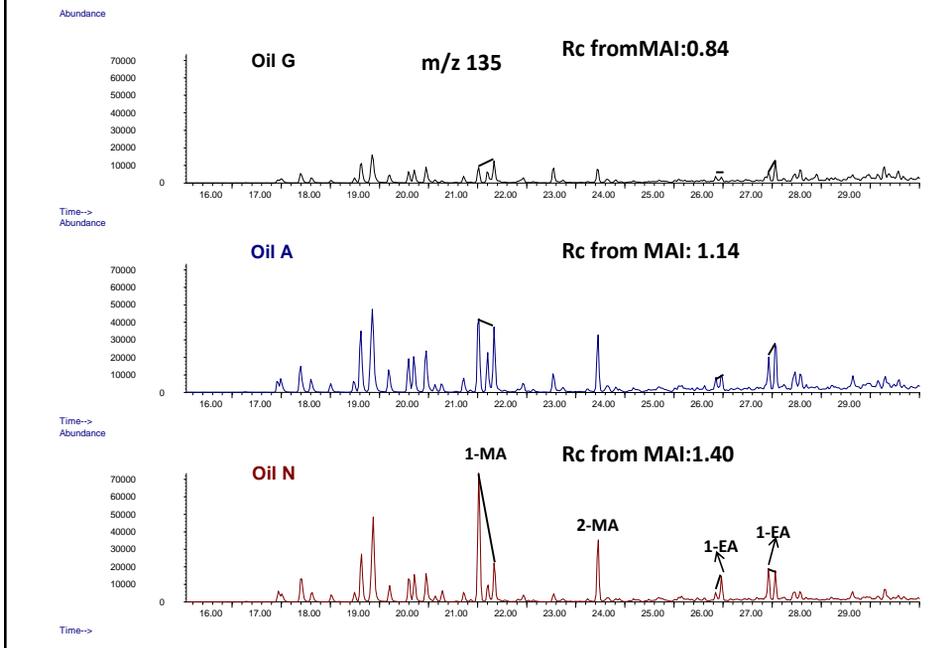
## • Characteristics of the Oils based on C<sub>7</sub> Compounds



# The Granite Wash Oils-Gas Chromatography



# The Granite Wash Oils-Gas Chromatography



# The Granite Wash Oils-Maturity

Sample	Rc from MPI	Rc From MAI	Rc from C7
A	0.94	1.14	0.92
B	1.05	1.16	1.04
C*	0.84	0.87	0.47
D	1.19	1.20	1.11
E	1.29	1.14	1.10
F*	0.90	0.85	0.80
G*	0.81	0.84	0.65
H	1.28	1.27	1.04
I	1.24	1.06	0.99
J*	0.86	0.82	0.63
K*	0.85	0.80	0.64
L	1.30	1.23	1.12
M	1.27	1.35	1.28
N	1.31	1.40	1.29

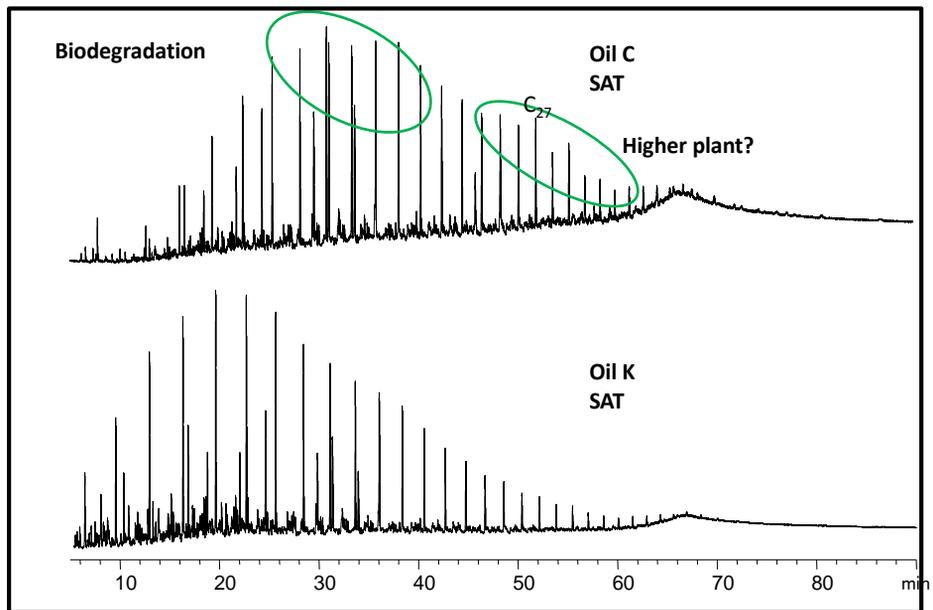
Rc from C7 =  $0.84 + 1.1 * \text{Log}(\text{Isoheptane ratio})$   
 Ref.: Schaefer and Littke. Org. Geochem. 1988, Vol. 13, pp. 887-892

Rc from MAI =  $3.26882 * \text{MAI} - 0.856452$   
 Ref. Generated from the data given by Chen J. et al. Org. Geochem. Vol. 25, No. 3/4, pp. 179-190, 1996

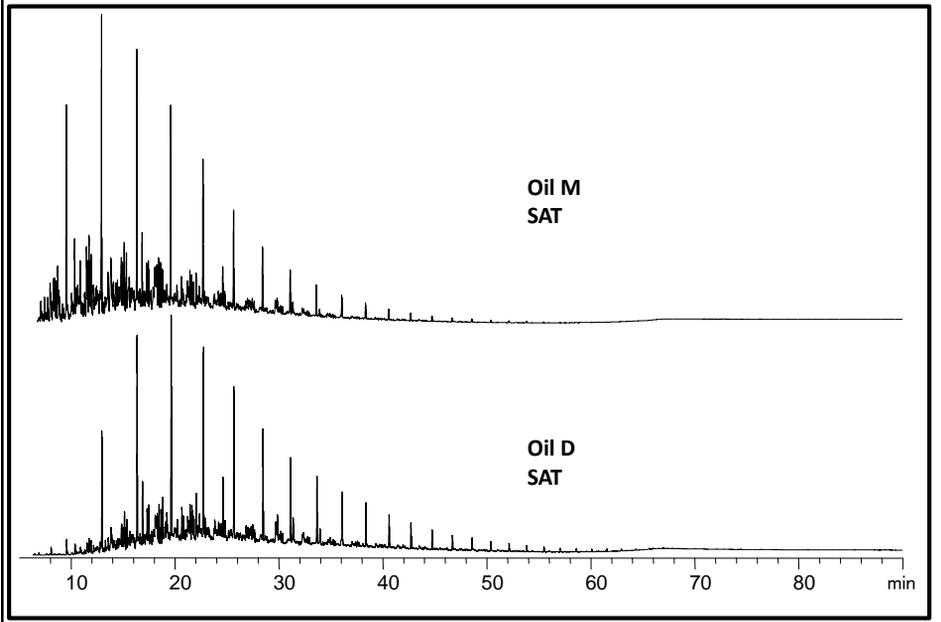
## Gas Chromatograms

- Saturated gas chromatograms again show the differentiation between the two groups of oils.
- Oil C was noteworthy for 2 reasons.
  - First it appears to be in the early stages of biodegradation
  - Second it is showing signs of low maturity and also an input of terrestrial source materials.
  - The presence of the condensate components in oil C suggests the condensate may be derived from a different source than the oil

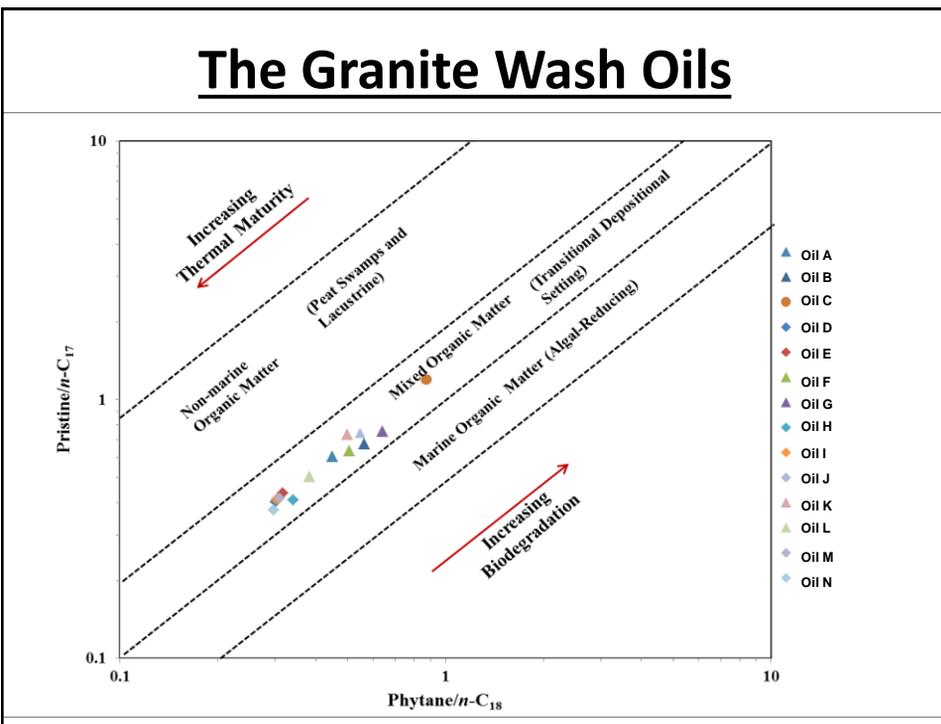
## Gas Chromatograms -Oils



## Gas Chromatograms - Condensates

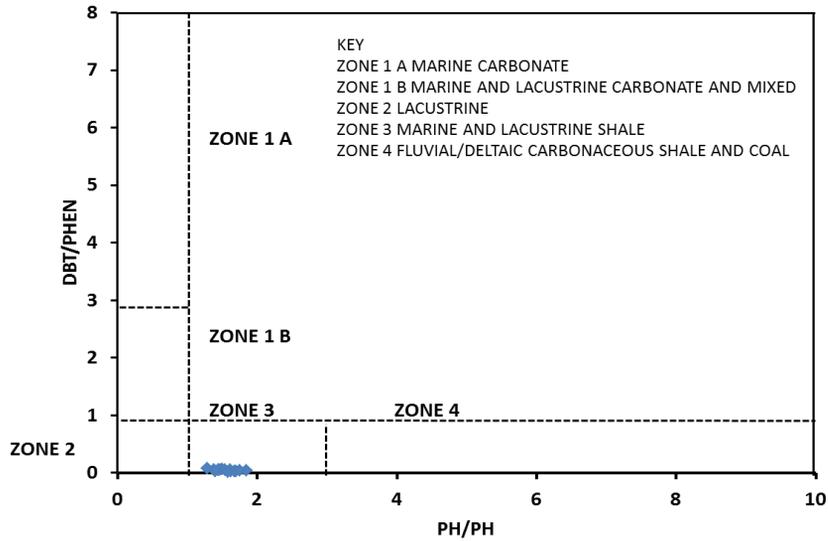


## The Granite Wash Oils

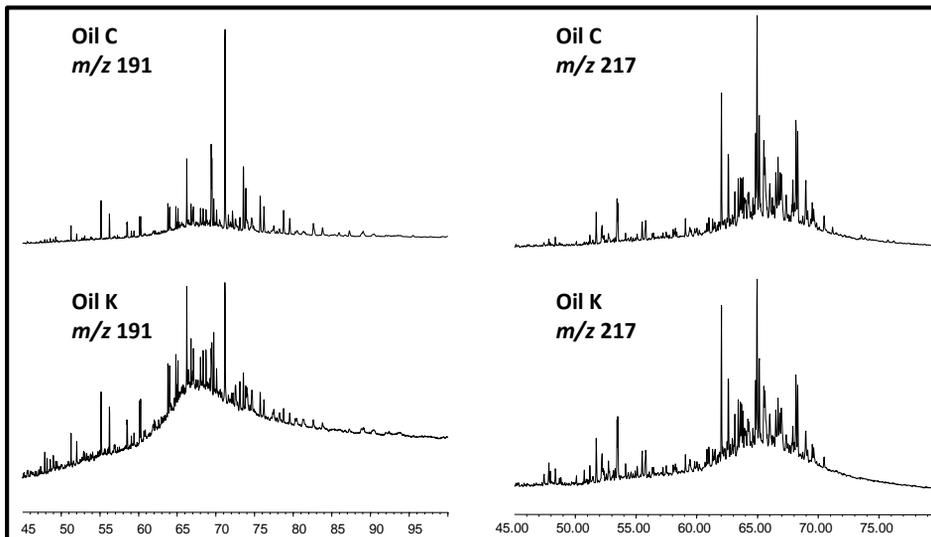


# The Granite Wash Oils

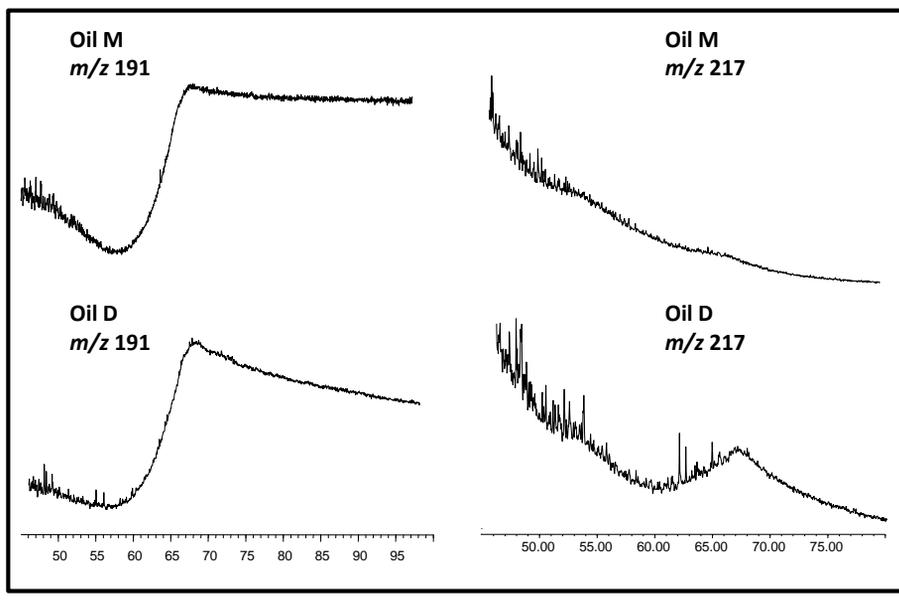
## Granite Wash



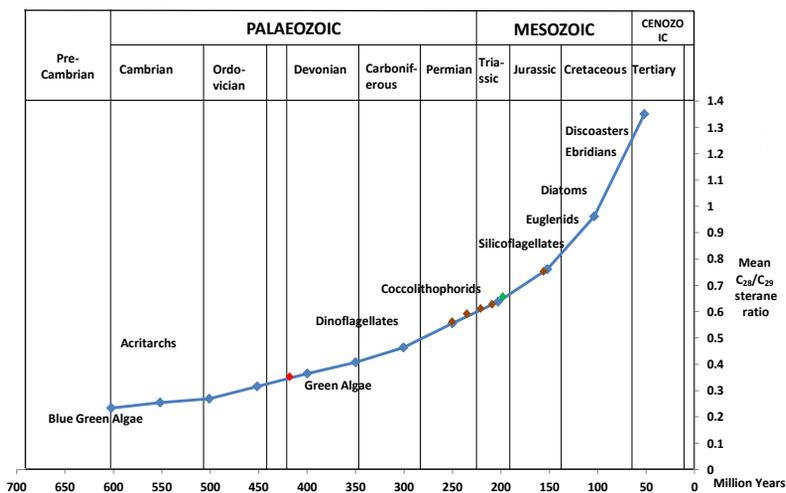
# Biomarkers in Oil Samples



## Biomarkers in Condensate Samples



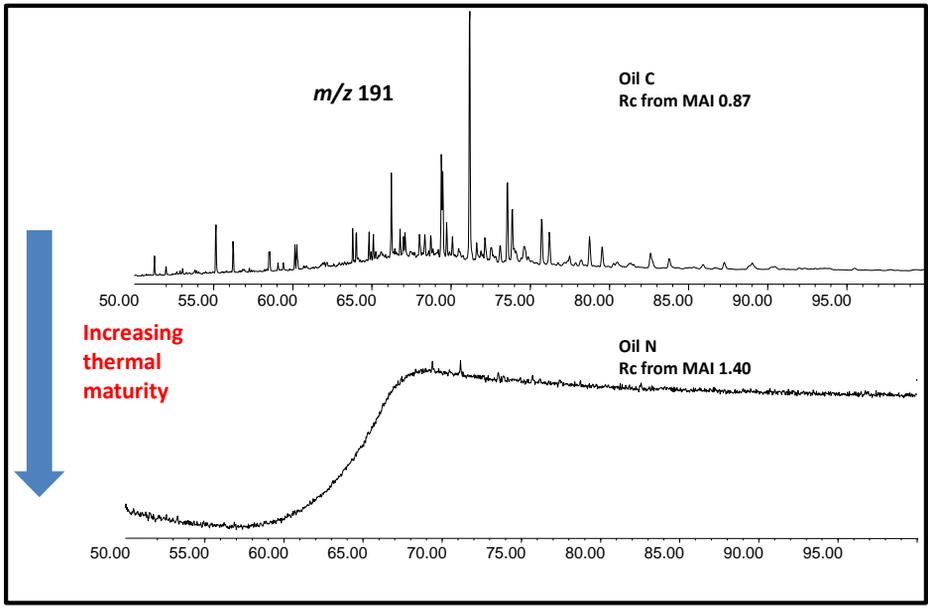
## Age Dating of the Oils



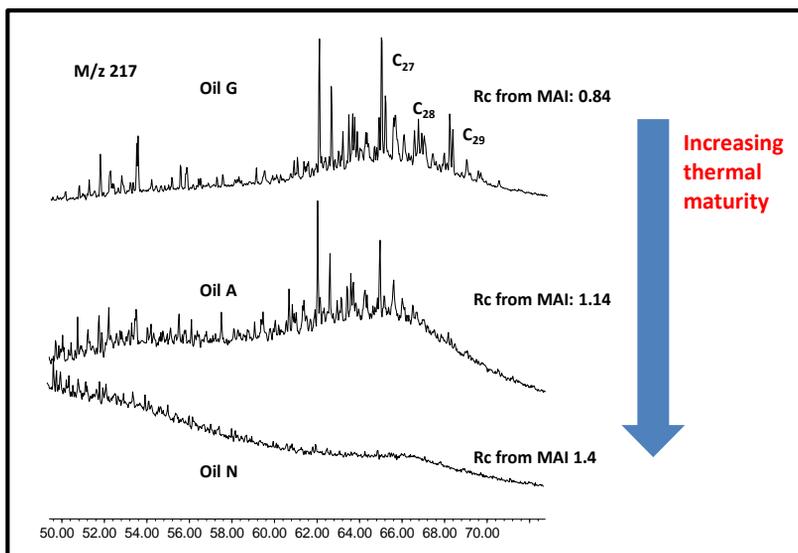
Modified from Grantham and Wakefield (1988)

The  $C_{28}/C_{29}$  sterane indicates that the source of the Granite Wash oils could be Permian to Jurassic, consistent with  $C_7$  data and stable isotopes.

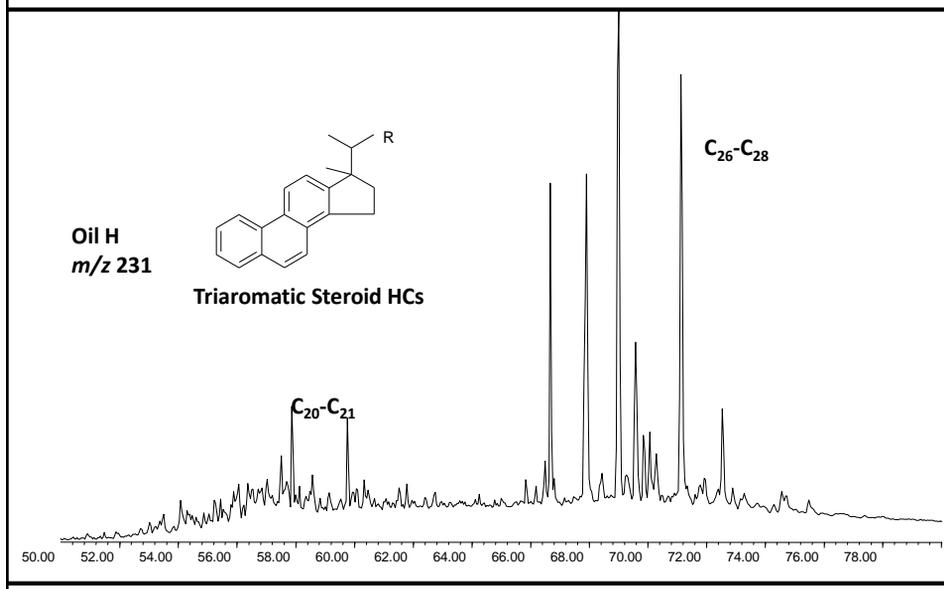
## Terpane changes with Maturity



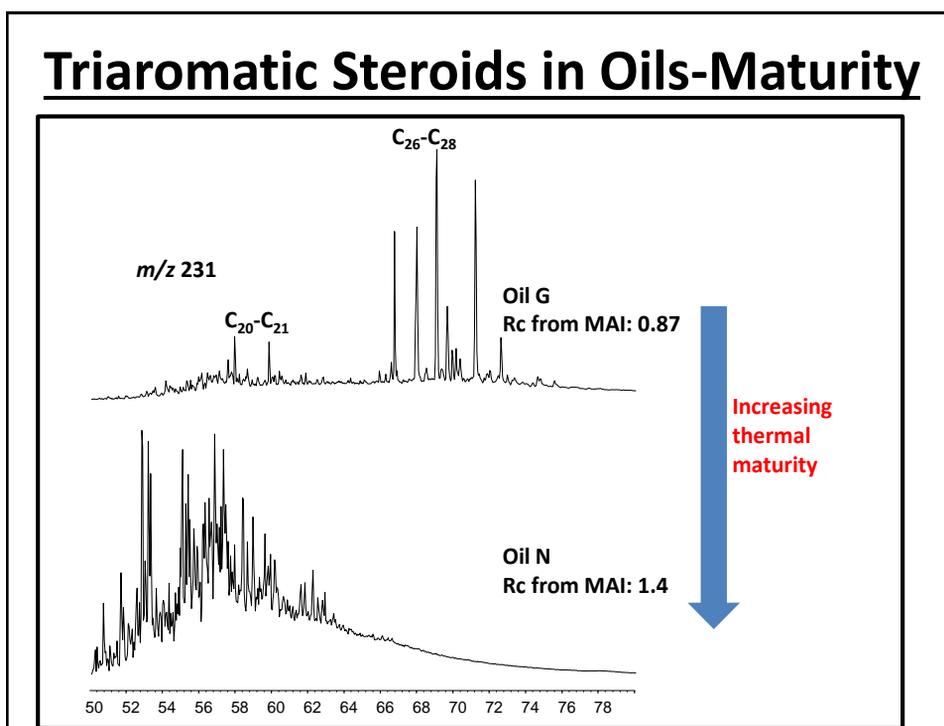
## Sterane Variations with increasing Maturity



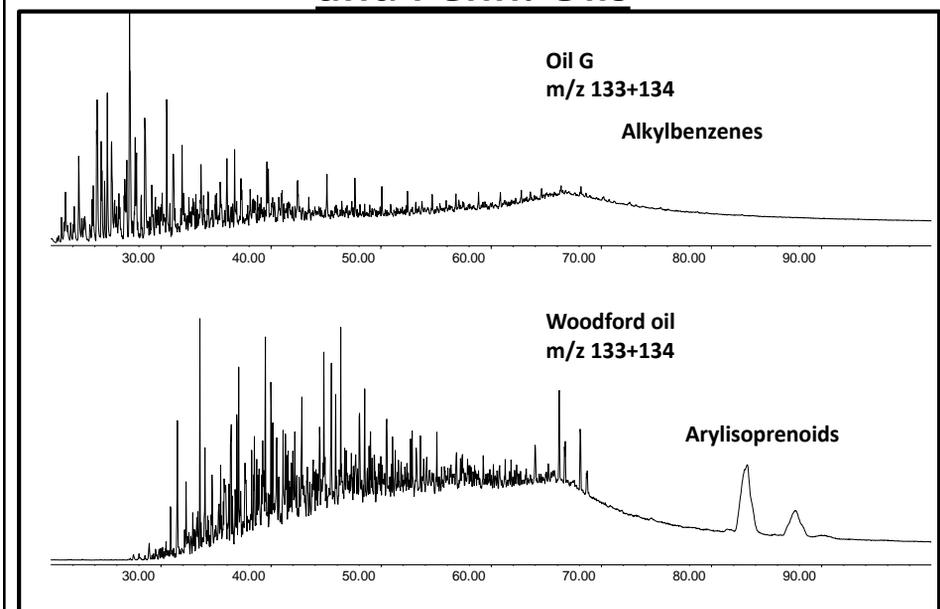
## Triaromatic Steroids in Oils



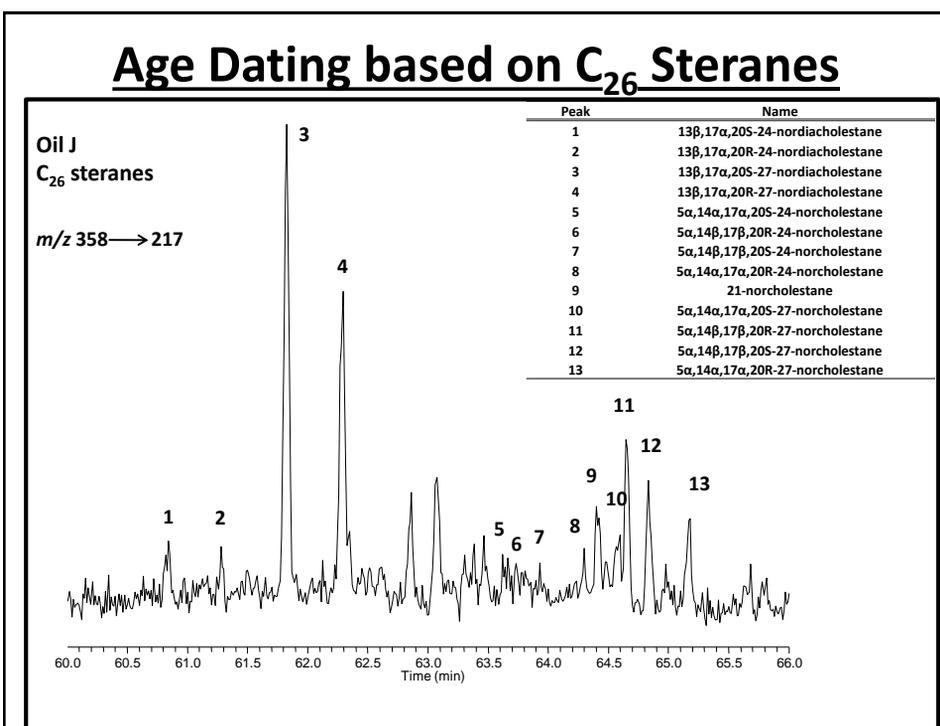
## Triaromatic Steroids in Oils-Maturity



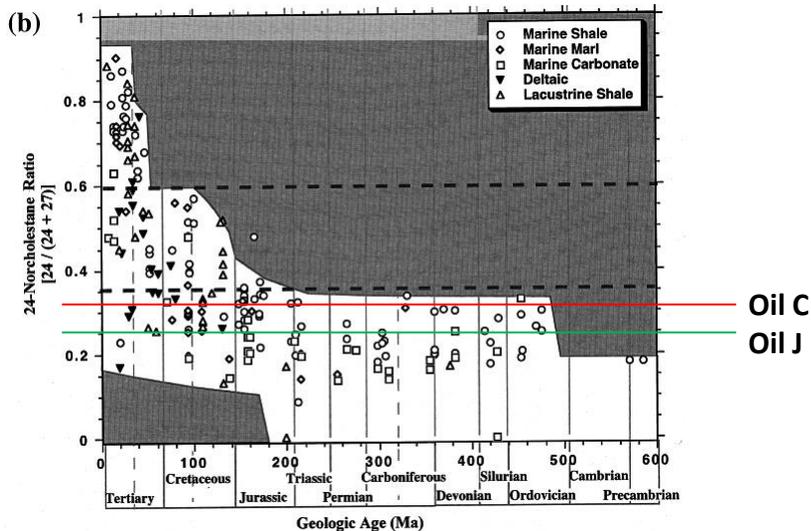
## Major Difference between Woodford and Penn. Oils



## Age Dating based on C<sub>26</sub> Steranes



## Age Dating based on C<sub>26</sub> Steranes



## Summary

- The oils in this study fell into two groups. Those in reservoirs below 11,000ft and those above that depth
- Deeper oils were primarily condensate.
- Shallower oils were more conventional oils but comingled with the condensate that may be derived from a different source
- Some signs of biodegradation
- Oils were probably sourced from Pennsylvanian shales with possible contributions from a younger source-evidence for higher plant input

## **Acknowledgements**

- We would like to acknowledge Bob Tehan for supplying the samples used in this study.