

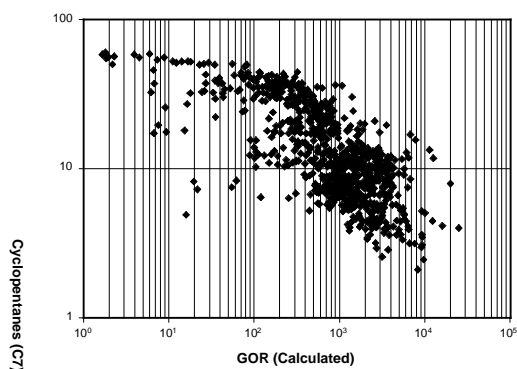
## Thermal stability of hydrocarbons in sedimentary basins

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Do the hydrocarbons in deep sedimentary basins thermally crack to natural gas? More specifically, is oil cracking an important source of natural gas? Perhaps, but there is little evidence of it. Oil and gas deposits in deep sediments do not resemble cracked products. The residual oil from cracking should be enriched in the more stable hydrocarbons, particularly the cycloalkanes (Greensfelder et al., 1945). But the cycloalkanes actually *diminish* in concentrations as oils mature (Figure 1). Moreover, oil cracks to wet gas, with about 20% methane (wt % in C<sub>1</sub> – C<sub>4</sub>), while natural gas is dry, on average about 80 % methane.

Figure 1: % Cyclopentanes in C7 vs Gas-to-Oil Ratios (Mango & Jarvie, 2001).



### References

- Mango F. D., and Jarvie D.M., (2001), Abstracts, 20<sup>th</sup> International Meeting on Organic Geochemistry, Nancy, France.  
Greensfelder B. S., Voge H. H., and Good G. M., (1945), *Ind. Eng. Chem.* **37**, 1168-1176.

## BSR, TSR and VFAs: clues and keys to reservoir processes

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The behaviour of sulphate and volatile fatty acids (VFAs) in waters from petroleum reservoirs is influenced by equilibrium reactions, irreversible biologically-mediated reactions and reaction kinetics. Thermochemical reduction of sulphate (TSR) in the presence of ethanoate yields rates of reaction showing that TSR is to be expected, on a geological time scale, at reservoir temperatures >150°C. The rate of ethanoate decarboxylation consistently is less than that of TSR at 50MPa, suggesting that homogenous decarboxylation may never occur in a 'normal' petroleum reservoir. Hence volatile fatty acid data for reservoir waters are controlled either by other chemical reactions, biological processes or reactions on mineral surfaces (likely biofilm covered). Ratios of ethanoate to propanoate reveal remarkable consistency for different petroleum reservoirs. For high T reservoirs (T>100°C) a log m<sub>et</sub> vs log m<sub>pr</sub> plot gives a slope of 1.5. Low T reservoirs (T<100°C) and other biologically active systems (e.g. landfills), give a slope of 1. Microbial metabolism apparently accounts for the stoichiometry of the 1:1 relationship. Thus the presence of active microbial populations (associated with specifically biochemical sulphate (BSR) and possibly Fe reduction) in a petroleum reservoir can be deduced from the ethanoate and propanoate contents of reservoir waters. Deviation from the 1:1 trend may reflect 'death' of the reservoir community, depending on the availability of electron acceptors.

