Organic geochemical proxies- Successes, failures and the future

STEVE LARTER[1] AND A CAST OF MANY

[1]PRG, Dept of Geosciences, University of Calgary, 2500 University Dr. NW, T2N 1N4, Calgary, AB, Canada

Molecular proxies have been used for decades in many aspects of energy and environmental organic geochemistry. Despite widespread application, generic challenges remain in the quantitative use of these proxies in all applications, including; uncertainties about the often complex mechanisms of proxy function; the impacts of component mixing and other mass transport phenomena on a large range of spatial and temporal scales; calibration issues. I review part of our groups past and present work, over two decades, on the use of organic geochemistry to quantitatively assess several phenomena in sedimentary basins, in which the interplay of geochemistry and physics, play either a complementary or complicating role in the success of proxy application.

Mass transport phenomena are always a factor in proxy utilisation and I review work on subsurface petroleum biodegradation and the use of molecular geochemistry linked to reactive transport models to determine fundamental properties of subsurface biosphere systems[1-3]. Conversely, we find that physical processes, especially ubiquitous mixing processes, greatly limit traditional application of molecular proxies to assessing migration and petroleum system properties such as maturity from analysis of reservoired oils[4] [5]. New strategies are needed!

Currently, we are assessing the viability of molecular routes to assess the residence age history for subsurface fluids in porous media. This also links chemical and physical phenomena and we describe recent work looking at the possibility of using chemical changes, related to natural, in-reservoir radiolysis of reservoir fluids, to the assessment of oil field petroleum charge histories and cap rock integrity studies for subsurface contaminant storage applications(e.g. CO2 storage)[6].

I acknowledge the many excellent scientists and technicians who collaborated in the groups I was/am part of.

[1] Larter et al(2003). *Organic Geochemistry* **34**, 601-613. [2] Jones et al (2008). *Nature* **451**, 176-180. [3] Head, Gray and Larter(2014). *Frontiers in Microbiology*;**5**:566. [4] Larter et al (1996). *Nature* **383**, 593-597.[5] Wilhelms and Larter(2004) in:. *Geol. Soc, Spec Pub*. **237**. 27-36. [6] Marcano et al(2015) Submitted to IMOG 2015