

## Metabolic indicators of anaerobic hydrocarbon decay in diverse petroleum-laden environments

L.M. GIEG<sup>1,2\*</sup>, V.A. PARISI<sup>2</sup> AND J.M. SUFLITA<sup>2</sup>

<sup>1</sup>Petroleum Microbiology Research Group, University of Calgary, Calgary, AB, T2N 1N4, Canada

(\*correspondence: lmgieg@ucalgary.ca)

<sup>2</sup>University of Oklahoma, Norman, OK, 73019, USA

Anaerobic microorganisms biodegrade petroleum hydrocarbons including alkanes, cyclic alkanes, mono-, and polycyclic aromatic hydrocarbons (PAHs) by novel mechanisms such as fumarate addition, carboxylation, hydroxylation, and methylation reactions [1]. Metabolites characteristic of these mechanisms have now been detected in numerous fuel-contaminated aquifers, providing evidence for intrinsic anaerobic hydrocarbon bioremediation [e.g. 2-5]. A recent study suggests that the *in situ* rates of such metabolite formation can be substantive and occur within hours [6].

The detection of signature anaerobic PAH metabolites in oils from deep reservoirs [7] demonstrates that a metabolite approach to assess anaerobic fuel decay transcends bioremediation applications. Anaerobes thrive in oilfield systems, but demonstrating their use of oil components has largely remained elusive. In studies of biocorrosion, paraffin biotreatment, or souring control, we examined several oilfield production water samples for metabolic evidence of anaerobic hydrocarbon biodegradation. Using GC-MS, we identified many signature anaerobic metabolites of monoaromatic hydrocarbons, PAHs, and C<sub>1</sub>-C<sub>4</sub> alkanes, indicating that oilfield populations can indeed biodegrade hydrocarbons under the prevailing oilfield conditions.

The identification of anaerobic hydrocarbon metabolites in terrestrial aquifers, deep petroleum reservoirs, and oilfield fluids exemplifies the widespread usefulness of using a metabolic approach to assess relevant microbial processes. Further, such evidence demonstrates that anaerobes from disparate petroleum-laden environments utilize common mechanisms for hydrocarbon metabolism.

[1] Heider (2007) *Curr. Opin. Chem. Biol.* **11**, 188-194.  
[2] Gieg & Suflita (2002) *ES&T* **36**, 3775-3742. [3] Beller (2000) *Biodegrad.* **11**, 125-139. [4] Griebl *et al.* (2004) *ES&T* **38**, 617-631. [5] Parisi *et al.* (2009) *Microb. Biotechnol.* **2**, 202-212. [6] Gieg *et al.* (2009) *Microb. Biotechnol.* **2**, 222-233. [7] Aitken *et al.* (2004) *Nature* **341**, 291-294.

## Oxygen trends in the coastal ocean and along deep ocean transects

DENIS GILBERT

Institut Maurice-Lamontagne, Pêches et Océans Canada,  
Mont-Joli, Québec, Canada, G5H 3Z4  
(denis.gilbert@dfo-mpo.gc.ca)

Oxygen data from public databases were assembled to determine trends over 10-year, 25-year and 50-year reference periods at fixed stations and for 1° latitude x 1° longitude 'squares'. In the deep ocean, the sparsity of oxygen data is such that we can only compute trends along a few standard oceanographic transects. On the upper continental slope and continental shelves, oxygen data are more abundant, allowing to compute oxygen trends with better spatial coverage. Interestingly, trends computed from oxygen timeseries published in scientific journals show higher rates of oxygen decline than trends computed from all available data, indicating a bias towards strong negative oxygen trends in the published literature.