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Predicting Petroleum Biodegradation in Undrilled Prospects: How Far Can You Go?

The historical view of petroleum biodegradation in the reservoir was that it takes place at low temperatures and under oxic conditions, requiring a flow of meteoric water to replenish the molecular oxygen needed by the aerobic bacteria supposedly involved. Aerobic oxidation was believed to be dominant since it had not been demonstrated that anaerobic bacteria could degrade saturated hydrocarbons in the laboratory. Recently, there has been a resurgence of work on biodegradation, in part due to the publication of several papers demonstrating that anaerobic bacteria can indeed oxidise saturated hydrocarbons, albeit more slowly than aerobes. Factors such as petroleum filling history, water flow and pressure, in addition to reservoir temperature, may be important controls on biodegradation and we rate their significance in this study.

But will an improved basic understanding of the mechanisms of biodegradation allow prospect-level prediction of petroleum biodegradation, since this is what explorationists are interested in when evaluating the economics of undrilled structures? We have adopted a statistical approach on a regional scale in order to see how far we can push prospect-level prediction at the present time. This approach can take you far, but it can lead to uncertainties over a certain temperature range, as exemplified by one field from the Norwegian Sea. The outcome of our approach will be used to discuss whether or not a greater understanding of fundamental mechanisms could actually lead to improved prediction of petroleum biodegradation at the prospect level.