Interference from Recent Organic Matter and Biodegradation in the Interpretation of Biomarker Data from Seafloor Hydrocarbon Seeps

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After the presence of thermogenic hydrocarbons has been confirmed, the focus of seafloor macro-seepage studies shifts to deciphering the nature of the seeped oil. Detailed biomarker analyses are usually done to determine if the seeped oil can be related to previously discovered oils and/or deduce the characteristics of its source rock. To be successful, the source controlled geochemical information in the seeped oil must be preserved. At low concentrations of seeped oil, recent organic matter can obscure the source controlled geochemical information. As the concentration of seeped oil increases, recent organic matter is diluted, reducing the interference, but the intensity of biodegradation is usually observed to increase. If biodegradation has changed the biomarkers, different groups of compounds are altered at different rates and it is necessary to assess which compounds can be used reliably.

To study these processes, seeps in Green Canyon Block 607 in the Gulf of Mexico were sampled to provide a range in both the concentration of seeped hydrocarbons and level of biodegradation experienced. In addition, the subsurface parent oil was available for comparison.

Results show for low concentration seepage it is essential to have the biomarker data from the recent organic matter to characterize its contribution to the biomarker distributions and allow the identification of thermogenic hydrocarbons from seeped oil. In high concentration seepage, the hopanes and regular steranes were found to be less resistant to near surface microbial alteration, while tricylic terpanes, diasteranes, and aromatic steroids were more resistant. If biodegradation is severe enough, all compounds are susceptible to alteration with little information preserved. Attempts to reconstruct altered biomarker distributions using low temperature pyrolysis of the seeped oils' asphaltenes recovered biomarkers that did not resemble the parent oil. Characteristics of some of the recover biomarker distributions suggest biodegradation, indicating that asphaltenes may not offer protection from microbial attack.

These results demonstrate that interpretation of biomarker data from seafloor seeps is a difficult task. Care must be taken to recognize contributions from recent organic matter as well as identify alteration by biodegradation. Failure to understand these processes will likely lead to erroneous interpretations being made about the seep's parent oil and source rock.