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Depositional Environment Indicators: How to Optimize Your Indicator to Avoid the Pitfalls of Conventional Indicators

Improved geochemical indicators for identifying source and depositional environment can be constructed to make them more useful and less dependent on other competing geochemical processes (e.g., thermal maturity, biodegradation) or interferences in special applications (e.g., piston-cored seeps overprinted by recent organic matter). In the past, biomarker ratios were often constructed as a matter of convenience by making ratios of adjacent peaks or the two biggest peaks in a chromatogram. Once published in the literature, their use in interpretations tended to be widely propagated within the geochemical community. For normal, well-behaved unaltered oils or source rocks, their use has been sufficient for successful source correlations and interpretations. However, when the level of thermal maturity or level of biodegradation varies quite widely within a basin, then conventional source and depositional environment indicators may be influenced significantly by these other processes.

In contrast, novel parameters can be constructed for source and depositional-environment intrepretation by careful selection of compounds with similar thermal stability or susceptibility to biodegradation. Three examples will be discussed in which a more robust indicator can be obtained by more thoughtful construction of the parameter. These include a tetracyclic polyprenoid freshwater lacustrine indicator, tricyclic terpanes and hopanes from marine upwelling; and gammacerane /hopanes. Case studies using oils, source rocks, surface seeps, and piston-core extracts from nonmarine, marine, and deep-water marine examples will be discussed.