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Recovering Pristine Bound Biomarkers from OBM-Contaminated Samples Using a Novel Method

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Oil-based drilling mud (OBM) is frequently used during oil well drilling but could introduce biomarker contaminations, which may overprint native biomarker signals, potentially affecting the source and maturity assessment.

MSSV-Hy is introduced as a novel approach that uses PtO_2 as a catalyst and tetralin as a hydrogen donor to release bound biomarkers, which eliminates the need for high-pressure hydrogen gas of the traditional HyPy method, offering both safety and convenience. The bound biomarkers are covalently trapped within kerogen and asphaltene networks, preserving the original biomarker signatures of the source rock. The impact of OBM contamination on biomarker-based interpretations was assessed through a systematic comparison of maturity and depositional environment parameters among four datasets: (I) free biomarkers from uncontaminated samples, (II) OBM-derived biomarkers, (III) free biomarkers from contaminated samples, and (IV) bound biomarkers released from contaminated samples by MSSV-Hy.

Based on the contamination–decontamination experiments, free biomarkers from contaminated samples are indistinguishable from OBM-derived biomarkers and yield maturity and depositional environment interpretations that differ markedly from those based on uncontaminated samples. In contrast, bound biomarkers released by MSSV-Hy accurately reproduce the biomarker profiles of uncontaminated free biomarkers.

These results demonstrate that MSSV-Hy effectively addresses the influence of OBM contamination by released bound biomarkers that retain primary geochemical information. It provides a practical solution for biomarker studies in OBM-contaminated samples.

