

Surface Geochemical Exploration in Deserts of North Africa and the Middle East: Strategies for Success

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Surface geochemical exploration for petroleum is the search for surface or near-surface occurrences of hydrocarbons and their alteration products. Most oil and gas accumulations leak, this leakage is predominantly vertical, it is dynamic, and this leakage can be detected using surface and remote sensing methods. Hydrocarbon microseepage surveys in deserts require careful planning and implementation. Microseepage data are inherently noisy and require adequate sample density to distinguish between anomalous and background areas. To optimize the recognition of a seepage anomaly, the sampling pattern and sample density must reflect survey objectives, expected size and shape of the target, expected variation in surface measurements. Defining background values adequately is an essential part of anomaly recognition and delineation. Undersampling and/or the use of improper analytical techniques is a major cause of ambiguity and interpretation failures.

Results of microbial and soil gas surveys in North Africa and the Middle East are presented here, and illustrate the value of hydrocarbon microseepage data for high-grading basins, plays, and prospects. Surveys in Algeria and Tunisia document hydrocarbon microseepage to the surface in spite of the presence of thick halite seals above Triassic reservoirs, and the composition of the migrating hydrocarbons correctly predicted the composition of the reservoir hydrocarbons. In Oman, samples were collected from 3000 line kilometers of seismic lines to high-grade seismic leads and prospects, and identify areas that warrant further evaluation. The Yemen survey illustrates the use of geochemical ground-truthing of possible seep-induced remote sensing anomalies. Results from surveys in Egypt, Yemen, Oman, and Algeria successfully discriminated prospects on basis of hydrocarbon charge. Geochemical exploration surveys such as these require close sample spacing and are most effective when results are integrated with subsurface data.

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