

Designing Onshore Surface Geochemical Surveys: Best Practices

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ABSTRACT

Geochemical exploration for petroleum is the search for surface or near-surface occurrences of hydrocarbons and their alteration products. Geochemical and geomicrobiological surveys document that hydrocarbon microseepage from oil and gas accumulations is common and widespread, is predominantly vertical (with obvious exceptions in certain geologic settings), and is dynamic (responds quickly to changes in reservoir conditions).

Geochemical exploration techniques can be direct or indirect, and measurements can be instantaneous or integrative. Direct techniques analyze small quantities of hydrocarbons that occur in the pore space of soil, are adsorbed onto clay minerals, or are incorporated in soil cements. Indirect methods detect seepage-induced changes to soil, sediment, or vegetation. Bacteria and other microbes play a profound role in the oxidation of migrating hydrocarbons, and are directly or indirectly responsible for many of the surface manifestations of petroleum seepage.

Onshore hydrocarbon microseepage surveys require careful planning and implementation. Microseepage data are inherently noisy data 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 number must reflect survey objectives, expected size and shape of the target, expected variation in surface measurements, and probable signal-to-noise ratio. Defining background values adequately is an essential part of anomaly recognition and delineation.

Geochemical exploration data have found their greatest value when integrated with subsurface geological and geophysical data. Properly applied, the combination of surface and subsurface exploration methods leads to better prospect evaluation and risk assessment.