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The Elements of a Cost-Effective Geochemical Soil Gas Survey-Applications for Oil and Gas Exploration and Sequestration

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Summary

Geochemical soil gas surveys can assist oil and gas companies in making timely and informed decisions (thereby reducing risk) at every stage of the exploration process from land acquisition to drilling. The method is based on the detection of leakage patterns of light hydrocarbons as well as fixed gases that have migrated from underlying oil and gas reservoirs. This microseepage signal can be correlated with type of reservoir such as biogenic or thermogenic gas, gas liquids and heavy or light oil. Soil gas surveys can evaluate at low cost the hydrocarbon potential of both mature and frontier regions including oil sands areas. With the current turmoil in the oil markets it is more important than ever to use the most cost-effective exploration methods first. It is one way of attaining your exploration objective at substantially reduced cost to balance the shortfall in available capital.

A number of factors come into play when considering whether to use geochemical soil gas surveys for oil and gas exploration. Some of the elements of a cost-effective geochemical soil gas survey are: sampling technology and procedure; portability and accessibility; accuracy, repeatability and speed of analysis; identification, quantification and speciation of light Alkanes and Alkenes; ability to sample and measure highly volatile methane; mapping system; interpretation and prediction; environmental footprint; applicability for mature and frontier regions; CO2/O2 analysis; and overall cost.

The cost-effectiveness of geochemical soil gas surveys is enhanced by correlation of surface anomalies with seismic structures. On the other hand those structures found by seismic alone may be found to be barren when drilled due, for example, to lack of source beds or breaching of overlying seals. Population studies of geochemical data can be used to identify stacked reservoirs, especially if they have different chemical characteristics, such as Upper Cretaceous biogenic gas overlying Mannville heavy oil.

Soil gas surveys for sequestration projects must be cost-effective as well and subject to the same stringent sampling and analytical procedures as for hydrocarbon exploration. However, the objectives are quite different. Soil gas surveys are used for monitoring purposes to ascertain whether any injected CO2 into depleted oil/gas reservoirs or saline aquifers remains permanently stored or migrates in any substantial amounts to the surface. The light alkanes and alkenes are measured as well, especially methane, a greenhouse gas, because CO2 can displace light hydrocarbons in oil/gas reservoirs and coal seams. It is important to establish baseline studies prior to injection and to conduct follow-up studies of a repetitive nature after injection to identify at an early stage CO2 plumes or open conduits such as fractures or faults.