Organic and Inorganic Compositional Links to Oil and Gas Reservoirs Using Surface Geochemical Methods

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Certain organic and inorganic variables in soil and soil gas can provide indications of reservoir fluid composition. Case studies will be provided to demonstrate the value of surface geochemical methods for predicting reservoir fluid compositional characteristics.

In the case of the 21 MMBO, Devonian dolostone-hosted Grant Canyon oil reservoir in Railroad Valley, Nevada, lithium, cesium, rubidium, strontium, magnesium and bromide anomalies in near-surface soils result from oil field brine leaking to surface along high-angle normal faults in the extensional Great Basin. The surface anomalies have the same chemical compsoition as that of the produced water from productive wells.

In another example, wet gas ratios (e.g. C5/C1) in soils over the Cretaceous Jonah tight gas sand field in Wyoming are anomalous only over overpressured parts of the field. The wet gas anomalies are consistent with the gas composition of the reservoir, which contains significant C2+ hydrocarbons and condensate.

Helium and ethane anomalies are evident in deep free gas samples over a Pennsylvanian Morrow channel in southeast Colorado.The channel sand reservoir produces gas that contains 3.26% helium and 1.79% ethane. The reservoir also produces minor quanities of medium gravity oil, and the fluorescence spectral pattern of the oil closely matches that of near-surface microseeps suggesting similar aromatic hydrocarbon composition between the reservoir fluids and the surface.

The main conclusion of these studies is that organic and inorganic variables in near-surface media can, in some cases, predict the general composition of reservoired oil, gas and brines. Confidence in surface geochemical surveys is therefore enhanced when surface anomalies can be linked to reservoir fluids.