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Managing Exploration Risk: Lessons Learned from Surface Geochemical Surveys and Post-Survey Drilling Results

Proponents of surface geochemical surveys contend that proper use of surface geochemistry -- and proper integration of geochemical results with conventional geologic and seismic data -- leads to better prospect evaluation and risk assessment. This may be true but the significance of surface geochemical anomalies to hydrocarbon exploration are not always readily apparent.

How can one quantify the value added by surface geochemical data when it is integrated with conventional exploration methods? One way to do so is to compare survey results with the results of subsequent drilling. The results of such a comparison are summarized here for more than 850 U.S. and International wells, all drilled on conventionally developed prospects after completion of surface geochemical surveys. Prospects are located in both frontier basins and mature basins, onshore and offshore, and occur in a variety of geologic settings. Prospect depth ranges from 300 meters to more than 4700 meters and include the full spectrum of trap styles. Prospects were surveyed using a variety of geochemical exploration methods including free soil gas, sorbed soil gas, microbial, radiometrics, micromagnetics, etc.

Of all wells drilled, 34% resulted in commercial discoveries. However, of wells drilled on prospects associated with positive geochemical anomalies 78% were completed as commercial discoveries. In contrast, only 12% of wells drilled in negative geochemical anomalies resulted in discoveries. Had drilling decisions included consideration of the geochemical data, exploration success rates would have more than doubled. Geochemical exploration methods cannot replace conventional exploration methods, but they can be a powerful complement to them.