

Surface Geochemical Exploration after 85 Years: What Has Been Accomplished and What More Must be Done

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Abstract

The science of surface geochemical exploration for oil and gas has made much progress in the decades since Leo Horvitz discussed the state of this technology in the 1980s. Among these accomplishments, there is today a wider acceptance of hydrocarbon microseepage and hydrocarbon detection surveys. This is due to improved analytical techniques, a better understanding of the migration mechanism and its varied near-surface effects, improved survey design and sampling strategies, and improved interpretation skills. Well documented case histories of microseepage surveys have appeared in peer-reviewed journals and books, and these illustrate the wide applications of this technology in all stages of exploration - from frontier basin reconnaissance, to high-grading exploration leads and prospects on basis of likely hydrocarbon charge, to identifying bypassed pay in mature fields, to monitoring hydrocarbon drainage due to production.

Nevertheless, many explorationists remain skeptical about the benefits of this technology. What more must be done to increase the acceptance of this reliable but under-utilized technology by the exploration community? We need a unified hydrocarbon microseepage model that links the many seemingly unrelated hydrocarbon-induced changes to surface and near-surface sediments. This model should predict the observed geochemical, mineralogical, and geophysical changes in different geologic settings. Also helpful would be better and more consistent integration of surface and subsurface data. Inferring the depth of origin for hydrocarbons that have migrated to the surface remains impossible with rare exceptions. Detailed chemical and isotopic characterization of the hydrocarbons in seepage anomalies shows promise for enabling us to infer a depth of origin in the future, as does integration of geochemical data with electromagnetic data. If we can accomplish most if not all of these tasks in the next 5-10 years, we may find that our exploration colleagues are not only more willing to add this technology to their exploration tool box, but may actually base exploration decisions on hydrocarbon microseepage data.