

GALLAGHER, A. V., Petro-Labs, Inc., Golden, Colorado

Surface Geochemistry and Radiometric Exploration for Petroleum

The tools of surface geochemistry and radiometrics, and their application to petroleum exploration are the most misunderstood and abused segment of geological and geophysical exploratory thought. Petroleum geochemical exploratory tools include electrical, magnetic, radiometric, and soil and gas analysis techniques. Their use and effectiveness is based upon acceptance of the following principles:

1. For practical purposes all oil and gas fields, irrespective of depth, experience rapid vertical microseepage through the geologic column to one degree or another.
2. The surface geochemical signature associated with

an oil or gas field can be expected to decrease with a decrease in reservoir pressure and/or water production with the oil or gas.

Geochemical techniques differ in their resolving capabilities in differing surficial environments. Thus a single geochemical surveying technique should not be used exclusively; rather a combination of geochemical surveying techniques should be crossplotted against one another. All geochemical techniques are oriented toward the identification of either halo or apical type anomalies (dependent on the type, size and configuration of the underlying oil and gas reservoir). These anomalies are associated with the "hydrocarbon reduction chimney" which extends vertically from the oil or gas deposit to the surface.

Continuous-profile radiometric surveying from a four-wheel-drive vehicle with a cross-check of observed anomalies by a soil sampling grid and analyses for iodine has proven to be a reasonable cost-effective surveying technique. Experience indicates that two or three out of ten observed, apparently valid radiometric anomalies will upon cross-check with iodine or hydrocarbon C₁-C₂₀, or helium gas analysis, prove worthy of further investigation and upgrading to prospect status. In a broad reconnaissance mode, a radiometric survey can readily acquire 100 to 150 line-miles of data per day and can effectively eliminate approximately 80% of an area as being non-prospective.