Geochemical Exploration Fluorescence Offers Low-Cost Liquid Hydrocarbon Signatures in the Permian Basin

Gary K. Rice, GeoFrontiers Corporation
gary.rice@geofrontiers.com

Fluorescent analysis of shallow samples has a long history in geochemical exploration for petroleum on land and offshore. Land sample collection requires only a shovel and plastic bag. Easy sampling, low-cost analysis, and ppb sensitivity for 2-ring and 3-ring aromatic petroleum hydrocarbons from oil are compelling advantages of fluorescence exploration techniques.

Laboratory fluorescence measurements use ultraviolet light to induce fluorescence in solvent extracts of soil or sediments. Fluorescence can be measured at selected wavelengths or using single-scan, synchronous scan, or total (multiple) scan (Brooks, et al, 1983) techniques.

Hydrocarbons measured by fluorescence techniques are in the liquid phase of petroleum. While mechanisms and models explain vertical migration of gaseous hydrocarbon, upward migration of liquid hydrocarbons is not as well understood. Clues about the migration mechanism can be gleaned from exploration examples in Navigator (Cannon, et al, 2001) and Iron Bridge fields Dickens County, Texas, and Dare I (Hope) field, Concho County, Texas. These fields illustrate fluorescent hydrocarbon concentrations highest over faults and fractures.

Fluorescence spectra of shallow soil samples can be similar to fluorescence spectra of the reservoir oil (Hebert, 1988) (Calhoun and Burrows, 1992). A 3-ring/2-ring fluorescence intensity ratio reduces a fluorescence spectrum to a single number and offers a simple way to differentiate oil reservoirs from surface signatures. Since the 3-ring/2-ring ratio tends to reflect amounts of “heavier” versus “lighter” hydrocarbons, fluorescent ratios are proportional to reservoir API gravity (Barwise and Hay, 1996).

Easy to collect samples, low-cost analysis, some structural information, and the

ability to identify and differentiate oil reservoirs are compelling reasons for using geochemical exploration fluorescence information.