Applications of Vertical Migration Data in Petroleum Geochemical Exploration

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9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Vertical migration describes the mechanism of mass transport by trace petroleum hydrocarbons from subsurface accumulations to the surface. Below the water table gases migrate vertically as a gas phase with buoyancy providing a mechanism for preferentially vertical migration. Petroleum liquids migrate similar to gases, but slower and through larger fractures and faults. Reservoirs can be mapped using gas data and surface expression of faults and fractures can be mapped using liquid data. These principles applied in case studies illustrate practical applications of complementary gas and liquid vertical migration patterns.The Iron Bridge Croton lime / Tannehill sand oil fields are located in southern Dickens County, Texas, USA. These Wolfcampian aged reservoirs trend east to west on a gently dipping eastern shelf of the Midland basin. These reservoirs are stratigraphic in nature and occur from fluvial - deltaic processes. The Iron Bridge Croton production occurs on the western side of the multi complex while the Tannehill “A” production occurs on the eastern side. Both reservoirs are related but are separate reservoirs. This field’s discovery was the result of regional subsurface mapping and geochemical exploration data. Petroleum gas concentration data reasonably outlined the producing Croton Limestone reservoirs. Geology, gas geochemistry, and liquid geochemistry were combined into a single interpretation demonstrating the power of integrating independent data prior to drilling. Navigator field also was discovered by subsurface geology and geochemical exploration in a similar geological setting. Surface expressions of petroleum liquids were found near drainage features that were inferred to be over major faults. Gases migrated up the faults and gases also migrated over reservoirs through a fracture network.The same geochemical exploration

interpretation methods have been applied worldwide including the Adigala Basin, Ethiopia. In this case geochemical gas data outlined a previously unknown reservoir while geochemical liquid data mapped the surface expressions of faults and fractures. Since none of these data depended on deep wells, these results were available early in the exploration program prior to any drilling.