Modern Log Analysis versus "Old" E-Log Method 3rd Bone Springs Sand: Southeast New Mexico

G.B. Asquith
Texas Tech University

In 1956 at a meeting at the University of Kansas Tixier put forward a technique called Maximum Producible Oil Index [Y]. The equation is listed below:

$$Y = (Rmf/Rxo)^{0.5} - (Rw/Rt)^{0.5}$$

Maximum Producible Oil Index [Y] represents the amount of oil per unit volume which is displaced by mud filtrate (Tixier, 1956). Therefore Y is Mobile Soϕh, and Mobile OOIPstb is:

Mobile OOIPstb = (7758 * Y * h * Area)/BOI
[NOTE: NO Porosity or RHS Needed]

Log analysis of a Permian 3rd Bone Springs Sandstone was done using a modern logging suite that includes: GEOCHEM (ECS), CMR, and Triple Combo logs plus Pyrolysis S1 Data. The results from these analyses [OOIPstb/160acre with a BOI of 1.4] are listed below:

Total Volumetric: 10.0mmbo

Volumetric: 6.6mmbo [T2>10ms] 3.4mmbo [T2>100ms]

Volumetric: 4.7mmbo [Bitumen Corrected]

Pyrolysis S1: 3.6mmbo

The resistivity log in this well is a High Resolution Laterolog Array-Rxo, therefore zones in the 3rd Bone Springs Sandstone that have been invaded can be delineated by the presence of hydrocarbon resistivity invasion profiles (i.e. HRLA5>HRLA2>Rxo). In order to define the better invaded zones, only zones

with HRLA5>1.3□HRLR2 and HRLA2>1.2*Rxo where used in the calculation of [Y] and Mobile OOIPstb. The results are listed below:

Mobile OOIPstb [Maximum Producible Oil Index: Y]: 2.7mmbo

The lower Volumetric OOIPstb [T2>10ms & 100ms], OOIPstb [bitumen corrected], OOIP [Pyrolysis S1], and OOIP [Y] compared to Total Volumetric OOIPstb indicate the importance of OOIP calculations based on measurements of mobile hydrocarbons. Rylander and others (2014) reported that comparing recovery efficiencies from free hydrocarbon volumes is a superior way of comparing the effectiveness of hydraulic fracture stimulations.

The Maximum Producible Oil Index [Y] method may be an addition method to determine Mobile OOIPstb. However, the Maximum Producible Oil Index [Y] is only valid if the zone being analyzed has been INVADED. Therefore, the method will be limited to salt mud resistivity logging suites, because invasion can be very difficult to verify in hydrocarbon-bearing reservoirs with fresh mud logging suites.