Study Of Predictability And Forecast Efficiency Of Rock Eval Data For Accumulation Prediction

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ABSTRACT

Rock Eval (RE) analysis, comprising heating of small amount of pulverized rock (less than 100mg) in inert environment, initially at 3000C for 3 minutes, followed by programmed pyrolysis to 6500C and further under oxic environment, up to 8500C, provides data on free hydrocarbon content (S1), petroleum generative potential (S2), thermal maturity (Tmax) and organic richness (TOC) of the sample. Accumulation is indicated by free hydrocarbon content (S1) and calculated parameters: Production Index (PI=S1/S1+S2) and Oil Saturation Index (OSI=S1/TOC*100).

We have examined RE Data of 147 side wall and conventional core samples from 22 exploratory wells of Cambay Basin, India, each corresponding to a tested interval that was identified based on geological and geophysical (G&G) data to determine effectiveness of geochemical data in terms of both the 'Predictability: Percent of hydrocarbon accumulation intervals predicted based on RE data out of total number of horizons selected for testing based on G&G data' and 'Forecast Efficiency: Percent oil producing horizons out of total number of predictions based on RE and G&G data both'.

As hydrocarbons higher than C24 elute with S2 peak (Tarafa et al., 1983), in the present work, RE pyrolysis was carried out both on whole rock and organic solvent extracted samples to obtain correct estimates of free oil. The difference between S2original and S2extracted was added to S1original to get S1total for total free oil content. PIoriginal (S1original/S1original+S2original) and PItotal (S1total/S1total+S2extracted) were also calculated. Four different sets of criteria of S1 and PI values: S1original>0.5 and PIoriginal>0.4 (CR1); S1total>0.5 and PItotal>0.4 (CR2); S1original>0.5 and PIoriginal>0.3 (CR3); and S1total>0.5 and PItotal>0.3 (CR4) were examined as indicators of presence of accumulated hydrocarbons vis-à-vis the actual testing results.

Out of the 147 tested intervals, 47 are oil bearing and 100 are dry or water bearing or show oil traces (non-accumulation). For oil bearing intervals, the 'Predictability' and 'Forecast Efficiency' respectively are 49% and 79% for CR1; 71% and 81% for CR2; 66% and 78% for CR3; and 74% and 70% for CR4. On the other hand, of the intervals identified as non-accumulation zones employing CR1, CR2, CR3, and CR4 respectively, 80%, 83%, 86%, and 83% were found to be dry or water bearing or show oil traces.

Observations indicate that the predictions employing the CR4 (S1total>0.5 and PItotal>0.3) yields the optimum results both for presence or absence of oil accumulations. The criteria results in 74% 'Predictability' and 70% 'Forecast Efficiency' for oil accumulations and 83% of predicted non-accumulation intervals were found dry or water bearing on testing. Out of the 147 studied intervals, 31 intervals have OSI data. Inclusion of OSI>100 mg HC/ gm TOC along with CR4 criteria results in increased 'Predictability' to 89% and 'Forecast Efficiency' to 100%.