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Examination Of Microseepage Based Surface Geochemical Anomalies Vis-À-Vis Hydrocarbon Production Data

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ABSTRACT

Geochemical prospecting for petroleum is the search for chemically identifiable surface or near-surface occurrences of hydrocarbons as clues to the location of sub surface oil or gas accumulations. Proponents of surface geochemical surveys suggest that integration of hydrocarbon seepage and seismic data can lead to better prospect evaluation than that possible using either method alone.

In last three decades, micro seep geochemical surface prospecting has been conducted in large number of areas of Cambay Basin, India. In the present work, a single propane anomaly map for whole of Cambay Basin has been prepared from data of 36 campaigns, conducted since 1989, by statistically re-processing propane concentration data of each campaign separately to obtain uniformity in the anomaly concentrations across all areas. In the first step, for each campaign, the outlier data points exhibiting more than 3 standard deviation values from the sample mean were screened from the initial data set and then new mean and standard deviation were calculated for remaining data and iterative elimination process was repeated till mean and standard deviation for consecutive steps showed only minor change.

In case of our data sets, the mean values of the 2nd and 3rd iterations nearly matched in all cases. In the second step, the mean and standard deviation values obtained for the 2nd iteration was adopted and applied to the original data sets of each campaign. Sample points were then grouped according to their propane concentration value falling within mean to 1 standard deviation, 1 to 2 standard deviation, and so forth. Contour intervals more than 2 standard deviation values were considered as anomalies.

In order to ascertain the utility of hydrocarbon microseepage data for pre-drill predictions of hydrocarbon charge, the aforesaid results of selected six survey areas comprising 12 oil producing fields of Cambay Basin were examined. Cumulative oil and/or gas production data of wells falling within and without the anomaly areas were calculated for the 12 fields and compared.

In eight out of the 12 fields, the combined cumulative oil production (CumOilProd) value of wells located within anomalies is higher by 13 % than the CumOilProd value of wells located outside of anomalies, whereas in four fields the CumOilProd value of wells located outside of anomalies is higher by 4 %. In the former case of 8 oil fields, for 154 wells falling inside anomaly, per well CumOilProd equals 54.6 Mm3 against a value of 37.3 Mm3 for the 200 wells falling outside of anomalies. For all 12 oil fields, about 265 oil producing wells within anomaly areas have cumulative per well production of 43.3 Mm3 in comparison to 336 wells outside anomalous area having oil production of 31.6 Mm3. In all four fields where gas is also produced, the cumulative gas production (CumGasProd) of wells within anomalies is higher by 56 %. In 28 gas producing wells within anomalies have average per well CumGasProd of 113.8 MMm3G while 27 gas producing wells outside

anomalies have average of 75.6 MMm3G. Per well oil and gas productions are higher by 37% and 50% respectively for wells within hydrocarbon anomaly areas than for wells outside the anomalies.

The value derived from the seepage anomaly maps delineated in this work can be utilized to rank/prioritize prospects and reduce exploration risk by integrating with subsurface geological maps.