Data Mining for Subtle Traps

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Subtle traps are by definition hard to find and commonly are discovered by chance. A corollary is that subtle traps are those that are difficult to impossible to detect using exploration seismology. Yet all mature basins contain large volumes of hydrocarbons in such traps. Mature basins accumulate large amounts of geological, engineering and production information as well as properties of produced liquids and gasses. Our principle objective is to use “data” mining procedures to understand and resolve subtle traps as well as subtle permeability barriers in hydrocarbon fields. This can involve screening and evaluating large amounts of data (one project involved 140,000 + wells each with 20+ tops and ancillary engineering and production data). A small project may involve a 200 well field coupled with a thousand surrounding wells for contrast. We have three principle objectives: 1) determine the location of trapping milieus with highest possible resolution, 2) relate these to analogous features that have a production history and 3) separate as well as possible hydrocarbon-yielding traps from unfilled traps. An important component in this is detection of erroneous data from analysis of the data rather than, for instance verifying a stratigraphic top by inspection of a well log or observing a flagrant error by its occurrence as a “bulls-eye” on a structure contour map. Data cleaning must be rapid and accurate—real anomalies cannot be thrown out with the bathwater. The next step is to analyze all stratigraphic surfaces for information that persists through the section. Persistence (congruity) of features through the section permits verification of subtle features as well as prediction of structures in deeper less densely drilled strata. Finally overlays represented cumulative production, decline curves, etc serve to evaluate the likely outcome of drilling similar features. These results are achieved with a combination of existing commercial software combined with analytical tools developed in-house.