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Using Capillary Pressure Curves in Exploration and Production Geology

Capillary pressure curves have been confined mainly to the realm of petroleum engineering but have some excellent applications in petroleum geology. Capillary pressure data are generated by injecting mercury, at increasing pressures, into one inch diameter plugs obtained from core or side wall samples. The percent mercury saturation, of the total porosity, is measured as a function of the injection pressure up to a maximum of 2000 psi. The resulting data are plotted on a semi-log graph of mercury saturation vs injection pressure. This produces a curve reflecting the reservoir characteristics of the rock. The technique is applicable to both clastic and carbonate lithologies.

Pore throat sorting, reservoir grade and oil column heights are values which are obtained from the capillary pressure curve. Pore throat sorting is an empirical number which indirectly reflects the grain or crystal sorting of a sample and can be mapped as a stratigraphic parameter. Reservoir grade is a number which defines the rock's ability to accept fluid. It permits comparison between reservoirs and can be contoured to show "reservoir fairways". Oil column heights can be calculated for various percentage oil saturations provided that sufficient engineering data are available (formation pressure, temperature, oil gravity, salinity and gas-oil ratio). The oil column heights indicate the trap closure (structural or stratigraphic) that is required to produce selected oil saturations. They are useful in defining oil-water contacts or minimum trap closures needed to produce economic accumulations of oil.

Data obtained from capillary pressure curves can be used for both regional exploration and local development programs. In the regional setting, a quick and inexpensive stratigraphic study can be performed to identify those areas with the best reservoir rock. This is done by generating contour maps based on pore throat sorting, reservoir grade and oil column heights. For field development or local exploration programs, capillary pressure data can assist by locating the down dip extent of the oil-water contact or by indicating how much additional trap closure is required to produce an economic oil saturation. Capillary pressure curves can be used to compare known wells and fields with drilled prospects to provide the geologist with additional data as to the quality of the reservoir rock. Relative permeability curves, obtainable directly from capillary pressure curves, can provide initial data to plan for future secondary and tertiary recovery programs.