Analysis of Change in Oil Reserves of Ukrainian Fields

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Initially indicated reserves in the Cis-Carpathian downwarp and Dnieper-Donets depression have not always been confirmed by development drilling.

The oil-gas fields of the Cis-Carpathian downwarp occur in Menilitov sediments of Oligocene age; thickness is up to 600-800 m and more. These are typically flysch, consisting of alternating fine- to medium-grained sandstones, siltstones, some carbonate, and a predominance of shale. The reservoirs are largely sandstones, rarely siltstones. Open porosity of the sandy-silty rocks ranges from units to 20.7%, but varieties with more than 10% comprise 15% of the total samples studied. Permeability is from 0.001 md to several hundred millidarcies; however, only 8% of the samples have values greater than 10 md.

The calculations of initial reserves of oil were based on logging data. All sandy-silty varieties with porosity of 3-3.5% and permeability of 0.01 md were included in the effective thickness. This led to considerable overestimation of reserves.

In the Orov-Ulichnyan field the average porosity for strata that yielded no oil was 7.8%, and for productive beds it was 8.5%. In the Spas field no commercial flows were recovered where porosity was 2.6-8.1%.

In the Menilitov sediments of the Cis-Carpathians the threshold for reservoirs is a porosity of 8-10% and a permeability of about 1 md. Effective thickness based on such parameters for the Bitkov field is in accord with test and production data.

In the Dnieper-Donets depression one of the causes of the discrepancy between calculated reserves and recovery is the wide distribution in the productive units along with the clayey oligomict (quartz) reservoirs also of polymict reservoirs, which contain clastic components that have been strongly altered to clay. This alters their reservoir properties. Clay content of such reservoirs is an average of 30% higher. The difference in content of residual water for quartz and polymict reservoirs of the same age reaches 30-40%. The secondary alteration can lead to two opposite effects: secondary cementation and secondary porosity.

In the central graben of the depression, for similar values of permeability, the greatest values of porosity are found in the sandy-silty rocks of the Upper and Middle Carboniferous. The first is marked by strong corrosion of the feldspars, and the second by intense alteration of effusive fragments.

In the sandstones and siltstones of the Lower Carboniferous of the central graben, secondary cement has sealed the sub-capillary pores, thereby lowering porosity.

In estimating reserves and planning development in the Dnieper-Donets depression, it is best to use not total reservoir parameters but rather to use ranges, depending on petrophysical characteristics. For example, the lower limit of porosity for a permeability of 1 md in various parts of the depression for sediments of the Lower Carboniferous is 8.5 to 11.1%, for the Middle Carboniferous 11.7 to 14%, and for the Upper Carboniferous and Lower Permian 10.4-13.2%.

Accuracy in estimating reserves can be increased by more detailed study of cores and improved well logging programs.