Bitumen Deposits of the Permian Sediments of Tataria and Prospects for their Exploration

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Bitumens are widespread in the Permian sediments of Tataria and adjacent areas. They are of interest from the standpoint of both practical use (mined in several regions) and as indicators of oil accumulations in lower occurring sediments of the Carboniferous and Devonian.

A large part of the bitumens of Tataria occur at depths of 50 to 400 m and are found along the entire Permian section. The bitumen is heavy (density 0.9626–1.081), very viscous (from thousands to tens and hundreds of thousand centipauses), high in tars (19.4–48.0%), and high in sulfur (1.7–8.0%).

Most of the bitumen deposits studied are closely related to modern structures. The outlines of zones of bitumen occurrence correspond with the outlines of structural traps; there is a single surface of water-bitumen (ancient water-oil) contact.

In the Assel sediments of the Lower Permian, bitumen deposits (about 20) are present on the east border of the Melekhess depression, west flank of the south cupola of the Tatar dome, and also the crest of the latter. The reservoirs are fractured and cavernous dolomites. The deposits are the massive type with dimensions from 2 to 40 sq km. Thickness of the bitumen-saturated rocks ranges from 0.2 to 63 m, porosity is 2.3–33%, bitumen saturation is 44–92%, and permeability is 1–2650 md.

Most of the bitumen deposits of the Sakmar stage occur in the same regions where the Assel pools are present. Such deposits are found on the east flank of the Tokmov dome, central part of the south cupola of the Tatar dome, and its southeast flank. The reservoir rocks are cavernous-fractured limestones and dolomites. The deposits are massive and 15–70 m thick, porosity is 1.9–35%, bitumen saturation is 21–95%, and permeability is from units to hundreds of millidarcies. At the present time more than 50 bitumen deposits are known in the Tatar ASSR; they range in size from 3 to 870 sq km.

The areas of occurrence of the bitumens of the Ufim sediments of the Upper Permian almost coincide with the areas of the Sakmar sediments. The main deposits are related to sandy rocks of the upper Sheshmin horizon. Thicknesses of these sandstones reach 30 m and more, porosity is 5–30%, bitumen saturation 10–90%, and permeability is from units to 1100 md. About 60 deposits are known, ranging in size from 0.8 to 110 sq km.

The main accumulations of bitumen in the Tatar ASSR are related to the upper Kazan sediments of the Melekhess depression. The upper Kazan consists of two independent multi-strata reservoirs separated by a sulfate unit. The reservoirs are carbonate and sandy-silty rocks. The carbonates have a porosity of 2-35%, bitumen saturation of 10-89%, and a permeability of 10-400 md. For the sandstones, porosity is 7-35%, bitumen saturation reaches 95% (average of 50%), and permeability ranges from units to hundreds of millidarcies. The total thickness of the bitumen deposits in each of the reservoirs of the upper Kazan is greater than the present closure on the traps; further, bitumen occurs extensively between the traps. More than 20 large deposits with dimensions of 100 to 1000 sq km are known in each of the productive horizons of the upper Kazan. See Fig. 1.