Devonian Oil-Gas Play in the North of the North Caspian Depression

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The Devonian Eifelian-lower Frasnian complex in the north of the North Caspian depression consists largely of clastic rocks of the lower Eifelian, Givetian, and lower Frasnian Stages. The oil and condensate pools of the Zaykin-Rostashin structural zone occur in clastic beds of the Ardatov (stratum D-III) and Vorob'ev (stratum D-IV) Horizons of the Givetian and carbonate buildups of the Biy and Afonin (strata D-V and D-V-1) Horizons of the Eifelian. See Fig. 1-A.

Block faulting and uplift during Frasnian time resulted in erosion of the seal above the Pashiy and Kynov Horizons; consequently, these otherwise oil-bearing reservoirs contain no pool on the raised blocks. This structural environment is found in many other places along the north border of the North Caspian depression. On the Yuzhno-Rozhkov raised block the Devonian section is quite reduced; upper Famennian carbonate rocks rest on an erosion surface across Proterozoic Riphean-Vendian clastic rocks. See Fig. 1-B.

Oil and gas pools may be associated with these raised blocks, where the seals have retained their integrity. Further, pools may be trapped against faults on the south of these raised blocks. Such fault traps are predicted in the Yuzhno-Karpov, Yuzhno-Rozhkov, and Burlin structures. See Fig. 2.

The lower Eifelian rocks of the study area consist of gray to dark gray, fine- to medium grained quartzo-feldspathic sandstones of shallow-water origin and variegated argillites; their total thickness is 100-130 m. The reservoir beds are 2-10 m thick.

The upper Eifelian rocks to the south of the latitude of the Zaykin and Davydov areas are a deep-water facies. This is the so-called Uzen-Sakmar depression. Reefs are present in the transition zone from shelf to depression. The depression facies are dark gray to black argillaceous-bituminous limestones, which can serve as seals.

The sediments of the Givetian stage of the Uzen-Sakmar depression were supplied from a land area on the north in the region of the Zhigulev and Tokmov arches. Thickness of this complex is 200-240 m in the western part of the depression and 250-300 m in the central part.

Sandstones are present in the lower Frasnian in the north of the study area close to the source of supply of detritus. To the south in the Burlin, Yuzhno-Rozhkov, and Yuzhno-Karpov areas, however, it is predicted that this part of the section will have a carbonate-clastic composition, and no reservoirs will be present.

Uplift of individual blocks in late Frasnian time resulted in erosion of the Eifelian-lower Frasnian sediments where this uplift was greatest. Fault traps are expected in lower Eifelian and Givetian rocks on the south sides of these raised blocks. See Fig. 2. Stratigraphic wells to depths of 5800-6000 m are recommended to explore for these fault traps.

Seismic surveys have provided new data on the Eifelian-Givetian sedimentary rocks of Karachaganak field. Reflector P-3 at the top of the Upper Devonian carbonate rocks is the marker for this study. See Fig. 3. Two isometric domes are recognized, one on the northwest enclosed by the -5600 m structure contour and the other on the south enclosed by the -5300 m contour. The northeast part of the uplift is complicated by a deep trough - to - the -6200 m contour.

In order better to assess the oil potential of the Eifelian-Givetian complex in Karachaganak field, a profile was compiled that extends through drilled and planned wells. See Fig. 4. This profile shows a relative uplifted position for the Middle Devonian rocks, which was then a base for formation of atoll-like reef buildups during Famennian-Tournaisian time.

The Devonian rocks rest on strongly eroded clastic rocks of the Lower Paleozoic (possibly Ordovician) or Upper Proterozoic. These latter sedimentary rocks rest on Archean basement.

The uplift on the Middle Devonian rocks has dimensions of 20 by 15 km. It has individual crests up to 300 m high with an overall height of the feature of 400 m. The surface on this uplift is not the top of the productive part of the Eifelian-Givetian complex. The pays are probably upper Eifelian lime-stones and possibly lower Eifelian sandstones 70-300 m below this surface. Eifelian-Givetian clays should make the seal, and the trap should be outlined by the -5900 to -6000 m structure contours. The spill point will probably be in the area of well 49. The Middle Devonian pool predicted here at Karachaganak would be similar to the Zaykin-Rostoshin pools.