Exploration for Non-Anticlinal Traps in the North of the Amu-Dar’Ya Regional Low

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Several paleogeographical zones distinguished by abrupt change in type of sediment and conditions of their deposition are present beneath the Lower Cretaceous in the north part of the Amu-Dar’ya regional low (sinclise). See figure 1. Zones of stratigraphic truncation and of regional pinchout are recognized using isopach maps beginning with the Upper Paleozoic-Triassic complex. These lines of pinchout reflect the position of the shore line of the basin at the various stratigraphic stages, and are favorable for discoveries.

Recently obtained geological and geophysical data suggest several directions for exploration, particularly the west border of the Balkui downwarp and the fault-flexure zone of the Amu-Dar’ya regional fault. Non-anticlinal traps are possible in sediments of the Kimmeridgean-Tithonian and Callovian-Oxfordian, where large reserves are present on the Achak, Naip, Gurgutli, and other structures. In some fields the oil column extends from weathered Paleozoic basement to the Lower Cretaceous, inclusively (Naip, Gurgutli). All these pools are on structures.

Zones where Lower Cretaceous sediments rest on an erosion surface on the top of the Kimmeridgean-Tithonian outline the inner part of the regional low and are the margin of the salt basin (III of figure 1). On the south these zones are bounded by facies change in the salt section, and the north by pinchout of the Kimmeridgean-Tithonian.

The line of pinchout of the salt reflects the shore line for Kimmeridgean-Tithonian time. Zones of stable sedimentation are characterized by a uniform salt section and persistence of the component formations as well as a predominance of fields of the structural type, whereas in the border zones the salt complex and its contact with the underlying and overlying sediments is complex. There thickness decreases, and individual formations pinch out completely. The salt pinches out or is replaced by sulfate-carbonate facies. Clastic-sulfate-carbonate sediments in the supra-salt part of the section are designated productive horizon XIV. Its thickness is as much as 100 m in the region where the salt is present. Up the regional dip the Kimmeridgean-Tithonian thins, accompanied by pinchout of salt horizons and then the overlying clastic-sulfate-carbonate sediments. Beyond the area where the salt is present the thickness of XIV decreases to 50 m, and it rests directly on an erosion surface on Callovian-Oxfordian sediments, forming with them a single reservoir. Erosion of the surface of the carbonate complex, which has contributed to the development of reservoirs, has been established from pinchout of formations of the salt complex. See figure 2. Beyond the line of complete pinchout of the Kimmeridgean-Tithonian, the Lower Cretaceous overlaps the eroded surface of the Callovian-Oxfordian. Lithologic-stratigraphic pools are found in the Kyrgyz area. Commercial flows of gas have been recovered from the upper part of the carbonate section directly beneath the erosion surface.

Structural-stratigraphic pools associated with anhydrite pinchouts have been found in Kimmeridgean-Tithonian sediments in Beurdeshik and Gurgutli fields. Although these are not commercial, never the less they indicate the possibility for the presence of non-anticlinal traps within the salt-bearing sediments and the prospects for the marginal zones of the regional low. However, direct mapping of non-anticlinal traps has been very difficult owing to the low state of study of the region by deep drilling and also the low resolving power of the geophysical methods. General geological considerations suggest that these traps should be larger than the structural traps because they are primary.

The principal method for determining pinchouts is analysis of the wave field. Four reflectors are recognized: IV at the base of the Neocomian sediments, V - the upper anhydrite of the salt-bearing beds, V1 in the lower anhydrite at the top of the Callovian-Oxfordian limestones, and VI at the base of the Callovian-Oxfordian. See figure 2. To the northwest of Kirpichli the thickness of the sediments between the reflectors is gradually reduced. For example, the Kimmeridgean-Tithonian decreases two fold from 325 m to 150 m. To the northwest of Shanazar reflector V1 becomes less distinct as it passes from sector II to sector III.

The outer line of pinchout of the Kimmeridgean-Tithonian from the section may be reliably drawn at the loss of reflection from horizon IV at the base of the Neocomian. Pinchout of the salt is thought to be controlled by the flexure zone between the central part of the Balkuin downwarp and the Beurdeshik step.

Thus, non-anticlinal traps can be predicted for the sectors where thickness of the Upper Jurassic is reduced, and where there are changes in the seismic horizons. A program of common depth point seismic surveys and drilling is recommended for these sectors.