Methods of Preparing Areas for Deep Drilling in the Orenburg Region

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In the Orenburg Region the principal method for preparing areas for deep prospecting is structural drilling, the data from which, apart from study of the structural plan of the Permian sediments, can also be used to evaluate their oil-gas productivity. In recent years there has been a great increase in seismic exploration, which has become increasingly more effective in finding local oil-bearing structures. Other methods of exploration of structures and their possible use under various geological conditions of the Orenburg Region have been treated by M. F. Svishchev(1).

The detailed geological and geophysical work should take into account the results of earlier regional investigations in the area that were directed toward evaluating the conditions of the oil-gas productivity and toward determining the position of the linear zones of dislocation on which the local structures occur. These structures are the direct objectives of exploration.

On a basis of the main geologic features and oil-gas productivity of the area of the Orenburg Region, six oil-geologic regions are recognized (1).

The method of exploration of the structures for deep drilling is examined individually for each region, based of features of the geologic section and the established dimensions of the uplifts.

The Severo-Kinel region has been covered completely in recent years by structural-geological surveys, electrical surveys, and a thin net of profile structural drill holes. These forms of investigation were used for the Upper Permian sediments which, as established by subsequent structural drilling, do not correspond with the Lower Permian sediments (Abdulin and Kandyz areas). As a consequence of the discordance between the Upper Permian structural plan and the Lower Permian, the preparation of objectives for prospecting in the Severo-Kinel region was carried out by structural drilling on the top of the Assel stage of the Lower Permian, which is the most clearly defined lithostratigraphic boundary below the unconformity. Deep prospecting drilling in the Arkayev Kislin, and other areas has established that the surface of the productive Tournaisian and Pashiy horizons only remotely repeat the structural plan of the Lower Permian. See Fig. 1. Therefore, before deep drilling of prepared uplifts, it is necessary to drill 2-3 structural wells of small diameter to the Tournaisian stage in order to place the exploration-prospecting wells more effectively.

Seismic surveying is not very effective in the Severo-Kinel region because of the strongly dissected relief and the occurrence of carbonate-sulfate formations at the surface.

The Bol’shekinel region is the best studied of the oil-geology regions of the Orenburg Region. Its territory has been covered completely by a geological survey and electrical survey. Structural drilling and seismic surveying have been carried out in a considerable area. In almost the entire region there is a correspondence between the Upper and Lower Permian structural plans. Uplifts that have been found and prepared on the Lower Permian sediments (Artinsk stage) as a rule are traced also on the lower occurring horizons of the Carboniferous and Devonian (Sultangulovo, Ashirov, Samodurov, Ponomarevka and other areas).

It has been established that there is a correspondence between the Upper and Lower Permian structural plans wherever the steep flank of the Bol’shekinel swell is traced clearly along the horizons of both divisions of the Permian. To the east of Ponomarevka, where the steep flank of the swell is traced only on the Lower Permian sediments, and on the top of the Kalinov beds its morphology is unclear and the swell is lost on a background of monoclinal dip, there is a discordance between the Upper Permian structural plan and the lower-occurring sediments. See Fig. 2. This region coincides with the appearance in the Kungur section of thick strata of salt which on the one hand contribute to smoothing out the sub-Kungur basement and on the other complicate the structure of the Upper Permian beds by elements that are not reflected in the sub-salt sediments. Therefore, structures in the eastern part of the Bol’shekinel region must be confirmed on the Lower Permian marker horizon.

As a consequence of this relationship between the morphological features of the Upper Permian structures and the character of their relationship to the Lower Permian, in the selection of a marker horizon it is necessary to orient on the main tectonic make-up of the large structures (swells, flexures), and to take as the marker the first horizon from the surface on which large structures or zones of uplift with clearly expressed morphology are known.

In carrying out geological exploration in the Bol’shekinel region it is necessary to take into account that the uplifts of the north flank of the swell are not the only positive complications. Structure drilling in the Sofiyev area has established the Terent’yevsko-Khomutov group of uplifts which extends parallel to the swell and is separated from it by a narrow synclinal downwarp. Neither this group of uplifts nor its analog have been mapped in the adjacent areas of the territory. This is due to the fact that the geological exploration carried out earlier in the Bol’shekinel region was oriented largely on prospecting uplifts directly adjacent to the steep