Geologic Prerequisites for Oil and Gas Exploration in Armenia

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Armenia has long attracted the attention of geologists. Up until recent years, however, the main efforts of geologic exploration had been directed toward ore deposits, construction materials, and water resources. Such specialization in geologic work was one of the causes for the unsystematic geologic study of the territory of Armenia.

Most of the geologic research has been concentrated in the north and east of the republic in the Lesser Caucasus. Large parts of the southern regions (Ararat trench, Leninakan depression, etc.), where thick sequences of sedimentary rocks of the Meso-Cenozoic occur beneath Pliocene-Quaternary lavas and alluvial deposits, have remained little studied up until recently, particularly with respect to oil and gas.

The absence of deep drilling data in the central parts of the Meso-Cenozoic depression and the numerous unsuccessful oil searches (1926 to 1940) in Turkey, where direct surface showings of oil are known, were the cause of the pessimistic expressions for this region. New geological and geophysical information, however, permits a different interpretation of the oil-gas resources of the territory.

Since the beginning of oil exploration in Armenia (1948), about 17 deep wells with a total meterage of 31,000 m have been drilled. The density of the drilling was very low - an average of one well per 1000 sq km. If this is recalculated for the very favorable regions, this figure drops to less than 200 sq km.

Taking into account that all the deep drilling up until 1962 was concentrated in only two small areas (Razdan and Oktemberyan), it becomes clear that the problem of regional study of the geology of southern Armenia and the Ararat trench, particularly by deep drilling, has not yet been resolved.

Of the 3 stratigraphic wells, which are included in the 17 deep wells, not one reached its projected depth. The Avan and Oktemberyan stratigraphic wells were shut down for the technical reasons at depths of 1734 and 2763 m, respectively; they bottomed in sediments of the Oligocene and Eocene. The Yenigdzhin well hit metamorphic Paleozoic basement at 517 m and was closed down. Thus, the stratigraphic wells did not accomplish their purpose, although several signs of bitumen were noted in the Avan well and particularly in the Oktemberyan well. In the latter, asphalts were found in connection with testing the 2683-2626 m interval, and a small flow of gas containing 99.53% methane was obtained in the 2590-2564 m interval.

Drilling of deep wells in the Razdan area of the Pri-Yerevan region was largely for exploration purposes. Not one of these wells penetrated the Paleogene section completely. The wells remained in sediments of the Oligocene (Shoragbyur unit) or upper part of the Eocene.

The main profile of seven deep wells (see Fig. 2, B), which extends from the Avan stratigraphic wells northwestward to Yegvard, as shown by the geological-geophysical literature, was placed along the trend of the east flank of the Ashtarak-Spandaryan buried uplift without taking into account the gravity data which was then available.

In the Oktemberyan region drilling was confined to the Neogene sediments, which serve as an adequate shielding cover for possibly favorable Paleogene-Upper Cretaceous sediments.

In spite of the fact that the deep drilling carried out up until 1963 did not resolve the problems of the deep subsurface geology of the Ararat trench as a whole and did not clarify the lithofacies characteristics or the bitumen content of the Upper Cretaceous and Paleogene sections, nevertheless the deep drilling in conjunction with core drilling and geophysical surveying did reveal the main features of the deep structure of the Ararat trench and gave a better idea as to the regional oil-gas prospects of this territory.

First of all, the drilling has established that beneath a relatively thin basaltic cover occur normal sedimentary deposits of the Upper Cretaceous, Paleogene, and Neogene with a thickness greater than 5000 m. During the process of drilling, direct signs of hydrocarbon gas were obtained from sediments of the Oligocene and Eocene in deep wells 3-p, 4-p, 6-p, 11-p, and 15-p. Gas showings were noted in the Razdan area from sediments of the Oligocene and Eocene, and also in stratigraphic and core wells 22-k, 23-k, and others of the Oktemberyan region from Neogene sediments. The gas was largely methane; heavy hydrocarbons were rare.

In well 11-p of the Razdan area, which is located on the flank of the Ashtarak-Spandaryan uplift, testing of the 1495-1369 m interval (statistical level of liquid, 1100 m) yielded combustible gas at about 10 m³. The composition of the gas was: methane plus heavy hydrocarbons, 98.8%; nitrogen, 1.2%.