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Forecasting sandstone uranium deposits in oil-and-gas bearing basins

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The interrelation between oxidation and reduction processes in the carbonaceous strata of Paleogene age was first studied in the 1950s in deposit of the Fergana depression. The presence of pre-ore and post-ore epigenesis of petroleum series was established. Part of uranium mineralization was found to be covered with fluid oil. In the middle of the 1960s in the Sabirsay deposit (Uzbekistan) in primary red-coloured continental sediment of Cretaceous age were studied pre-ore reduction changes, which caused industrial uranium mineralization in contrasting geochemical barrier. Futher research showed that multidirectional epigenetic processes had changed repeatedly. Later, in the 1970s, American geologists studying uranium deposits in the oil-and-gas bearing Texas Plain reached similar conclusions. From their point of view, in the Benevides deposit the main zones of mineralization tend to be located near the boundary where the zones of oxidation in the strata wedge in, developing in epigenetically reduced formations. A second post-mineral reduction was registered in a number of rock bodies.

The complexity of the processes is determined by the double role of hydrocarbon fluids and the products of their dissolution. On the one hand, bituminization of permeable strata as well as pyritization, chloritization, dolomitization and other alterations associated with it create favourable geochemical conditions of a reducing character for a subsequent concentration of ore and nonmetal raw materials. On the other hand, intrusion of bitumen and its dissolution in the aeration zone leads to the burial of the mineralization which formed earlier and disappearance of all traces of its formation (epigenetic oxidation zoning). Thus forecasting and subsequent prospecting become impeded.

The established sequence of epigenetic alterations allows us to carry out specialized mapping in productive regions, uncovering hidden parts of epigenetic oxidation zoning and "buried" mineralization. Such work was carried out within the limits of the Ordos oil and gas basin and adjacent structures, where a set of paleontological maps and cross-sections was created. They reflect the relationship between hydrogenic redox processes over long periods in the geological history of the region.

Comparative analysis of the sequence of multidirectional epigenetic alterations in sedimentary basins in Central Asia and adjacent territories was instrumental in forming the overall picture of uranium ore genesis complicated by the intrusion of various reducing agents. The methods used in the study of epigenetic alterations in the formations of oil and gas sedimentary basins were developed on uranium rock bodies in Central Asia. These methods were successfully applied during forecasting on the fringes of oil-and-gas basins across the whole of the Asian continent. They made it possible to carry out metallogenic zoning of a large territory in terms of uranium and at the same time to estimate the role of hydrocarbons. The interrelation of epigenetic processes determines the distinctive characteristics of ore genesis in different parts of oil and gas basins. Their detection by means of mapping creates the necessary conditions for determining the prospects for both local regions of subsoil assets and large geological structures.

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