

**GEOLOGICAL STRUCTURE OF THE RESEARCH AREA IN EXPLORATION OF
URANIUM MINERALIZATION ZONES**
(A Case Study of the Jengeldi Area)

Majidova Shirinbonu Mansurjon kizi

Lecturer, Department of Geophysics, Mirzo Ulugbek National University of Uzbekistan

E-mail: sultanmurodova@gmail.com

Amirqulov Jalil Jumaboy ugli

Lecturer, Department of Geophysics, Mirzo Ulugbek National University of Uzbekistan

Based on review

E-mail: amirqulovjalil@gmail.com

Phone: +998938672200

Annotation: As human needs for energy continue to grow, attention to nuclear energy, which currently has no real alternative, needs to be strengthened in the near future to meet it. Economists estimate that traditional reserves of natural fuel (oil, gas, coal) will reach 100-150 years. Today, Japan, Germany, Italy, France, Belgium, Switzerland and other developed countries are facing a fuel shortage. Replenishment of the main energy resources is carried out through the construction of nuclear power plants (NPP) and the operation of these stations with radioactive energy sources (uranium, thorium, etc.).

Keywords: Djengeldi area, sandstone type, gamma-karotaj, permeable horizon, oxidation-reduction.

Introduction. In recent years, there has been an observed increase in global demand for fuel and electric energy. This, in turn, requires the expansion of uranium reserves by exploring and identifying uranium deposits that are used as fuel in the sector. The Central Kyzylkum region is considered the main uranium-bearing area of our Republic. In this region, sandstone-type uranium deposits are considered industrially significant, and they are located at depths ranging from 200 m to 600 m. Geophysical research methods play a leading role in the exploration of these deposits.

Based on the exogenous series in Uzbekistan, stratiform deposits of local uranium are found in the oxidizing-reducing barriers of oxidation zones formed in the permeable sandy horizons of the Baur and Paleogene periods. In foreign classifications, these deposits are referred to as the "sandstone" type.

The Jengeldi area stretches in a broad linear form along the northeastern flanks of the Tomditov, Aristontov, and Sangruntov formations. Various seismic surveys of different scales have been conducted within the deposit layer, and maps of the magnetic and gravitational fields have been compiled.

The region, as well as the surroundings of the Tomditov Mountains, is distinguished by a two-layered structure: the lower layer consists of the folded Paleozoic basement, while the upper layer is the cover of the Meso-Cenozoic platform. The Paleozoic complex of rocks, fragmented by granitoids—mainly Silurian limestones and shales—is found in the Tomditov Mountains. Overall, these rocks have a highly complex composition and possess tectonics that are difficult to identify. The sedimentary deposits that formed them have undergone intense metamorphism.

The folded basement is represented by a complex of Upper Riphean–Middle Carboniferous sedimentary, metamorphic, and effusive rocks that form the Tomditov, Aristontov, and Sangruntov mountain ranges.

The oldest part consists of shales, amphibolites, and silicic rocks of approximately Upper Riphean age (R3?). In the upper part of the section, Vendian–Lower Cambrian (V–C1) shales and quartzites are observed, followed by Middle Cambrian–Lower Ordovician (C2–O11) layers

of shales and siltstones. The Lower–Middle Ordovician (O12–O21) metapelites and metasandstones, and the Middle Ordovician–Lower Silurian (O2–S1) sandstones, gravelites, and conglomerates are also present. Upper Ordovician–Lower Silurian (O3–S1) sandstones, siltstones, and shales are distinguished, along with Wenlock (S1v) limestones, dolomites, siltstones, and tuffs. The Upper–Lower Silurian to Lower–Upper Silurian (S12–S21) sequence includes sandstones, siltstones, conglomerates, tuffs, and porphyrites. Lower Devonian (D1) limestones, dolomites, and conglomerates are present, followed by the Middle Devonian Eifelian stage (D2ef) limestones, dolomites, tuffs, and metabasalts. The Middle Devonian Givetian stage (D2zv) contains limestones, dolomites, siltstones, and conglomerates; the Middle–Upper Devonian (D2–3) limestones; and Upper Devonian Frasnian stage (D3fr) limestones and dolomites. Lower Carboniferous (C1v–sp) limestones, tuffaceous sandstones, tuffs, and andesites are present, as well as various aged sequences of Middle Carboniferous (C2b, C2m11, C2m12, C2m1) limestones, shales, and volcanics. The total thickness of the folded basement deposits in the Jengeldi area is estimated to be approximately 8–9 km.

From the perspective of modern structural geology, the area is considered part of the Central Kyzylkum Arch (antecline), a segment of an active epigeric platform. The structural state here is characterized by the active manifestation of fault tectonics, which determines the large-block structure of the entire region. Movement along these faults primarily controls the variable depths at which the prospective Baur and Paleogene deposits occur.

In the frontal structure, two hierarchical levels are clearly distinguished: a highly dislocated basement and a relatively thin sedimentary cover.

The first level consists of the intrusion of Upper Paleozoic granites, up to 7–8 km thick, into highly metamorphosed Paleozoic formations (corresponding to the geosynclinal development stage of the region). The rocks of this horizon are exposed in the Tomditov uplifts, as well as near the Yangikazgan well, appearing as small uplifts in the northwesternmost part of the region. The elements of the second upper structural layer are attributed to the Alpine orogenic cycle. In this area, this manifests as localized block uplifts of the basement and as soft layers of Mesozoic–Cenozoic sediments, representing the second structural layer.

The largest Alpine structures are the Tomdi, Beshbuloq, and Ergashquduq brachystructures. These are consedimentary, long-term developmental structures: their formation began at least in the Lower Baur, and their development continues to the present day. This is confirmed by the upward continuation from uplift centers to bending centers across nearly all elements of the cross-section.

with distance from the mountains. The eastern flank is gentler, where the dip angles do not exceed the primary values.

The Beshbuloq depression is represented in the area by its northeastern flank. The depression is filled with Meso-Cenozoic sedimentary rocks, which are overlain at the surface by strongly aeolian formations (Jamankum sands). The flank is complicated by a series of disjunctive structures. The first is a horst formed as a result of two sub-synclinal faults. To the south lies the sub-synclinal Northern Tamdtau depression (foothill fold — 18×10 km). A large plicated structure, the Ergash trough, expressed by its western flank and open toward the east, is also filled with Meso-Cenozoic formations, with the Jamankum range covering it externally. During the Pliocene, the activation of the platform led to extensive development of Alpine fault tectonics in the area. As a result, a horst-graben relief was formed. The Tamdi horst is bounded to the north by the large Northern Tamdi fault and to the south by the segmented Kizilkak fault. East of Tamditov, the Jengeldi horst is formed, bounded by the Balkubay and Jalikun faults. A system of northwest-oriented faults is distinguished, reflecting various directions of deformation.

The dip angles of the sedimentary layer rocks are usually $3-5^\circ$. The displacement amplitudes of the sedimentary cover rocks along faults range from 20–40 m up to 100–150 m.

The thickness of the sedimentary cover increases significantly in areas corresponding to the axes of major depressions. The main structures within the sedimentary cover are large depressions of the folded basement, whose development led to the formation of Beshbuloq and Ergashquduq synclinal-type structures. Conversely, during the development of the uplifted portions of the folded basement, anticline-type structures, such as the Tamdi structures, were formed.

As a result of previous studies, the possibility of identifying epigenetic sedimentary-infiltration ores within the Palaeogene and Baur period cover deposits has been confirmed. Of particular importance is the presence of a layer of permeable, grayish horizons capable of filtering large volumes of water, separated from the rest of the section by impermeable layers. The permeable rocks (sands) contain reagents—plant residues and divalent iron—which can convert water-soluble hexavalent uranium into insoluble tetravalent forms, thereby immobilizing it. The sandy deposits of the Maastrichtian and Lavlacon horizons of the Upper Eocene within the Tamditov area correspond to these conditions.

In all areas of the described layer, and where it is absent, it is overlain by a layer of Middle Eocene marine marls within the Maastrichtian or Paleozoic deposits due to erosion. The marls, ranging from gray-white to gray and brown, are dense, massive, or horizontally bedded, and contain phosphatized shark teeth and fish scales, occasionally forming thin lenses up to 1–2 mm thick. The thickness of the marls is 20–30 m. The sequence is typically interbedded with clays. The clays are limestone-bearing, gray or greenish-gray, horizontally bedded, and contain fish scales and, rarely, mollusk detritus. The thickness of the clays reaches up to 15–20 m. Thin layers of phosphatic gravelite, a few centimeters thick, are often observed at the upper and lower parts. Pyrite and marcasite are widespread throughout the section. The total thickness of the described deposits ranges from 30 to 50 m.

Conclusion

During the exploration stage of uranium-bearing deposits and the assessment of their reserves, the application of the gamma logging method has once again proven to be of critical importance. This method allows for the positive resolution of key tasks, such as determining the location, boundaries, depth, and thickness of mineralized horizons (deposits), identifying the elements of the ore body, and estimating parameters like the ore quantity through interpretation of their anomalies. Based on the conducted gamma logging studies, uranium mineralization intervals were identified, which mainly belong to the sandstone type and are characteristic of Meso-Cenozoic deposits. In the identified mineralized intervals, an increase in natural field values and low resistivity values were typically observed. The obtained positive results—indicating the presence of uranium ore deposits with balanced uranium content—allow for the recommendation of detailed exploration and evaluation work in the Jengeldi mining area. The presence of

additional economically valuable minerals with balanced composition, such as selenium, rhenium, and strontium, further increases the significance of this site. Overall, the conducted studies enhance the value of the prospective Jengeldi area, and if a decision is made to develop this site, they provide a basis for recommending detailed exploration and prospecting activities.