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Research Article

PROSPECTS FOR INCREASING POTENTIAL RESOURCES SOUTHEASTERN PART OF DZHENGELDA ORE FIELD (NORTHEASTERN SLOPES OF ARISTANTAU AND SANGRUNTAU)

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ABSTRACT
The article discusses the prospects of the Dzhengeldinsky ore field. The ore-forming zone of seam oxidation, which develops in a northwesterly direction, is fed by oxygen water from ground flows of the Upper Pliocene-Quaternary sedimentary complex. The main part of the ore deposits in the territory is associated with the maximum predominance of sandy rocks of the alluvial and underwater-deltaic facies zones. A targeted study of the identified ore-bearing horizons will make it possible to establish the multi-layered mineralization in connection with the wedging out of the zone of seam oxidation, not only in the northeastern framing of Sungruntau, but also in other areas of the Dzhengeldinsky ore field.

***Key words**: Uranium, Dzhengeldin Ore Field, Geological Exploration, Underground Leaching Method, Zone Of Seam Oxidation, Central Kyzylkum Uranium Ore Province, Lyavlyakan Horizon, Maastrichtian, Middle Eocene, Lower Eocene, Uranium Anomaly, Underwater Deltaic Facies Zone.*

INTRODUCTION
The Dzhengeldinsky ore field is located in the Central Kyzyl Kum in the east of the Tamdytau uranium ore region. It extends in the form of a wide strip along the northeastern slopes of Tamdytau, Aristantau and Sangruntau (Karimov *et al.*, 1996).

As a result of previous work, the possibility of detecting epigenetic sedimentary-infiltration ores in the Paleogene and Cretaceous cover deposits was confirmed (Anonymous, 2001). An important factor in this is the presence of gray-colored water-permeable horizons in the section, which are capable of filtering a significant amount of water through themselves, separated from the rest of the section by water-resistant layers. Water-permeable rocks (sands) contain reagents - plant residues from reactive ferrous iron - capable of converting hexavalent uranium dissolved in water into an insoluble tetravalent form and thus fixing it (Golstein, 1992; and Shumilin *et al.*, 1985). Sandy deposits of the Cretaceous and Paleogene age correspond to these conditions in the frame of Tamdytau (Fig. 1). Specialized work on uranium has been carried out in the region since 1962. For the first time for this region, the development of reservoir oxidation zones was established in sandy deposits of the Maastricht horizon of the Upper Cretaceous and the Lyavlyakan horizon of the Upper Eocene (Karimov *et al.*, 1996). In the areas of wedging out of these zones, the Tamdynskoe and Dzhengeldinskoe uranium ore occurrences were discovered. As a result of the work carried out within the Dzhengeldinskaya area, in the sandy deposits of the Maastricht and Lyavlyakan horizons, 18 ore deposits suitable for mining by underground leaching were identified and delineated. Prospects are associated primarily with the development of ore-bearing zones of seam oxidation (ZPO) in the Campanian-Maastrichtian and Upper Eocene deposits (Lyavlyakan horizon), which are represented here by gray-colored sands, sandstones and gravelstones with pyrite and charred plant organic matter.

MATERIALS AND METHODS

The wedging out front of the formation oxidation zone in the Campanian-Maastrichtian sand-gravel sediments (K2km-m) has been traced for approximately ~85 km and generally has a northwestern trend. Depths of occurrence of uranium mineralization are from 250 to 650 m. The horizon is composed of shallow-water marine sands uniformly - fine-grained, quartz and inequigranular sandstones on clayey cement. The thickness of the horizon varies from 10 to 25 m. In the section, the Campanian-Maastrichtian uranium ore bodies are a classic roll, the wings of which are approximately equivalent in terms of the distribution of uranium reserves, the main part of the reserves is concentrated in its bag part, where the maximum thickness of mineralization reaches 10-11 m.

The wedging out front of the formation oxidation zone in the Lyavlyakan horizon also has a northwestern strike and a length of ~ 85 km (Fig. 1). Depths of occurrence of uranium mineralization range from 100-300m. The Dzhengeldy ore occurrence, located in the eastern foothills of the Alab trough, is confined to the deposits of the Lyavlyakan horizon. Uranium mineralization in a strip of 50-150 m is traced in the north-west direction for 18 km. The depth of occurrence of the ore-bearing horizon is from 200 to 300 m.

Two members are distinguished in the composition of the horizon: the lower one consists of clayey sandstones and silty sandstones. The upper (ore-bearing) sands are fine and fine-grained, light gray, quartz. The thickness of the horizon is 20-25 m. The ore-bearing zone of seam oxidation, which develops in the northwest direction according to the general direction of the regional flow, is confined to the upper unit of the horizon. The morphology of the formation oxidation zone is simple in plan. Uranium mineralization is clearly controlled by the pinch-out boundary of the stratal oxidation zone. Ore bodies with industrial parameters are discontinuous. In the section, uranium mineralization is confined to both the wing and bag parts of the roll. The length of ore bodies with industrial mineralization of the wing parts of the roll reaches up to 200 m and they are mainly associated with the ore bodies of the bag part, however, in isolated cases, they are located at some distance from the boundary of the wedging out of the zone of in-situ oxidation in plan, forming a lenticular body inside the in-situ oxidized rocks. The length of the bag part of ore bodies in the section is 25-100m.

In the section, the morphology of the formation oxidation zone in the deposits of the Lyavlyakan horizon is quite simple and only in some areas is tortuous, splitting into several narrow, unextended jets.

In the section, the morphology of the formation oxidation zone in the deposits of the Lyavlyakan horizon is quite simple and only in some areas is tortuous, splitting into several narrow, non-extended bands.

RESULTS AND DISCUSSION

Subsequently, as a result of geological exploration in 2012-2018, the southeastern part of the Dzhengeldinsky ore field (the northeastern framing of the Aristantau and Sangruntau mountains) was defined as an area of wider manifestation of productive stratal epigenetic processes. Zones of seam oxidation here were also identified in sandy deposits of the Lower Eocene (Suzak Horizon) and Middle Eocene. The areas of wedging out of these zones are accompanied by the formation of accumulations of uranium ores. These processes are most intense along the northeastern margin of Sangruntau (Fig. 1).

The wedging out front of the zone of seam oxidation of ore in the Lower Eocene (Suzak horizon) has a northwestern strike and a length of ~ 25 km. The depth of occurrence of uranium mineralization varies between 100-180m. Uranium mineralization in a strip of 75-200m can be traced in a northwestern direction for 10 km. Lithologically, the horizon is represented by two packs. The lower unit is composed of oligomictic quartz, fine-grained sands, the thickness of which varies from 1-2 m to 20 m; in places, these sands are facies replaced by clayey and clayey-carbonate sandstones. The upper unit is composed of silty, sometimes marl-like clays, up to 20 m thick. In terms of facies, the sediments of the Lower Eocene are typical marine accumulations. In the southwestern framing of Arstantau and Sangruntau, the deposits of the Lower Eocene are also confined to the Varadzhan and Terekuduk deposits (Anonymous, 2001).

The uranium mineralization found in the northeastern margin of Sangruntau is confined to the sandy horizon of the Middle Eocene. In terms of lithofacies, the facies of the relatively deep-water part of the open sea basin predominate, represented by a monotonous stratum of brownish-brown, greenish-gray, in some places black marls and marly clays enriched in bone detritus, fish scales, and phosphorite nodules (Yakzhin, 1961). The thickness of the deposits is 10–15 m. Sandy layers up to 15–20 m thick appear in the upper part

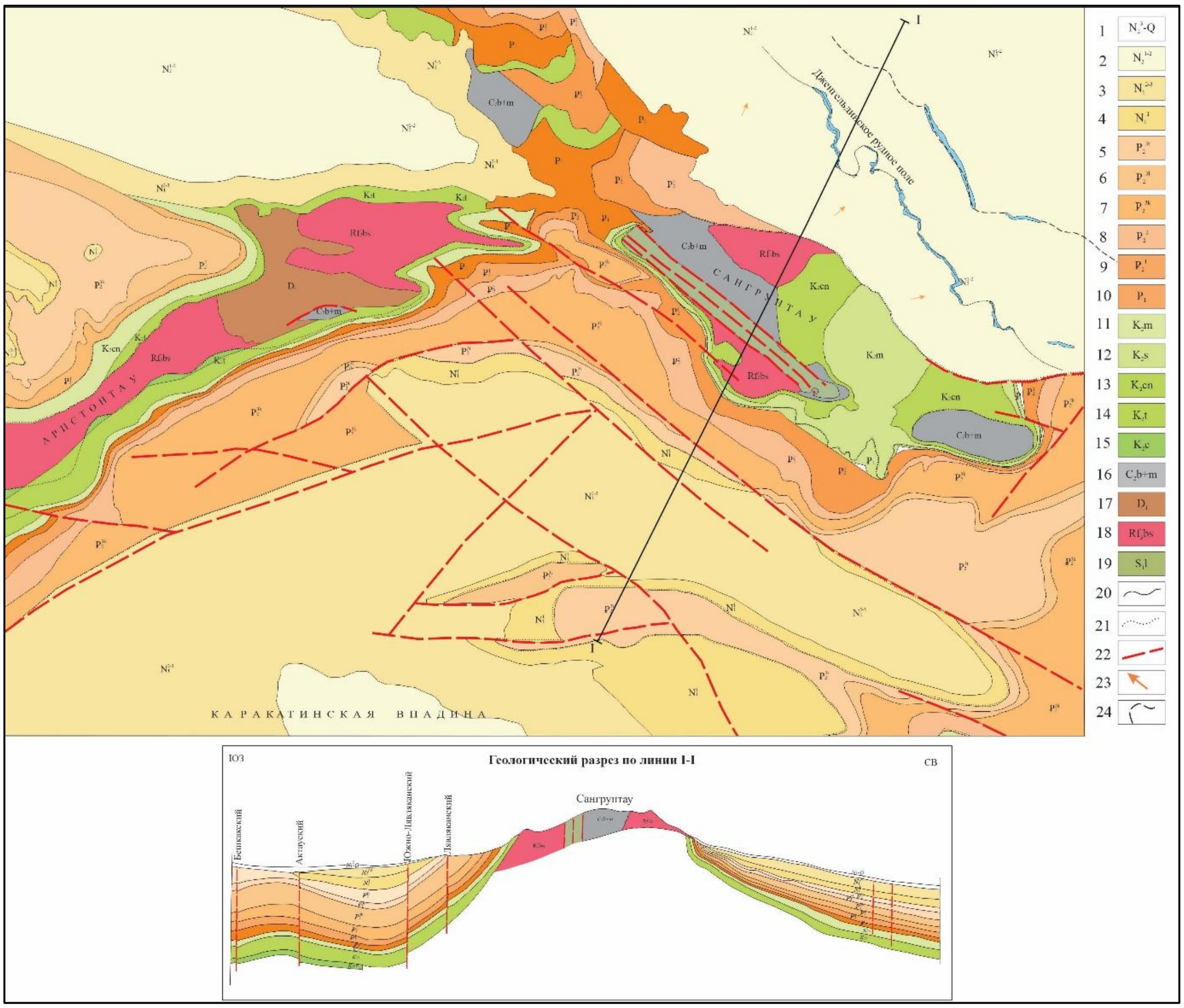

Figure 1. Geological map of the eastern part of the Tamdytau uranium ore region

Legend: 1 - Upper Pliocene - Quaternary deposits; 2 - Lower-Middle Pliocene. Siltstones, jackdaws and gravel; 3 - Middle - Upper Miocene. Siltstones; 4 - Lower Miocene. Clays, sands, sandstones; 5 – Upper Eocene, Toktintau horizon. clays; 6 – Upper Eocene, Lyavlyakan horizon. Sands, sandstones; 7 – Upper Eocene, Kerizi horizon. clays; 8 - Middle Eocene. marls, sands; 9 - Lower Eocene. Sands, sandstones, clays; 10 - Paleocene. Sandstones, limestones, dolomites; 11 - Maastrichtian stage. Sands, sandstones; 12 – Santonian Stage. Sands, siltstones; 13 – Coniacian Stage. Sands, siltstones; 14 - Turonian Stage. Sands, clays, siltstones; 15 - Cenomanian stage. Conglomerates, siltstones; 16 – Carboniferous, undivided Bashkirian and Moscow stages. Limestones, dolomites; 17 - Lower Devonian. Conglomerates, limestones; 18 - Upper Riphean. Siltstones and sandstones; 19 – Silurian, Llandoverian. Shales, siltstones and sandstones; 20 – Stratigraphic boundaries, consonants; 21 – Stratigraphic boundaries, unconformity; 22 - Tectonic disturbances traced and assumed with displacement amplitude; 23 – Formation water movement; 24 - Boundaries of formation oxidation zones.

of the section among this monotonous pack of marls, attributable to the flowing facies of the sea shallow, in which a zone of reservoir oxidation develops and the uranium mineralization associated with it is localized.

The ore-forming zone of seam oxidation, which develops in a northwesterly direction, is fed by oxygen water from ground flows of the Upper Pliocene-Quaternary sedimentary complex. The insignificant remoteness of the zone of pinching out of the zone of formation oxidation (3.0-5.0 km, up to 7.0 km on the eastern flank) is explained, first of all, by the low permeability of the ore-bearing deposits (Shumilin *et al.,* 1985). The morphology of the ore deposit is simple. In plan, this is a rather narrow strip of north-western strike. The length of the pinch-out boundary of the formation oxidation zone is about 15 km in plan view. The depth of mineralization is from 70 to 100 m.

CONCLUSION

At present, the pinch-out of the zone of seam oxidation and the associated uranium mineralization in the area have been studied in detail only on a few profiles. However, the presence of uranium anomalies, in some places ore intersections in almost all drilled profiles, indicates the scale of productive epigenetic ore-forming processes.

And the southeastern part of the ore field is poorly studied, the presence of precisely the above conditions for the formation of uranium in this area also requires the study of this area (Fig. 1).

The main part of the ore deposits in the territory is associated with the maximum predominance of sandy rocks of the alluvial and underwater deltaic facies zones (Popov *et al.,* 1963).

It is also necessary to note the shallow depths of the pinch out zones of the in-situ oxidation zone (up to 180 m), which significantly increases the prospects for the southeastern part of the Dzhengeldinsky ore field.

All of the above allows us to conclude that a targeted study of the identified ore-bearing horizons will make it possible to establish the multi-layered mineralization due to the wedging out of the zone of seam oxidation not only in the northeastern frame of Sungruntau, but also in other areas of the Dzhengeldinsky ore field.

The potential possibility of which will be determined in further geological prospecting studies.

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