

On the Possibility of New Discoveries in the Strel'tsovka Ore Field

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Abstract—As further development of ideas stated by F.I. Wolfson on principles of uranium ore localization in the Strel'tsovka ore field, a possibility of an increase in uranium reserves in the northern portion of this ore field is substantiated. A large caldera, which is not less than the Strel'tsovka caldera in dimensions, is suggested beneath Cretaceous sediments in the northern portion of the ore field.

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The Strel'tsovka ore field, discovered with the active participation of F.I. Wolfson, is one of the world's largest uranium ore objects. Deposits located in this ore field have been mined for almost 40 years. The mining enterprise that operates here is currently the only large supplier of uranium in Russia (*Hydrothermal...*, 1978).

The uranium reserves of the ore field are still rather large; however, the quality of ore has been substantially degraded due to the selective mining of high-grade areas in the 1990s.

The last large discovery in the Strel'tsovka ore field, of the Argun deposit, was made in 1977, 15 years after discovery of the Strel'tsovka deposit. Since that time, no new deposits have been found. Therefore, the opinion that possibilities for an increase in reserves are limited to the flanks and deep levels of known deposits is rather popular.

However, as Wolfson said, "Nature may be more generous than optimists."

In the context of the planned sharp increase in uranium mining in Russia, the problem of replenishment of resources in the Strel'tsovka ore field is becoming especially pressing. However, current geological exploration is mainly being carried out in areas that are distant from this ore field. These works are focused on prospecting for uranium deposits in the crystalline basement and, by analogy with the Argun deposit, are directed to revealing structural and lithologic traps formed by xenoliths of metamorphic rocks in granites.

In his process, it is not taken into account that the Argun deposit, like the large Antei deposit, also hosted in the basement, is localized beneath the volcanic and sedimentary rocks that fill the Strel'tsovka caldera. Beyond this caldera, where volcanic capping at the moment of ore deposition was absent, conditions favor-

able for ore formation probably were lacking. In the areas where such capping existed but afterward was eroded, the uranium deposits should crop out at the surface, and, keeping in mind that this ore district is thoroughly explored, such a deposit would have been discovered long ago.

Thus, the accepted line of exploration hardly will lead to positive results.

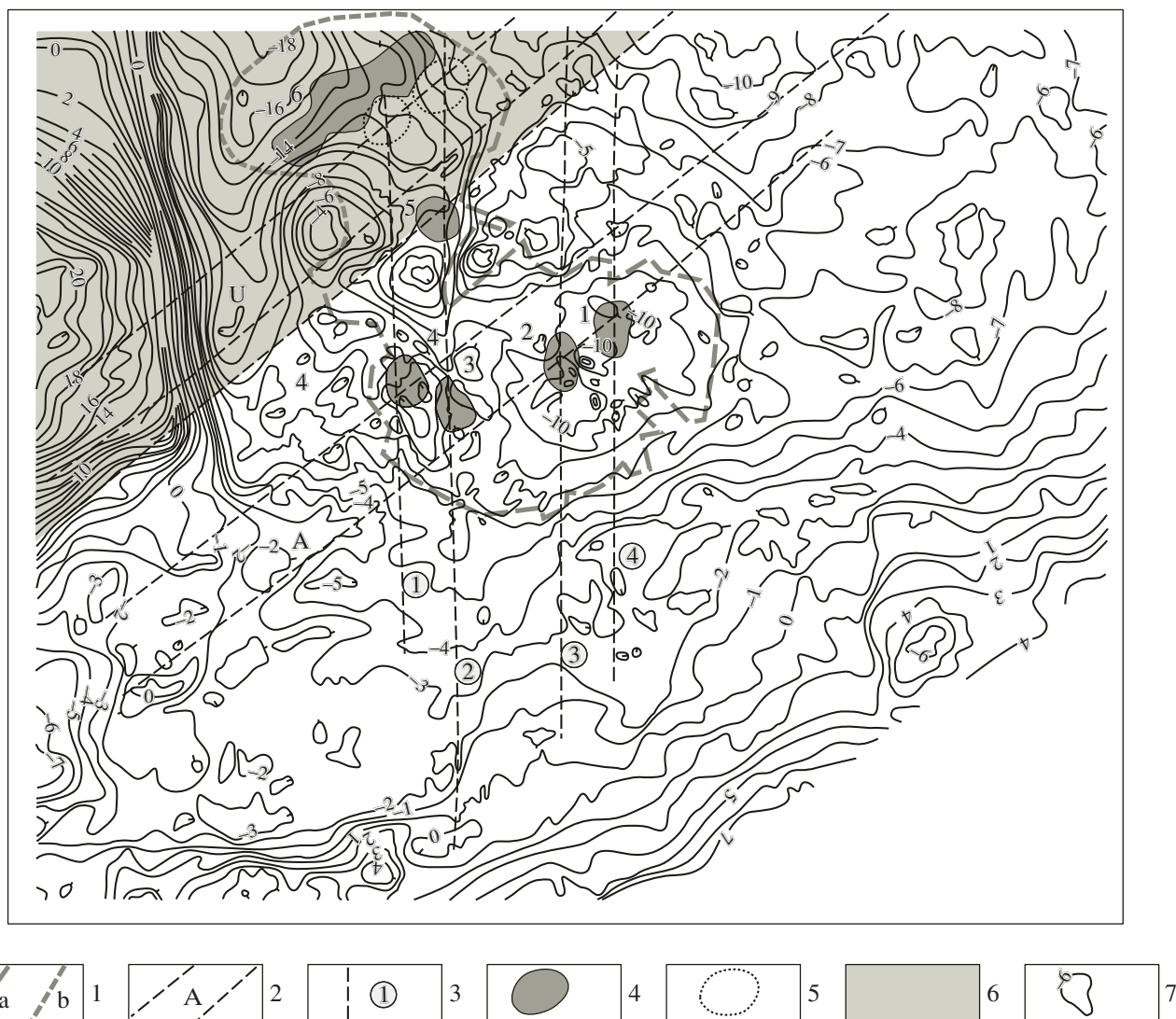
As was repeatedly emphasized by Wolfson, the relation of uranium ore mineralization to volcanotectonic structures is the specific feature of the Strel'tsovka-type deposits. The Strel'tsovka ore field was understood by Wolfson primarily as a volcanic caldera bounded by normal ring faults (*Hydrothermal...*, 1978). However, the boundaries of the ore field defined in these terms have remained uncertain.

The segments of ring faults that bound the caldera in the north are traced to meet each other but remain unclosed because the volcanic rocks are transgressively overlapped here by a thick cover of Lower Cretaceous sedimentary rocks.

As is clearly seen in a map prepared by Yu.A. Filipchenko, the Strel'tsovka caldera is delineated in the gravity field by closed contour lines of negative anomalies (Ishchukova et al., 2007; *Uranium...*, 2005). A similar character of the gravity field is retained to the north of the probable closure of ring faults. It may be suggested that to the north of this region the ring faults diverge and the general shape of the caldera in plan view resembles an hourglass. The northern block, hidden beneath the Lower Cretaceous sediments, probably, is only insignificantly smaller than the southern block in size (figure).

Indeed, a few boreholes drilled near the Polevoe deposit penetrated volcanic rocks of the lower structural stages, including dacite and felsite, beneath the Lower Cretaceous sedimentary cover (Ishchukova et al., 2007).

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The main structural features of the Strel'tsovka ore field plotted on a map of the anomalous gravity field. (1) Boundary ring faults of the caldera: (a) mapped and (b) inferred; (2) northeastern fault zones; (3) near-meridional faults; (4) known deposits; (5) forecasted new deposits; (6) Lower Cretaceous sedimentary rocks; (7) contour lines of the gravity field. Characters in figures: north-eastern fault zones: (A) Argun and (U) Urulyungui; near-meridional faults (numerals in circles): (1) Flyuoritovy, (2) Meridional, (3) Lesser Tulukui; (4) Central; known deposits: (1) Strel'tsovka–Antei, (2) Oktyabr'sky–Martovskiy, (3) Tulukui, (4) Argun–Zherlovoye, (5) Dal'nee, (6) Polevoe.

The general structural scheme of the ore field is also determined by large faults of near-meridional (Flyuoritovy, Meridional, Lesser Tulukui, etc.) and northeastern (Argun, Urulyungui) orientations. As is known, the localization of deposits in the southern block of the caldera is controlled by intersections of the near-meridional faults with the Argun Fault Zone.

The NE-trending Urulyungui Fault Zone, located northerly, is clearly expressed in the gravity field and thus reaches the basement and like the Argun Zone is rather old. Hence, it might be a conduit for ore-forming solutions as is commonly assumed for the Argun Fault Zone.

The Dal'nee deposit, the northernmost in the Strel'tsovka ore field, is located at the intersection of

the near-meridional Lesser Tulukui Fault and the north-eastern Urulyungui Fault. The stratiform orebodies of this deposit are hosted in sedimentary and tuffaceous rocks in the upper portion of the middle member of volcanic rocks (the Subfelsite Unit). This deposit is characterized by a relatively low uranium grade, which is commonly regarded as a manifestation of northward waning of the ore-forming process. However, this deposit indicates that the Urulyungui Zone was not inert during the ore formation.

It may be suggested that, farther to the north, the intersections of this zone with the Lesser Tulukui and Flyuoritovy faults might control localization of unknown deposits hosted in favorable volcanic rocks.

It is noteworthy that the extensive cover of ore-bearing Quaternary sediments of the Polevoe deposit, which is commonly regarded as a halo of scoured uranium ore removed from the deposits known in the south, is located precisely in this place. However, of all known deposits, only the small and already exhausted Krasny Kamen deposit is eroded to a certain extent. The ore-bodies of other deposits, though situated hypsometrically higher than the Polevoe deposit, are largely blind. It should also be noted that the ore layer of the Polevoe deposit extends in the northeastern direction along the Urulyungui Zone rather than in the direction of sediment transport from the south.

It cannot be ruled out that the formation mechanism of the Polevoe deposit is more complex and its location marks the discharge site of an artesian water flow washing ore lodes at a depth. In other words, this deposit is a halo that was derived not only from deposits distant in the lateral direction but also from lodes occurring at a depth.

The deep geology of this area remains extremely poorly studied. The structural and lithologic levels, which are ore-bearing in the southern block, are subsided here to a depth of 700 m or deeper. The rare test boreholes that have reached these levels were targeted at structural studies, and not ore exploration.

However, all other areas with a shallower depth of forecasted ore mineralization, both within the ore field and beyond its probable limits, have already been explored. Thus, a substantial increase in reserves of the Strel'tsovka ore field may be related only to rather deep levels. It is impossible to provide such an increase with minor efforts and costs.

In my opinion, a significant depth of potentially ore-bearing levels cannot be a reason for refusal to conduct geological exploration in immediate proximity to an operating mining enterprise and under the conditions of the currently rising price for uranium.

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