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GEOLOGICAL-GEOPHYSICAL PROSPECTING INDICATORS OF THE ARGANATY DISTRICT PREDICTIVE BLOCKS (EASTERN BALKHASH)

Abstract. Ground-based magnetic exploration and electrical exploration geophysical studies are carried out on the predicted areas of the Arganaty dictrict (Eastern Balkhash), revealed by the cosmological methods. The area is in the zone of influence of Zhongar geosuture. Paleozoic rock masses developed in the area, starting from the Silurian to Serpukhov-Middle Carboniferous. By a qualitative interpretation of magnetic data, a number of local and linear anomalies identified. Electrical exploration made it possible to construct pseudo-sections of primary data, pseudo-sections of 2D inversion in three profiles. At one of the projected sites, it was possible to establish a contact of the intrusion hidden beneath the sediments, presumably of an average composition with the volcanic-sedimentary rocks enclosing it. Both in the endo- and in the exocontact of the intrusion, by the presence of local magnetic anomalies and anomalies of induced polarization (IP), areas, presumably sulphide mineralization, were established. It is recommended to drill prospecting wells in these areas.

Key words: Magnetic exploration, Electrical exploration, Anomaly, Buried granitoid, Sulphide mineralization, Prospecting drilling.

Introduction. The Arganaty district is located in the Eastern Balkhash region, on the territory of the Alakol area of the Almaty region. The relief of the site is flat, in places it is slightly hilly. Most of the area is occupied by ridge and hilly-dune sands, fixed by grassy, sometimes shrub vegetation. A low-mountain plateau rises among the plains, the marginal parts of which are named after the Arganaty, Arkharly, Kyskash mountains with the highest absolute altitudes of 700-750 m. The northern slopes of the Arganaty mountains are steep, sharply dissected by a thick network of ravines, separated from the adjacent plain from the north by a tectonic ledge 100-150 m high. They are limited to a high tectonic bench and are similar in nature to the Arganaty mountains.

In the geological structure of the studied territory, the oldest deposits are the Silurian system, which is represented by the sediments of the Wenlock series, which form a small tectonic block in the zone of the regional Zhongar fault on the northern edge of the Arganaty mountains. As part of the Wenlock series, a pack of normal-sedimentary rocks – siltstones, limestones, calcareous sandstones, and a bundle of tuffogenic-pyroclastic rocks: crystalline and ash tuffs of acidic composition interbedded with tuffogenic sandstones are distinguished. The Devonian system is represented by sediments of the Eiffel stage, which are known on the northern edge of the Arganaty mountains, where they are separated by tectonic contact from the Wenlock series. Tuffogenic sandstones and siltstones consisting of angular-rounded fragments of acidic plagioclase, acidic effusions, less often quartz porphyrites and an admixture of pyroclastic material – volcanic ash and larger fragments of acidic, less often than average volcanic glass – predominate in the Eifelian section. Undifferentiated Devonian-Carboniferous systems represented by volcanogenic-sedimentary deposits of the Tastau Formation (D_3-C_1ts), which agrees with a gradual transition lies on the sediments of the middle Devonian. The retinue is represented by monotonous, predominantly fine and fine-grained tuffogenic and sedimentary rocks that have undergone secondary changes – silification, sericitization, and chloritization. The Carboniferous system is represented by the deposits of the Visean stage (C_1v), developed in the Arganaty mountains. The lithological composition of the Visean deposits is quite diverse. In the lower horizons, psammitic rocks predominate: polymictic and tuffogenic sandstones. Conglomerate-breccia and fine-grained differences are of primary importance: siltstone, tuffogenic siltstone, tuffite. Up the section, the psammitic formations replaced by a pack of uniform silty carbonaceous-clay shales, among which in a small amount there are siltstone, siliceous-clay, carbonaceous-chlorite and mica schists. The total capacity of the Visean stage is up to 1100 m.

Cenozoic is represented by sandy-clay deposits in the composition of two Miocene suite: Aral and Pavlodar, as well as pale-colored loam and gravelite and forest of Pliocene age. They come to the surface in the central part of the area and exposed in separate areas in the south of it. The size of exposed areas does not exceed 2-5 km.

Quaternary formations are widely developed on flat areas. They subdivided into alluvial, lacustrine, deluvial-proluvial, takyr-salt bottom and aeolian deposits, the thickness of which varies from the first to 10-20 m.

Intrusive formations. Outcrops of intrusive rocks are represented by an insignificant area of quartz diorites, located in the southwestern part of the Arganaty mountains. The rocks of the vein facies – the veins and dikes of acid and medium composition – are much more widespread. An array of quartz diorites is located at the northwestern margin of the Arganaty mountains, 0.8 km northeast of an altitude of 433 m. The body of quartz diorite has a rounded shape, somewhat elongated from the southeast to the northwest. The size of the array is 250 x 150 m.

Hornfelsification rocks, similar to those described in the exocontact of quartz diorite massive are also noted in other areas, located mainly in the north-eastern part. The area of the largest of them reaches 16 km^2. Hornfelsification of rocks can serve as an indication of the presence of an intrusive occurring at a shallow depth that has not yet been eroded. Intensive development of vein formations is an additional confirmation of this assumption. The presence here of unopened intrusion also confirmed by geophysical data. Quartz diorite massive is probably the apical part of the dome of an intrusive body that has not yet been exposed to erosion.

The presence of granitic pegmatites, granite-porphyre dykes and quartz porphyries among the gangue rocks encountered in the area, which are apparently derivatives of unopened intrusion, indicates its acidic granitoid composition. Of the rocks of the vein facies, dykes of medium composition are most common; acid dykes and quartz veins are less common. On a separate site revealed the veins of granite pegmatites. The following sequence of dykes introduction is planned for the district. The most ancient are, apparently, granite-porphyre and quartz porphyre, followed by the introduction of dykes of medium composition, and finally, granite pegmatites and quartz veins are formed [1].

Most of the described territory confined to the Tastau structural-formation zone (SFZ). Only the extreme, north-eastern part of the area, covered by Cenozoic formations, belongs to the Alakol structural-formation zone. The Tastau SFZ is separated from it by the regional Zhongar fault, traced 400 km from the Zhongar gates to the Shubartau mountains in the Northern Balkhash region.

The extensive development of Cenozoic sediments within the region under consideration does not allow deciphering the main Paleozoic structures with sufficient completeness. The geological data obtained as a result of the survey and editorial work of the region indicate that the Tastau SFZ during the Devonian and Lower Carboniferous was a deflection area, where continuous sedimentation occurred. Here, in the marine and coastal conditions, thick strata of siliceous pyroclastic and terrigenous rocks deposited.

The main linear folded structures formed after the deposition of the Visean stage. The upper horizons of the middle Carboniferous, which characterized by gentle platform-type brachis-folds, are sharply inconsistent with the lower mid- Carboniferous deposits. This indicates the average carbon age of the formation of linear folded structures of Tastau SFZ.

A sinclinorium is confined to the Tastau structural-formation zone within the region under consideration, the most submerged part of which is located on the site of the Arganaty-Arkharly mountains. Sinclinorium is a large structure, complicated by smaller syncline and anticline folds, which characterized by a steep fall of the wings, and vertical and overturned occurrences are often observed.

In the Kyskash mountains region, several syncline and anticline folds are noted. In the Arkharly mountains there are three syncline structures, the axes of which can be traced from the southern slopes of the mountains in the north-west and then in the latitude direction. The cores of syncline folds are composed of calcareous rocks, the wings and the anticlines that separate them are formed by shales, tuffs and tuffites. Along the strike of syncline structures, centricline closures associated with uplift of their hinges often observed. The axes of the folds are somewhat tilted to the south and southwest. The southwestern wings of the synclines fall to the northeast at an angle of 50-60°, while the northeastern wings have vertical or overturned beddings with a fall to the northeast at an angle of 80-85°.

Two syncline structures, the cores of which are made of calcareous rocks of the upper horizons of the upper sub-suite of the Tastau suite, are observed to the south of the Arganaty mountains. The axes of the synclines extend from the eastern border of the territory in question in the latitudine direction; in the western part of the Arganaty mountains, they turn steeply to the south and north-west of the Kok-Donbuk hill, extend in a sub-latitudine direction with a slight deviation to the south-west. There are also several cases of centricline closure of synclines associated with the undulation of hinges.

In the Arganaty mountains, between the faults that flank the regional Zhongar fault, a graben is formed, which is made up of intensively stationed Visean sediments. Breeds are collected here in steep folds, the fall of the wings of which is 60-80°. Two anticline folds are outlined, the cores of which are composed of sandstones and conglomerate-breccias of the lower horizons of the Visean stage. The wings of the anticlines and the adjacent synclines formed by the carbonaceous-shale of the upper horizons of the Visean layer. The axis of the folds extends in the northeastern direction.

Fault tectonics has a significant impact on the geological structure of the area. Two main fault systems are clearly distinguished: the northwest and northeast. The most widespread and clearly expressed faults of the north-west strike. This system includes the regional Zhongar Fault and several associated with it faults in the area of the Arganaty mountains. The Zhongar fault has an ancient foundation and long-term development. During the Devonian, Carboniferous, and Permian, it was the boundary of two structural-facies regions. In the zone of the Zhongar deep fault, which is the eastern geosuture fragments between the first and second core structures of the nuclear, large amplitude movements (up to 9 km) occurred, resulting in contact of the Silurian and upper horizons of the Lower Carboniferous. The Zhongar fault in the Arganaty mountains is fledged by small fracture faults along the latitudine and northeastern directions, which by their significance are large faults limiting the Visean graben.

In the Remote sensing research process, the most promising areas were identified [2-5]. Ground prospecting routes, areal geophysical studies: magnetometric and electrometric mappings were carried out for the formulation of prospecting operations.

Methods and Results. Below are the results of ground geophysical works carried out on the research area. Magnetometric work was carried out at 9 local sites. Electrical exploration by the method of induced polarization (IP) carried out in an experimental method in the local area 4 (figure 1).

Magnetic exploration carried out using high-precision MM-61 proton magnetometers. Technical characteristics of the device allow to achieve high accuracy of shooting. Before starting the survey, a control point and a place for the installation of a magnetovarization station selected near the work site, one place for all sites. The choice was made based on the requirements: the absence of a high magnetic field gradient (less than 5 nT/10 meters) and sources of technical interference. The magnetometer MM-61, operating in automatic mode with a measurement interval of 60 seconds, was used as a magnetovariation station. Before starting work, the magnetometers synchronized in time to within one second. At the beginning and at the end of each route, control measurements made at the control point. When processing field observations, a correction for the variation of the magnetic field introduced. The results of specialized observations calculated relative to the control point.

Control observations were carried out by independent flights or various instruments. These flights were carried out in such a way as to ensure representative control over the number of measurements and the area. On the basis of the common and control measurements, the values of the mean square error calculated both for individual profiles and for the entire survey area according to the instruction (Magnetic Survey Instructions, 1981). The value of the mean square errors for the site was ±2,52 nT, with the volume of control observations of 7%.

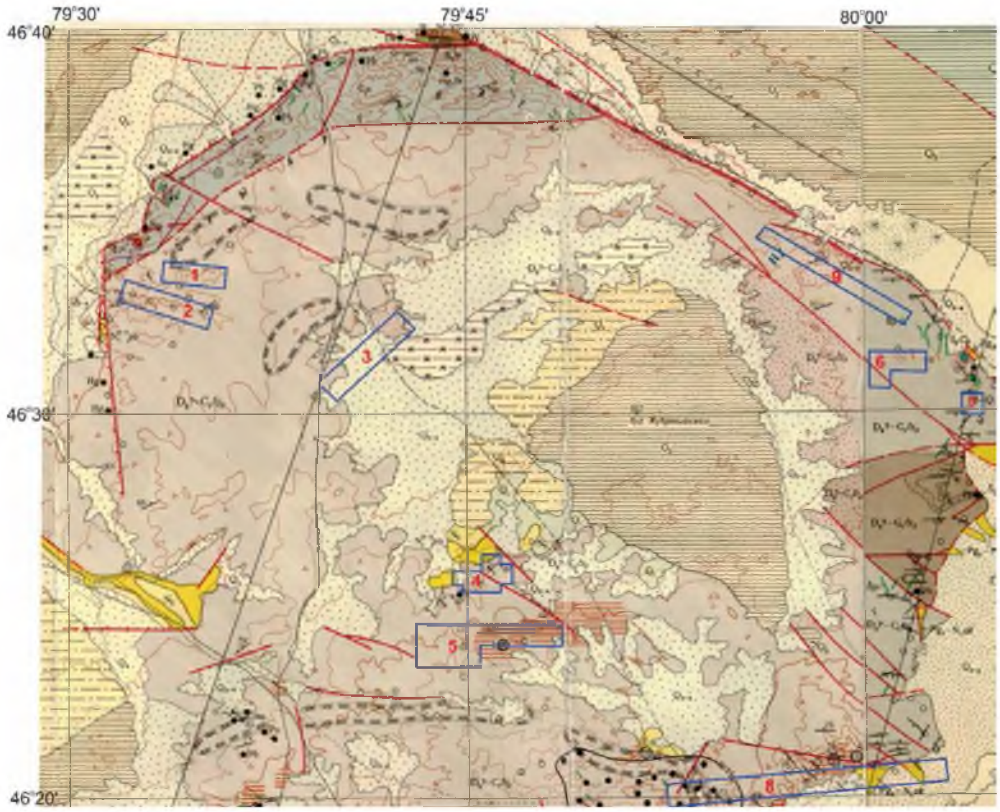

Figure 1 – Promising blocks of Arganaty district (East Balkhash) and their numbers

Electrical exploration work was carried out in the modification of the profile soundings of the induced polarization (IP) by the pol-dipole system in a separate designated area, where the anomaly was identified by magnetic prospecting (section No 4 of the profile 1600, 2000, 2400).

In the process of performing electrical exploration work, the following equipment of the IP system was used:

– 16 channel GDD IP ReceiverModel GRx8-32 (16-channel receiver IP/Resistance manufactured by Canadian company Instrumentation GDD).

– GTT-30 Transmitter TX (Transmitter manufactured by Zonge Engineering and Research Organization, Inc., USA).

– Generator15 kW manufactured by Zonge Engineering and Research Organization, Inc., USA.

The profile probing of the IP/Resistances carried out using a pole-dipole multi-electrode installation, including a supply dipole (AB) and a receiving line consisting of 14 receiving dipoles.

When performing profile soundings with a step of 40 m, the following electrode alignment was used: A = 40 m, B = infinity (1000-3000 m), the distance between the measuring electrodes was 40 m, the distance between the nearest measuring and power electrodes was 40 m. Metal stakes, up to 100 cm long, stacked three to one ground in previously dug to a depth of 10-15 cm and poured with water. In the supply line was used a copper cable with a section of 4 mm covered with a vinyl sheath. The installed electrodes were filled with soil and poured on top with water while simultaneously mixing the soil. Non-polarizable ceramic electrodes with a solution of copper sulfate, whose own EMF did not exceed 2 mlV, were used as receiving electrodes. The diameter of the cross-section of an insulated eight-core copper wire of the UTP 5e category in the receiving line was 8x1 mm. The actual values of contact resistances at the dipoles of the receiving line were within 6 kOhm. In general, they were distributed in the range of 1-4 kOhm.

The transmitter and receiver were synchronized according to the standard scheme for the equipment used on the basis of the transmitter signals recorded at one of the receiving dipoles. During the measurement, synchronization automatically maintained, as provided for in the hardware implementation. The actual shape of the rectangular pulses generated by the transmitter and the decay curves for each of the receiving dipoles monitored by the operator in the process of measuring the computer screen, which is part of the registration system of the receiver. For the operator to enter data: profile, station, current, distance and pitch of the receiving and supply lines.

The polarizability value recorded by the receiver for each of the specified time windows, having the dimension [mV/V], recorded on each picket in the instrument file (date, time, profile, station, current, polarizability, natural polarization of the field, error rate, resistance). In this case, a weighted average calculated for all registration windows in the registration system processor, which was also recorded in the instrument file.

When performing sensing at each picket of the profile, a series of measurements carried out, consisting of 20-50 cycles of feeding and switching off polar opposite rectangular pulses. The duration of the current pulse was 2 seconds, the interval between current pulses, within which the IP potential decline recorded was 2 seconds. The process of stabilization of the measurement during many work cycles controlled visually on the screen of a laptop computer connected to the receiver of the IV. If necessary, if the process of stabilization of measurements in the cycle was not stable, which controlled by the absolute error values each receiving dipole in this series of cycles, the operator performed additional series of measurements at this point (station), which subsequently averaged during processing.

When developing electrical survey profiles, repeated measurements taken at the beginning, at the end and at each fifth point of the installation location of the dipole AB and 14 dipoles MN. Repeated measurements carried out at different current values (+/- 5 %) in the supply line. Based on the convergence of the measurements, the quality of the survey regularly monitored.

Control measurements were made of 6.43 %, the error in polarizability was 2.1 % and the resistance of 1.9 %.

Processing of magnetic data divided into primary, carried out directly in the field and secondary processing. Primary processing of field observations consisted in introducing corrections for the variation of the geomagnetic field and calculating its values relative to the control point. Profile fragments worked on different days were combined for each profile and the site as a whole. In addition, in the process of field work, preliminary maps were prepared for the waste sections in the adopted profile/picket coordinate system.

Subsequent processing included the transition from the profile/picket coordinate system to the WGS 84 system, the construction and interpretation of a magnetic field map.

Processing of the results of electrical exploration began with pre-processing, which carried out directly in the field. The data obtained during each field day processed in the evening on the same day. The results of the pretreatment presented in the form of pseudosections of polarizability and resistance in a color graphic form.

The observed data for each profile for each picket, on which the repeated measurements taken, were averaged by the number of repeated measurements. Directly in the field, pseudosections built and preliminary data inversions carried out for each profile and for the entire section.

The final data processing was carried out after the completion of the field work and included the following steps:

– Constructing pseudosections of polarizability and resistances;

– Solving the inverse problem for geophysical profiles using successive approximations of models for polarizability and resistance (geophysical inversions 2D).

The pseudosections of polarizability and resistance obtained from electrical sounding data represent the express visualization of the information obtained during the survey. At the same time, the accuracy of mapping of geological objects depends both on the degree of severity of the objects themselves in geophysical fields, and on additional factors, including electrode effects, screen influence of low resistance zones. The main task in the analysis of data is to represent the objects being mapped while reducing the influence of these additional factors on this representation.

This problem solved using 2D inversions, first resistances and then polarizability. In fact, inversion is a modern implementation of the solution of the inverse problem in geophysics.

The solution of the inverse problem in inversion algorithms carried out using an iterative selection of a physical model based on the observed distribution of potentials in the receiving dipoles, taking into account the location of current sources. Previously, the lower half-space divided into a set of unit cells that approximate the physical parameters of the lower half-space. The inversion of polarizability carried out taking into account the distribution of resistances obtained from the results of inversion.

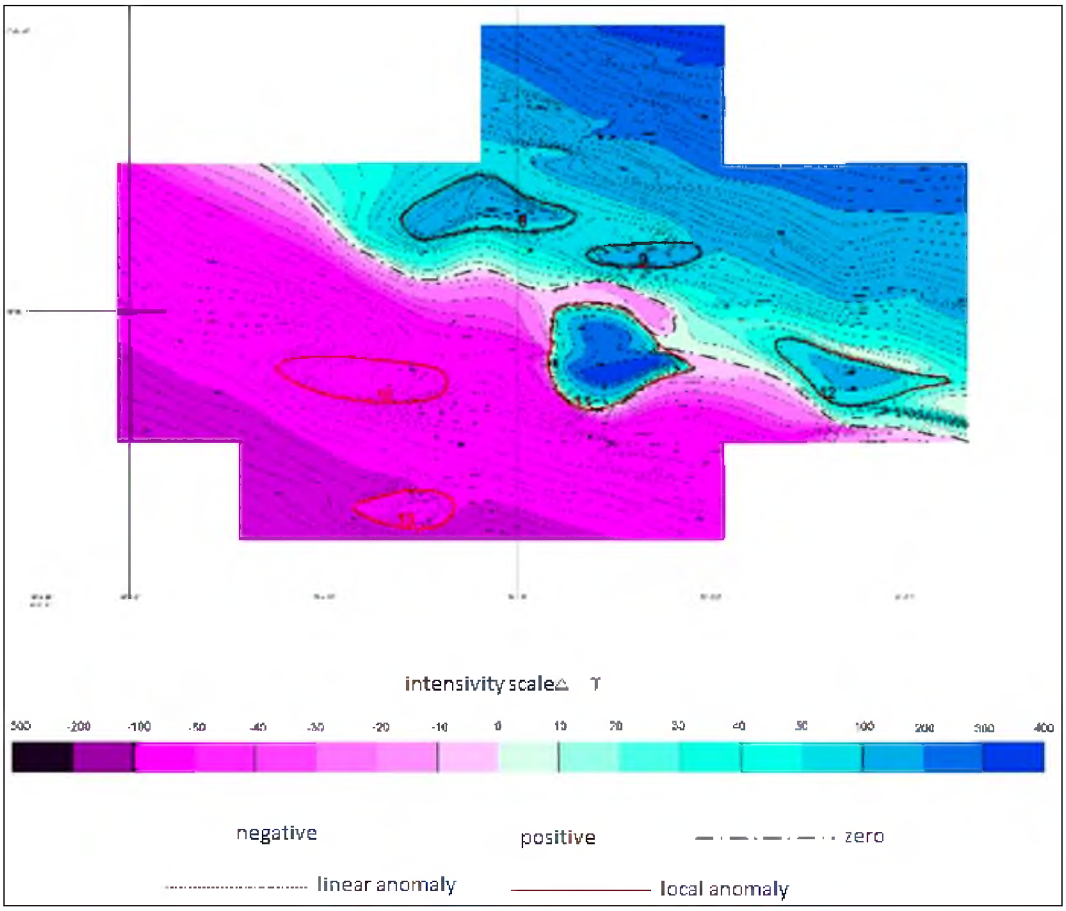

Figure 2 – Map of magnetic field anomalies of Block № 4 (normal field 57734 nT)

Magnetic exploration. Geophysical magnetic exploration work performed on selected sites with high quality and in full, provided by the task. The work performed allowed us to obtain a new, substantially refined, more detailed and informative version of the magnetic ΔT maps of the 1:10 000 scale. Experimental electrical exploration work performed at section 4 in the area of the identified magnetic anomalies on individual profiles made it possible to construct pseudosections of primary data, 2D pseudosections inversions along these three profiles (figure 2). By qualitative interpretation of magnetic data, a selection of a number of local and linear anomalies carried out at sites.

Conclusion. Prospects for the Arganaty district sites, according to cosmogeological studies, are associated with the possibility of detecting endogenous metal mineralization (gold, copper, molybdenum, lead, zinc, tin, tungsten). This mineralization is most likely associated with the manifestation of intrusive magmatism, indicators of which (single stock, thermal impact areas on host rocks, magmatic ring structures, halos, and individual samples containing increased amounts of copper, lead, mercury, tungsten, and gold) are detected within the area. Here you can expect a wide range of the above-mentioned metallic minerals.

Ground-based geophysical works (magnetic exploration and experimental electrical exploration in the modification of core soundings caused by polarization (IP) using the pole-dipole system) were performed at 9 local sites based on remote sensing data and analysis of geological materials of the predecessors. As a result, in almost all areas, by analyzing the obtained magnetic maps, it is possible to identify important structural elements, relative to the occurrence of the Paleozoic basement rocks, various dyke formations (especially of medium composition) giving distinct positive anomalies.

Interesting data obtained at site No 4, where it was possible to establish a contact of the intrusion buried below the loose sediments of presumably medium composition with the Devonian-Carboniferous volcanogenic-sedimentary rocks of the Tastau formation. At the same time, in both the endo- and exocontacts, by the presence of local magnetic anomalies and anomalies of induced polarization (IP), areas allegedly enriched with sulfide mineralization identified. It recommended to drilling prospecting wells.

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АРГАНАТЫ АУДАНЫ БОЛЖАМДЫҚ БӨЛІКШЕЛЕРІНІҢ ГЕОЛОГИЯЛЫҚ-ГЕОФИЗИКАЛЫҚ ІЗДЕУ БЕЛГІЛЕРІ (ШЫҒЫС БАЛҚАШМАҢЫ)

Аннотация. Зерттелген алаң Шығыс Балқашмаңында, Алматы облысы Алакөл ауданының аумағында орналасқан. Алаңның бедері жазық, кей жерлерінде шағын төбелер бар. Алаңның үлкен бөлігінде қырқалар және құм төмпелері-шұңқырлары орналасқан, олар өскен шөптер тамырымен бекітілген, кейде бұта өсімдіктер де кездеседі. Зерделенген аумақтың геологиялық құрылысындағы ең көне жаралымдарға силур жүйесінің түзілімдері жатады, олар венлок легінің түзілімдерінен тұрады. Бұл түзілімдер Арғанаты тауының солтүстік шалғайында өңірлік Жоңғар жарылымы зонасындағы шағын тектоникалық блокты құрайды. Ені 300-400 м және ұзындығы 15 км болатын силур таужыныстарының ашылымдары ендік созылымды жарылымдармен шектеліп, олар солтүстігінде ортаңғы девоннан, ал оңтүстігінде серпухов-ортаңғы карбон жаралымдарынан ажыратылады. Интрузиялық таужыныстар ашылымдары ауданы бойынша шағын кварцты диориттер денелерінен тұрады, олар Арғанаты тауының оңтүстік-батысы бөлігінде орналасқан. Желі фациясының таужыныстары айтарлықтай кең таралған, оларға қышқылды және орташа құрамды желілер мен дайкалар жатады. Қарастырылған ауданның қалыптасуы палеозой плюмінің әрекетімен байланысты Жоңғар-Балқаш ойысының ішкі бөлігінде орналасқан және Қазақстанның бірінші сақина құрылымы ауқымында болып табылады.

Арғанаты алаңының перспективалары эндогендік металдар (алтын, мыс, молибден, қорғасын, мырыш, қалайы, вольфрам) рудалануларын анықтау ықтималдығымен байланысты. Бұл рудалану ең алдымен интрузиялық магматизм білінімдерімен байланысты, олардың белгілері (жекелеген штоктар, сыйыстырушы таужыныстарға термалық ықпал ету бөлікшелері, магматогендік сақина құрылымдар, құрамында жоғары мөлшерде мыс, қорғасын, сынап, вольфрам және алтын бар ореолдар мен жекелеген сынамалар) зерттелген алаң ауқымында анықталған. Мұнда жоғарыда аталған металдар пайдалы қазбаларының кең спектрін күтуге болады.

Дистанциялық космогеологиялық зерттеулер нәтижесінде ең перспективалы екі бөлікше анықталған, осы жерлерде жербетілік геофизикалық зерттеулер магнитометриялық және электрбарлау әдістерімен жүргізілген. Мағнитометриялық жұмыстар 9 шектеулі бөлікшеде жүргізілді. Электрбарлау жұмыстары мәжбүрлі поляризация (МП) әдісімен шектеулі 4-бөлікшеде тәжірибелік-әдістемелік нұсқада жүгізілген. Электрбарлау жұмыстары бастапқы деректердің псевдоқималарын тұрғызуға мүмкіндік берді, осылайша алынған үш кескін бойынша 2D инверсиясының псевдоқималары жасалды.

Зондылау жүргізген кезде кескіннің әр пикетінде өлшеулер легі орындалған, әр лек әртүрлі полюсті тік бұрышты импульстерді берудің және сөндірудің 20-50 циклінен тұрады. Ток импульсінің ұзақтығы 2 секундты құрайды, ал ауқымында МП потециалының қайту процесін тіркеу жүргізілген интервал да 2 секунд. Көптеген жұмыстық циклдер ағымындағы өлшеу процесінің тұрақталуы қолға алып жүретін компьютердің экранында көзмөлшермен қадағаланған, ал компьютер МП ресиверімен (қабылдағышымен) қосылған. Қажет болған кезде, егер циклдегі өлшеулердің тұрақталу процесі орнықты болмағанда, ол циклдердің берілген легінде әрбір қабылданатын диполь бойынша абсолют қателіктердің шамалары бойынша қадағаланған. Оператор берілген нүктеде (пикетте) өлшеулердің қосымша лектерін орындаған, ары қарай өңдеу процесінде бұл өлшеулердің орташа мәні анықталған.

Тәжірибелік электрбарлау жұмыстарын интерпретациялау процесінде үйектелудің және байқалатын кедергінің псевдоқималары тұрғызылған, сонымен қатар олардың 2D инверсияларының псевдоқималары да тұрғызылды. Байқалғандай, аудандағы үйектелгіштіктің таралуы ықтимал өнімді қатқабатта сульфидтердің аялық таралуының қосынды әсеріне байланысты болуы мүмкін. Сульфид минералдану зоналары палеозой бетінен бірнеше метр тереңдікте жайғасқан жерлерде айқын білінетін МП әсері байқалады, мұндай жағдайда жоғары үйектелгіш зоналар анық білінеді. Сульфид минералдану зонасы үзік-үзік сипатқа ие болғанда және тереңде орналасқан жағдайларда бейконтраст аномалиялар байқалады. Бұл аномалияларды сульфидтердің

жекелеген ұсақ шогырлануларының таралуына байланысты туындаған аномал әсерлерінен ажырату қиын болады. Зоналар әдетте үйектелгіштік аномалияларының жогаргы бөлігімен сәйкестендіріледі.

Кедергілер (ρk псевдоқималары) деректері бойынша, кедергілердің өзгеруі мезозой-кайнозой қатқабаты қалыңдыгының артуына байланысты болады, оның артуымен кедергі бойынша көрсеткіштер де өзгереді. Электр өрістері таралуының жалпы көрінісі, магнит өрісіндегі сияқты, өрістердің орнықты градиентін көрсетеді. Өрістердің қарқындылыгы бөлікшенің солтүстік бөлігінде артады.

Магнитбарлау жұмыстары жогары дәлдікті ММ-61 протондық магнитометрді пайдалану арқылы жүргізілді. Құралдың техникалық сипаттамасы түсірудің жогары дәлдігіне қол жеткізуге әкеледі. Жұмысты орындау магнит өрісінің 1:10 000 масштабты ΔT картасының жаңа, біршама дәл және ақпаратты нұсқасын алуга мүмкіндік берді. Магнитбарлау деректерін сапалы интерпретациялау жолымен бөлікшелерде бірқатар шектеулі және сызықтық аномалиялар бөліктері анықталды. Магнитбарлау деректері бойынша ең қызығу-шылыққа 4-бөлікше ие. Бөлікшенің магнит өрісі екіге бөлінеді – ССШ және ООБ. Осы бөліктердің шекарасы бойынша нөлдік изосызық өтеді. Өрістің ССШ бөлігі айқын оң мәнді (градиенті ΔT 250 нТл мәні шамасына дейін). ООБ бөлігі бішама теріс градиентті ΔT -250 нТл мәніне дейін. Ең алдымен, оң мәнді өріс (МП электрбарлау кескіндерінің деректері бойынша сияқты) төрттік тысы астында орташа құрамды интрузия массиві шығуына, оның эндо- және экзожапсарындағы метасоматоздық өзгерген таужыныстар зоналары болуына байланысты.

Түйін сөздер: магнитті барлау, электр барлау, аномалия, жерленген гранитоид, сульфидті минералдану, барлау бұргылау.

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ГЕОЛОГО-ГЕОФИЗИЧЕСКИЕ ПОИСКОВЫЕ ПРИЗНАКИ ПРОГНОЗНЫХ УЧАСТКОВ РАЙОНА АРГАНАТЫ (ВОСТОЧНОЕ ПРИБАЛХАШЬЕ)

Аннотация. Исследованная площадь расположена в Восточном Прибалхашье, на территории Алаколь-ского района Алматинской области. Рельеф площади равнинный, местами слабо холмистый. Большая часть площади занята грядовыми и бугристо-лунковыми песками, закрепленными травянистой, иногда кустар-никовой растительностью. В геологическом строении изученной территории самыми древними являются отложения силурийской системы, которая представлена отложениями венлокской серии, слагающими не-большой тектонический блок в зоне регионального Жонгарского разлома на северной окраине гор Арганаты. Выходы силурийских пород шириной 300-400 м и длиной 15 км ограничены разломами широтного простирания, которые отделяют их от среднего девона на севере и серпухова-среднего карбона на юге. Выходы интрузивных пород представлены незначительным по площади массивом кварцевых диоритов, расположенным в юго-западной части гор Арганаты. Значительно более широко распространены породы жильной фации – жилы и дайки кислого и среднего состава. Рассматриваемый район приурочен к внут-ренней части Жонгаро-Балхашского прогиба, формирование которого связан с деятельностью палео-зойского плюма и представляет собой первую кольцевую структуру Казахстана

Перспективы площады Арганаты связаны с возможностью обнаружения эндогенного металлического оруденения (золото, медь, молибден, свинец, цинк, олово, вольфрам). Это оруденение, вероятнее всего, связано с проявлением интрузивного магматизма, признаки которого (единичный шток, участки термичес-кого воздействия на вмещающие породы, магматогенные кольцевые структуры, ореолы и отдельные пробы, содержащие повышенные количества меди, свинца, ртути, вольфрама и золота) обнаруживаются в пределах площади. Здесь можно ожидать широкий спектр вышеупомянутых металли-ческих полезных ископаемых.

В результате дистанционных космогеологических исследований были выделены наиболее перспектив-ные участки, на которых проведены наземные геофизические исследования двумя методами. Магнитомет-рические работы были проведены на 9 локальных участках. Электроразведочные работы методом вызванной поляризации (ВП) были проведены в опытно-методическом варианте на локальном участке 4. Электрораз-ведочные работы дали возможность построить псевдоразрезы первичных данных, псевдоразрезы 2D ин-версии по этим трем профилям.

При выполнении зондирования на каждом пикете профиля выполнялась серия замеров, состоящая из 20-50 циклов подачи и выключения разнополярных прямоугольных импульсов. Длительность токового импульса составляла 2 секунды, интервал между импульсами тока, в пределах которого осуществлялась регистрация процесса спада потенциала ВП составляла 2 секунды. Процесс стабилизации замера в течение множества рабочих циклов контролировался визуально на экране переносного компьютера, соединенного с

ресивером (приемником) ВП. При необходимости, если процесс стабилизации замеров в цикле не был устойчивым, что контролировалось по величинам абсолютных погрешностей по каждому приемному диполю в данной серии циклов, оператором выполнялись дополнительные серии замеров на данной точке (пикете), которые в дальнейшем осреднялись в процессе обработки.

В процессе интерпретации опытных электроразведочных работ были построены псевдоразрезы поляризуемости и кажущегося сопротивления, а также псевдоразрезы их 2D инверсий. Отмечено, что распределение поляризуемости в районе может быть обусловлено суммарным влиянием фонового распределения сульфидов в возможной продуктивной толще. Там, где зоны сульфидной минерализации залегают на глубине нескольких метров от поверхности палеозоя, наблюдается ярко выраженный эффект ВП, который контрастно выделяет зоны с повышенной поляризуемостью. В случаях, когда зона сульфидной минерализации имеет прерывистый характер и находится на глубине, наблюдаются неконтрастные аномалии, которые трудно отделить от аномального эффекта, обусловленного распределением отдельных мелких скоплений сульфидов. Зоны, как правило, коррелируются с верхней частью аномалий поляри-зуемости.

По данным сопротивления (псевдоразрезы ρk), изменения сопротивления зависят от увеличения мощности мезозой-кайнозойской толщи, с ее увеличением растет и показания по сопротивлению. Общая картина распределения электрических полей, как и магнитного поля, показывает устойчивый градиент полей с увеличением их интенсивности в северной части участка.

Магниторазведочные работы осуществлялись с использованием высокоточных протонных магнитометров ММ-61. Технические характеристики прибора позволяют достичь высокой точности съемки. Выполненные работы позволили получить новый, существенно уточненный, более детальный и информативный вариант карт магнитного поля ΔT масштаба 1:10 000. Путем качественной интерпретации магниторазведочных данных, проведено выделение на участках ряда локальных и линейных аномалий. По данным магниторазведочных работ наиболее интересные данные получены на участке 4. Магнитное поле участка разбивается на две части – ССВ и ЮЮЗ. По границе этих участков проходит нулевая изолиния. ССВ часть поля отчетливо положительна (с градиентом до ΔT 250 нТл). ЮЮЗ часть относительно отрицательна с градиентом до ΔT -250 нТл. Скорее всего, положительное поле (как и по данным электроразведочных профилей ВП) связано с выходами под четвертичным чехлом интрузивного массива среднего состава, с зонами метасоматически измененных пород как в эндо-, так и в экзоконтактах.

Ключевые слова: магнитная разведка, электроразведка, аномалия, погребенный гранитоид, сульфидная минерализация, поисковое бурение.

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