## МІНЕРАЛОГІЯ, ГЕОХІМІЯ ТА ПЕТРОГРАФІЯ

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# THE PECULIARITIES OF THE MAIN ORE-FORMING COMPONENTS DISTRIBUTION IN THE FILIZCHAY FIELD OF THE SOUTHERN SLOPE OF THE GREATER CAUCASUS

***(Представлено членом редакційної колегії д-ром геол. наук, доц. С.Є. Шнюковим)***

***The article has been devoted to the distribution of the main ore-forming components in Filizchay field of the southern slope of the Greater Caucasus. 3D model of the mineral elements of Filizchay field has been using "Leapfrog GEO" program. Analysis of the iso-thicknesses map clearly shows that the eastern flank of the deeper, shallow dipping part of the deposit is characterized by the greatest thickness where its thickness exceeds practically universally average value of this parameter according to the field. It has been found that zinc and lead distributions repeat practically each other. The western half of the body differs sharply from the eastern half by stable high (more than average value) contents. The overwhelming majority of zinc concentrations minimums and nearly all lead minimums are located in the eastern half which is generally characterized by the contents being below average. According to the copper concentrations distribution the deposit is very clearly divided into two parts – the southeastern part being thicker and richer and the northwestern part being relatively less thick and with contents being below average according to the field. The comparison of silver and lead isocontents' maps indicates a close relationship of both elements as evidenced by the very similar nature of their spatial distribution within the deposit. As well as for lead one can be generally distinguish two halves in it that are generally differed from each other in the intensity of the silver mineralization – the northwestern being richer and the southeastern being relatively poorer. The boundary between these parts repeats mainly the boundary determined for lead not only according to the spatial position but also according to the main details of the outline. All the maxima of the silver mineralization are located in the northwestern half of the field, the most of which are located on the upper horizons. According to the intensity degree of the zinc, lead and silver mineralization manifestation in the deposit, two parts can be distinguished: the western one is richer where almost all maxima are concentrated and the eastern one is poorer which accounts for the most of the minima. The boundary between them passes approximately in the middle part of the body from the upper to the lower horizons; it nearly coincides with the direction of its fall and it is distinguished by complex outlines. The frequent isolines repeatability of the zinc and lead contents, the close spatial position of their maxima centers suggest a close positive correlation between them.***

***Keywords: Filizchay field, the southern slope of the Greater Caucasus, 3D model of elements, "Leapfrog GEO" program, distributions of zinc, lead, copper, silver.***

**Introduction.** The pyrite-polymetallic deposits are concentrated either among igneous rocks (mainly Ural, Altay, Lesser Caucasus types) or they are localized both among effusives and sedimentary strata ("Kuroko" types) or among sedimentary shale strata (the fields localized in the Jurassic shale strata of the Greater Caucasus).

Presently these families of the pyrite deposits are combined into three groups (*Lobanova and Nekosb, 2017; Imamverdiyev et al., 2021; Lobanov and Yakubchuk, 2014; https://www.sciencedirect.com; https://en.wikipedia.org*).

*The first* of them is closely connected with the volcanic rocks and it is accepted as a typical classical pyrite that is called *VMS (Volcanogenic Massive Sulfide).*

*The second group which* is connected with terrigenous-carbonate, terrigenous strata is called stratiform Pb-Zn deposits or *SEDEX (Sedimentary Exhalative).* The deposits of SEDEX groups type are currently main source of zinc, lead and silver (*Emsbo et al., 2010; Goodfellow, Lydon, 2007; https://www.sciencedirect.com; https://en.wikipedia.org*).

*The third group* is stratiform deposits in the carbonate formations. They are analogous *of MVT (Mississippi Valley-Type).*

If the origin of the first and the third groups of deposits in the literature has been sufficiently substantiated, the models have been built then there is no consensus on the origin of the second group of deposits. The most geologists support the concept of academician V.I. Smirnov – about the polygenic genesis of the pyrite-polymetallic deposits of the Greater Caucasus (*Baba-zade et al., 1999, 2005, 2017; Smirnov, 1967*).

Due to the above-mentioned the new stage in the pyrite deposits' research is development and construction of the geological-genetic 3D models of the ore-forming systems on the basis of the geochemical data taken from boreholes. Based on the detailed mineralogical-geochemical data, the determination of the ore formation stages, referring them to some type of the pyrite deposits (*VMS or SEDEX)* and the clarification of the ore-forming systems' sources are very relevant in the modern geology.

**The peculiarities of the geological structure of the Filizchay field.** The meganticlinorium of the Greater Caucasus occupies a special place in the complicated heterogeneous structure of the Caucasian segment of the Mediterranean folded belt. Developed on the thin continental crust in contrast to typical ensialic island arcs it is characterized by the reduced magmatism with the overwhelming dominance of the sedimentary formations that are successively replaced each other in time – aspide (black-shale), terrigenous-flyschoid and carbonate-flyschoid of the Jurassic-Paleogene age (*Agayev, 1979; Geology of Azerbaijan, 2007; Kurbanov, 1982*).

The available literature data and the huge factual material collected for more than 30 years of the Filizchay field's exploration and mainly in the southeastern Caucasus indicate that the early stage of the Alpine tectonic-magmatic cycle covers the Lower and Middle Jurassic after which the tectonic regime restructuring is occurred (*Kurbanov, 1986*). So an extensive sedimentary basin of the border sea type was formed during the Liassic-Aalenian within the Greater Caucasus where aspide-shale and terrigenous-flyschoid formations with total thickness of more than 10 km were formed in the Early and Middle Jurassic (*Geology of Azerbaijan, 2005; Kengerli, 2009*).

The Sperozo-Tufan and Zagatala-Govdag zones are distinguished in the megazone of the Southern slope of the Greater Caucasus according to T.N. Kengerli (*Geology of Azerbaijan, 2007*). The first zone within Azerbaijan is the axial structure of the Greater Caucasus. The Zagatala-Govdag flysch zone is downthrown along the Gamarvan fault. The megazone of the Southern slope has been bounded by the Krasnopolyan-Zangin deep fault from the south.

According to this author data the Tufan, Jikhikh-Dindidag, Mazym-Sarybash, Galal-Rustambaz and Megikan subzones are distinguished within the Sperozo-Tufan uplift (*Geology of Azerbaijan, 2005*).

All known pyrite-copper-polymetallic deposits (Filizchay, Kasdag, Katekh, Jikhikh, Mazymchay, Cheder, Kasmalin) and ore occurrences (more than 70) are concentrated in the Lower-Middle Jurassic terrigenous strata of two longitudinal subzones – Tufan and Mazym-Sarybash. Their geological structure is distinguished by a number of the specific peculiarities within the Southern slope of the Greater Caucasus (*Agayev et al., 2005; Baba-zade et al., 2005; Novruzov, 2016*).

An analysis of the Jurassic and Cretaceous sedimentary formations of the considered territory has shown that they belong to the deposits of the graywacke, aspide, terrigenous-flyschoid and multicolored terrigenous-carbonate-flyschoid formations according to the composition. The rocks of these formations form here three rhythmic complexes. From which the early (graywacke formation) and middle (aspide and terrigenous-flyschoid formations) ones correspond to the Lower-Middle Jurassic development stage of the Alpine trough zone but the late rhythmic complex (multicolored formation) corresponds to its Upper Jurassic-Paleogene, marginal sea stage (*Agayev, 1979; Geology of Azerbaijan, 2007; Kurbanov, 1982*).

The structural position of the Filizchay field is determined by its confinement to the junction zone of the northern flank of the Karabchay coffer-shaped anticline with the Kekhnamedan reverse-thrust that is complicated by the Balakyanchay local transverse inversion uplift. The main elements of the deposit structure are: the core of the Karabchay anticline, its northern flank and part of the Kekhnamedan shear zone that are covered by the indicated transverse uplift. The peculiarities of these main structure elements determine the main features of the Filizchay field structure.

The main peculiarities of the Kasdag-Filizchay ore knot structure are:

1) The beginning of the modern structures' formation of the ore knot is connected with growth of the Kasdag and Karabchay longitudinal consedimentary uplifts which have been separated by a narrow uncompensated trough during the Lower Jurassic where the eruptions of the initial basalts and ore exhalations have occurred. They have formed stratiform ore bodies of the considered ore knot deposits that are corresponded to the Pliensbach and Toarian centuries in time.

2) The following tectonic movements have already caused compensated trough origin of the Kekhnamedan deep-seated upthrow-thrust shear zone in the site and the transformation of the brachiform uplifts into the Kasdag and Karabchay anticlines of the first order;

3) Three various aged, permanently alternating each other tectonic deformations stages can be distinguished within the ore knot. The first stage is preceded by the formation of dykes and sills of the first group and it corresponds in formation time to the first-order anticlines, the second-order linear folding, the second-order folding, flow cleavage, upthrow-thrusts; the stage is completed by the injection of the subvolcanic intrusions of the second group;

4) The second stage of the tectonic deformations has formed steep cleavage zones of the fault, contorted folds, ductile ruptures. It has created dikes boudinage of the first and second group and has complicated by the injection of the small intrusions of the third group gabbro-diorite association;

5) The third stage of the deformations led to the development of the transverse flexural bends and fault-shear faults, previously formed longitudinal linear folds, faults, flow cleavage and the secondary schistosity (*Kurbanov, 1986*).

The main peculiarities of the morphology of the pyrite-polymetallic deposit of the Filizchay field is that it is a single, compact sheet-like body being mainly composed (at 90–95%) of sulfide ores aggregates, the basis of which is pyrite and a far lesser degree sphalerite, galena, chalcopyrite and pyrrhotite (*Novruzov, Sattar-zade, 2019*). The carbonate minerals and even less – quartz, sericite and chlorite played a subordinate role in the deposit composition. The ore body lies among the monotonous clay shales of the upper – third bend of the Filizchay series.

**The results discussion.** 3D model of mineral elements of the Filizchay field was built using the Leapfrog GEO program which was developed specifically for geologists (*https://leapfrog3d.co*m).

Using 3D models gives possibility to build a model of the field in a cross strike of the deposit (*https://leapfrog3d.com*). The geochemical model not only for one ore deposit but for all elements of the field was created by the means of 3D model and structures realized in the integrated package of "Leapfrog GEO" programs. The geochemical model according to the individual elements or due to assembly of the certain elements (for example, Cu + Zn + Pb) is built after creating 3D from the selected models of the Filizchay field elements. This block-diagram can rotate in different directions and it is possible to consider their full 3D field model.

The analysis of the thickness values distribution and the useful components content along the lateral, normal and down-dipping of the deposit was conducted for the purpose of characterizing the spatial variability of the mineralization. For this purpose, the isolines of the true thicknesses and contents of the valuable (Cu, Zn, Pb) components, their sum as well as the distribution of Ag having a high content for the deposit of the Filizchay field were built on the projection of the ore deposit on the horizontal plane. They were constructed on the basis of the above-mentioned "Leapfrog GEO" program (table, fig. 1–5).

The parameters of the complete ore intersections (wells and mine workings) – the total intersected thickness of the body and the average contents of useful components over the intersection, calculated according to the conditions within the geological deposit boundaries without including spotty-disseminated and massive copper-pyrrhotite ores were occurred as single observation. The traditional method of data interpolation between neighboring observations was used at constructing these isolines.

Analysis of the iso-thicknesses map clearly shows that the eastern flank of the deeper, gently sloping part of the deposit is characterized by the greatest thickness, where its thickness exceeds the average value of this parameter for the field almost everywhere. This part of the field is represented by an area of the increased and high thicknesses on the graph which has the form of a wide (400–300 m) and extended along the dip (more than 1000 m) 53 line, plunging into the plane of the body in a northeast direction approximately at 45º angle with respect to strike. The upper flat boundary of this line is determined by the position of the almost universally manifested bending of the deposit. Three maxima of the isometric outlook are established within the line: two small ones in its upper part and one being the most significant in intensity and spatial development at the deepest explored horizons of the northeastern deposit flank. Updip described line continues through a narrow pinch on the upper horizons of the western part of the field and it is expressed by the limited area of the increased thicknesses values with one small maximum (*Sattar-zade and Imamverdiyev, 2022; Novruzov, 2011*).

***Table***

**Fragments of the results of the group samples analyzes for compiling a geochemical model of the Filizchay field**

| № well | From-to, m | Cu % | Zn % | Pb % | S % | Ag g/t |
|---|---|---|---|---|---|---|
| 26 | 117,3–126 | 0,48 | 10,5 | 3,95 | 40 | 90 |
| 30 | 400,9–411,9 | 0,3 | 9,9 | 5,75 | 42,9 | 140 |
| 56 | 409–412 | 0,29 | 3,74 | 0,88 | 42,9 | 90 |
| 57 | 383–388,3 | 0,68 | 3,3 | 1,2 | 38,9 | 25,8 |
| 67 | 554,3–564 | 0,56 | 4 | 1,47 | 38,9 | 29 |
| 68 | 303–309,5 | 0,81 | 3,88 | 1,5 | 41,8 | 44 |
| 70 | 253,8–264,5 | 3,7 | 0,55 | 0,28 | 39,5 | 150 |
| 310 | 189,2–199,1 | 0,51 | 7,12 | 3,3 | 45,5 | 43,4 |
| 312 | 119,7–131 | 0,7 | 6,25 | 2,55 | 39,1 | 48 |
| 314 | 251–260,3 | 0,53 | 4,12 | 1,74 | 36,8 | 36,8 |
| 315 | 151,1–163 | 0,55 | 3,85 | 1,6 | 38,2 | 43,8 |
| 342 | 303,9–313,3 | 0,63 | 1,63 | 0,44 | 35,3 | 22,6 |
| 349 | 385,9–391,5 | 0,8 | 2,2 | 0,76 | 38,7 | 36 |
| 360 | 134,6–144,5 | 0,53 | 5 | 1,9 | 43 | 62 |
| 374 | 202–216,4 | 0,53 | 6,75 | 1,65 | 42,7 | 36 |
| 404 | 335–346,6 | 0,41 | 4,75 | 2,24 | 43,6 | 46 |
| 416 | 86,1–90,4 | 0,3 | 2,24 | 0,24 | 29,3 | 25,6 |
| 443 | 458,3–469,4 | 0,8 | 1,81 | 0,55 | 36,7 | 23,2 |
| 444 | 290,6–303,6 | 0,48 | 4,95 | 1,42 | 39,5 | 60,3 |
| 469 | 302,8–316,3 | 1,22 | 2,57 | 0,64 | 36,3 | 9,1 |
| 515 | 756,3–762 | 0,53 | 3,65 | 1,87 | 45,1 | 80 |
| 528 | 505,6–513 | 0,48 | 2,7 | 1,55 | 29,7 | 46,6 |
| 555 | 657–661,6 | 0,34 | 0,8 | 0,22 | 30,5 | 40 |
| 558 | 199–206 | 0,78 | 2,9 | 0,96 | 40 | 24,6 |
| 560 | 860,8–864,9 | 0,4 | 1,57 | 0,27 | 42 | 21 |
| 575 | 781–785 | 0,43 | 6,6 | 0,52 | 37,2 | 47,2 |
| 583 | 876,2–877,1 | 0,47 | 1,16 | 0,71 | 42,4 | 3,1 |
| 584 | 664–667,2 | 0,9 | 1,84 | 0,42 | 34,6 | 20 |
| 592 | 756–762,8 | 2,4 | 1,05 | 0,08 | 38,5 | 10,4 |
| 594 | 952–960 | 0,63 | 0,13 | 0,28 | 45,8 | 28,8 |
| 600 | 836,1–844 | 0,42 | 1,73 | 0,44 | 37,9 | 16 |
| 605 | 188,8–192,9 | 0,42 | 5,39 | 1,82 | 37,3 | 72 |
| 606 | 197,6–202,6 | 0,32 | 8,25 | 3,09 | 41,1 | 71,4 |
| 608 | 273–280,4 | 0,47 | 1,03 | 0,25 | 43,3 | 2 |
| 611 | 273,6–275,5 | 0,33 | 3,13 | 0,93 | 40,4 | 17,8 |
| 620 | 252,4–254 | 0,38 | 6,12 | 2,87 | 37 | 82 |
| 624 | 178–188 | 0,96 | 0,03 | 0,84 | 41,7 | 20,5 |
| 644 | 245,4–258 | 0,37 | 10,52 | 2,81 | 37,6 | 67,8 |
| 659 | 475,4–476,6 | 0,43 | 7,02 | 2,28 | 39.7 | 45 |
| 668 | 288,5–297 | 0,54 | 1,31 | 1,3 | 42 | 60 |
| 670 | 709,1–710,3 | 0,16 | 0,48 | 1 | 40,9 | 55 |
| 676 | 731,4–737 | 0,63 | 0,69 | 0,14 | 41,4 | 600 |
| 696 | 522,8–530 | 0,33 | 5,86 | 1,82 | 38 | 70 |
| 698 | 344–352,4 | 0,7 | 5,66 | 3,04 | 34,1 | 80 |
| 703 | 581–588,9 | 0,29 | 2,37 | 0,64 | 39 | 35,4 |

The *zinc and lead* isoconcentrations' map (Fig. 1–2) clearly show that these elements distributions repeat practically each other. The western half of the body differs sharply from the eastern one by the stable increased (more than average value) contents. The overwhelming majority of zinc concentrations' minima and nearly all lead concentrations' minima are located in the eastern half that is mainly characterized by the below average contents. The boundary between two parts of the deposit is established by the position of the metal isoconcentrations lines. The subvertical one has a rather clear, generally upcoming to the linear form being typical for zinc and steep tortuous, more complex in outlines – for lead. The largest maximum of the zinc contents being elongated to a depth in the direction from southwest to northeast and spatially coinciding with one of the most significant thicknesses minima, is on the western periphery of the upper deposit part. The other very small maxima are entirely distributed in the same western half of the deposit. The lead distribution is more complex here: the maxima of the contents are more numerous and the appearance of the part of them on the upper horizons is due to the development of oxidation and secondary enrichment processes. The comparative analysis of the values distribution of all three named parameters shows that in general the concentrations' minima are either overlapping with the thicknesses maxima or they are laying in the region of the increased values of the last ones. The mentioned circumstance indicates the existence of the feedback between the thickness and metals contents. The closeness of this relationship is not the same for different deposit parts and it will be estimated below. The frequent isolines repeatability of the zinc and lead contents, the close spatial position of their maxima centers suggests a close positive correlation between them.

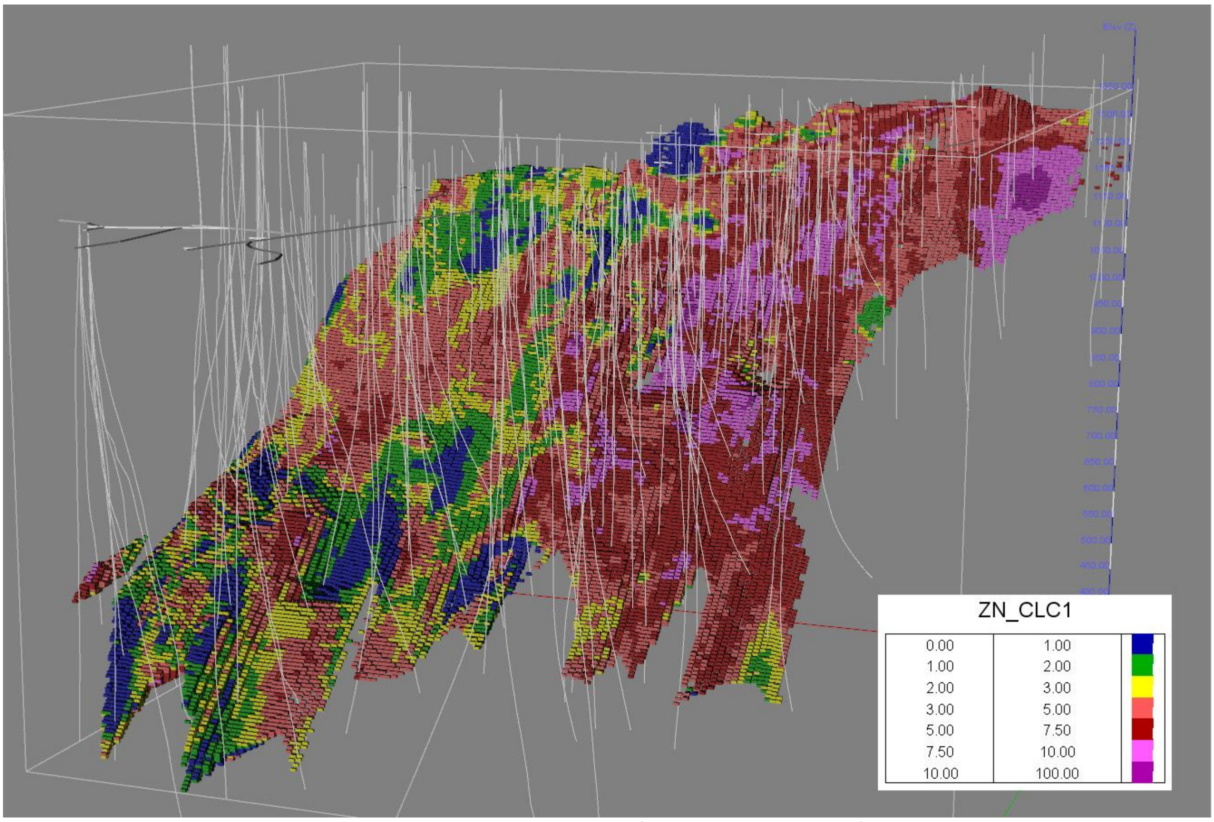


**Fig. 1. The spatial distribution of zinc in the Filizchay field**

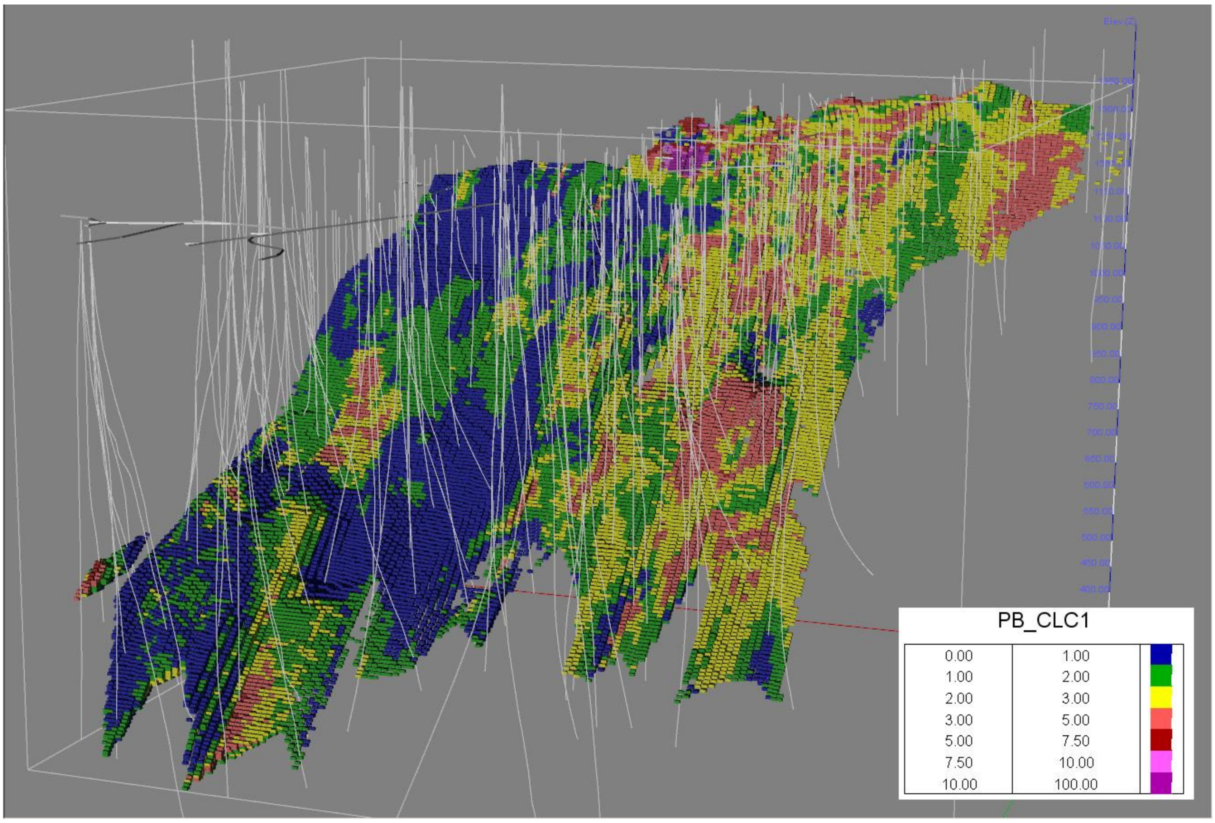


**Fig. 2. The spatial distribution of lead in the Filizchay field**

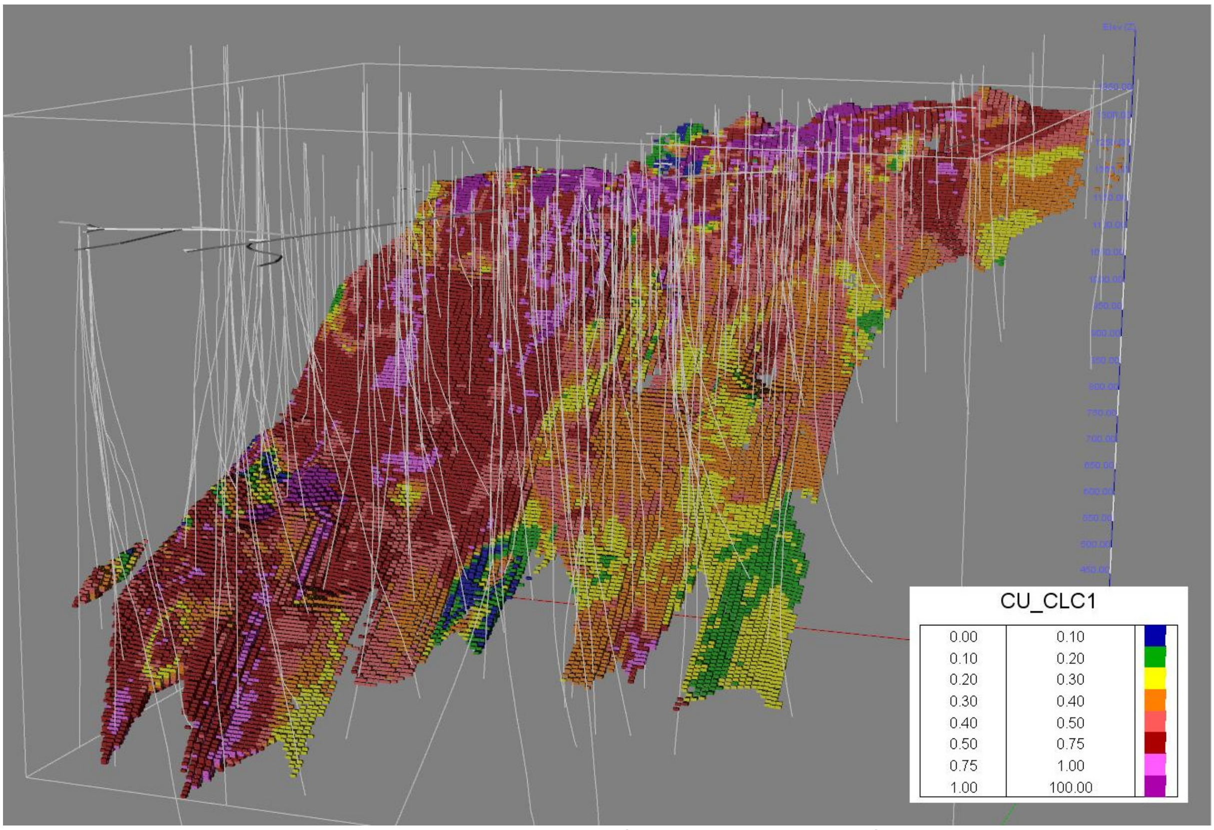


**Fig. 3. The spatial distribution of copper in the Filizchay field**

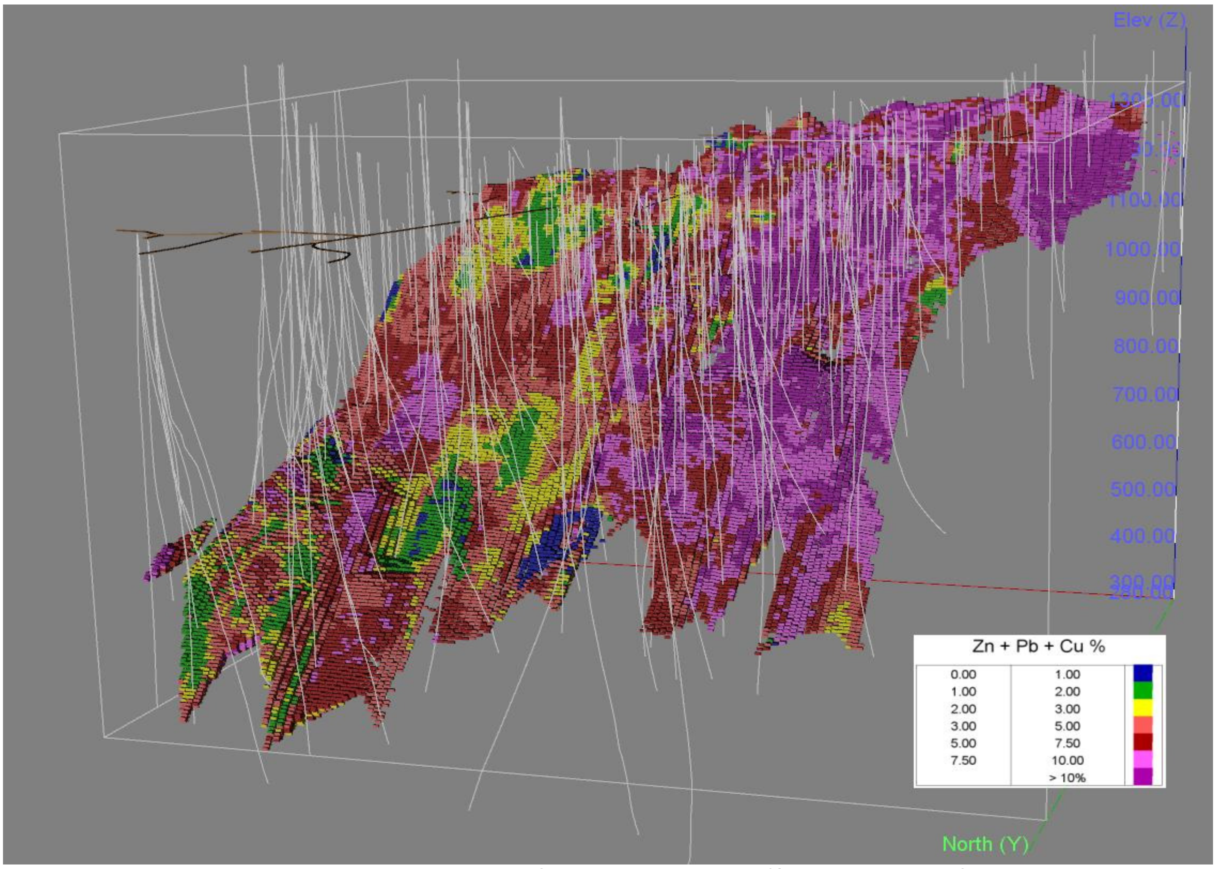


**Fig. 4. The spatial distribution of zinc + lead + copper (%) in the Filizchay field**

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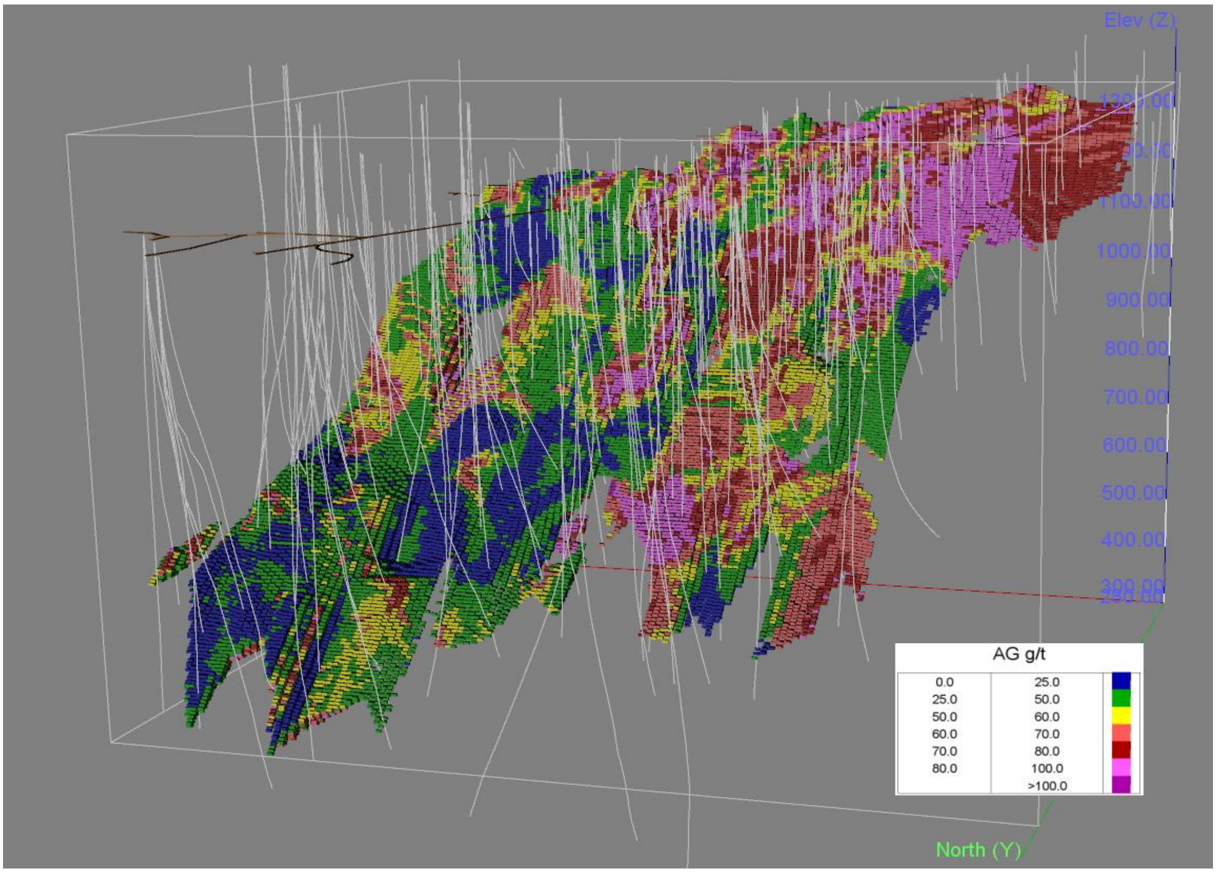


**Fig. 5. The spatial distribution of silver in the Filizchay field**

The behavior of the *copper* mineralization is completely different (Fig. 3). According to the distribution of the copper concentrations the deposit is very clearly divided into two parts: southeastern and northwestern. The boundary between them can be established diagonally in the plane of the ore body from the southwest (from its western flank in outcropping place) to the northeast (to the deepest horizons of the eastern periphery) approximately at 45º angle i.e. according to its declination. The southeastern half is occupied by the areas of the increased copper concentrations with the maximum in the eastern part within hypsometric marks of 600–700 m and several maxima elongated almost along the entire length near the surface which are arisen in connection with secondary enrichment processes. These areas have complex irregular outlines. In the generalized form they can be divided into two groups according to the conditions of occurrence. The flat line on the uppermost horizons with numerous "tongues" running to the shallow depth being perpendicular to the strike of the deposit belongs to the first group. The second group has been represented by three vast regions which are mainly located in the direction of the declination and having lines form. The last eastern line narrows sharply with depth turning into a narrow band with the same orientation. The areas with the ordinary contents are located between them. The total low content of copper and complete absence of the increased concentrations distinguish the northwestern half of the body. The minima being extensive in sizes and having mostly relatively simple isometric and elliptical shapes occupy about half of its area. All minima are located below 920 m, the westernmost of them is also the largest one in area. The copper concentrations distribution largely repeats the thicknesses distribution. So there are almost completely coincided the main (general) diagonal boundaries passing through all deposits and dividing them into two halves being heterogeneous in content and thickness; the maxima of these parameters values located in the northeast of the deposit as well as the majority of the most significant minima are spatially close. The pattern being more complicated and irresponsible to this scheme in the southeastern part of the deposit is explained by the enrichment of the secondary copper minerals that are occurred at the upper horizons. Generally, the graphic material analysis clearly indicates the presence of the total positive relationship between the considered parameters.

The distribution of the *silver* is characterized by the great complication (Fig. 5). Comparing maps of the silver and lead isocontents is indicative of the close relationship of both elements as evidenced by the very similar nature of their spatial distribution within the deposit. As well as for lead two halves can be generally distinguished in it. They are generally different from each other in the intensity of the silver mineralization – the northwestern one being richer and the southeastern one being relatively poorer. The boundary between these parts repeats largely the boundary determined for lead not only according to spatial position but also according to the main details of the outline. It also has a complicated flexuous configuration and it runs approximately diagonally from the southwestern to northeastern corner of the deposit dipping to the northeast in the ore body plane. All the maxima of the silver mineralization are located in the northwestern half of the deposit. The most of which are distributed on the upper horizons. The extended (about 250 m) gentle line of the highest silver concentrations is located near the surface occupying all length of this half. It is connected with the

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secondary enrichment of ores. Several small maxima are established areally towards the strike normal below it, the distribution of which is limited about 820 m depth. Finally two more maxima falling on the deep horizons of the central part of the deposit occupy the lowest position. Three minima being small in area are located in the western periphery of the body beginning from medium ones up to the maximum reached depths. The development of the minima, being significant in area and established in all investigated depths interval, is characterized for the southeastern half distinguishing by the general low silver content. Relatively high concentrations areas have the limited distribution mainly on the southeastern flank of the area and they are separated from the minima by wide lines of the ordinary contents. The western number of the minima marks the conventional boundary dividing the deposit into two parts.

The distribution of the *gold* concentrations in the most general terms is similar to the copper mineralization location. The maxima chain is located diagonally in the ore body plane that is subjected to the direction of the general subsidence from the southwest to the northeast. These maxima are developed across the entire range of the investigated depths dividing the field on the diagonal into two parts. The upper ones of the maxima are associated with the secondary enrichment. The lower ones reflect the primary zoning of the ore deposition. The wide development area of the minimum gold concentrations with a number of the deep minima can be distinguished below (northwest) of the chain adjacent to it. Another maximum appears at deep horizons in the northwestern part of the deposit. It is framed by the narrow gentle line of minimum contents values. Generally the southeastern (upper) half of the body is characterized by the greater intensity of the gold mineralization manifestation in comparison to the northwestern (lower) half that directly corresponds to the distribution of thicknesses in which the eastern part of the deposit is distinguished by the great thickness (thereby the secondary enrichment zone is not taken into consideration). Generally the gold contents maxima coincide with the thicknesses maxima in the above mentioned chain. The boundaries of the deposit separation according to the intensity degree of the gold mineralization and in terms of the thicknesses into richer, comparatively thick and relatively poor and thin halves are close to each other in spatial position and even in many outline details. This is especially true of the lower gently pitching part of the body where several maxima of the both parameters values are superimposed on each other.

**Conclusion.** Giving a brief overview of the conducted investigations we note that according to the analysis of the actual material the variability of the distributions of the thicknesses and copper content is the most contrasting. For which the deposit declination in the northeast direction is very clearly manifested during its falling to the north. This declination has been expressed by maxima and the increased values lines of the mentioned indicators as the individual lines or chain passing in the body plane from its southwestern to northeastern flanks. According to the distribution nature of the thicknesses and copper contents the deposit is clearly divided diagonally into two parts – the southeastern, thicker and richer part and the northwestern, relatively lower thickness and with contents being below the average over the deposit. According to the intensity degree of the manifestation of zinc, lead and silver mineralization in the deposit one can distinguish two parts: the western part is richer where almost all maxima are concentrated and the eastern part is poorer which accounts for the most of the minima. The boundary between them passes approximately in the middle part of the body from the upper to lower horizons; it roughly coincides with the direction of its fall and is distinguished by complex outlines. The gold distribution is the most complex. The extensive area of low and minimum metal concentrations is distinguished in the middle part of the deposit beginning approximately from the level of the incidence angle change and below to the hypsometric mark of about 500 m. This area is framed (with the exception of the northwestern and southeastern angles) by a wide halo of the increased contents. It occupies all other area of deposit and within which many small maxima in size are located. The distribution of the main ore-forming components (zinc, lead and copper) in the horizontal section is illustrated on the plans of three horizons representing the upper, middle and deep parts of the deposit.

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## ОСОБЛИВОСТІ РОЗПОДІЛУ ОСНОВНИХ РУДОУТВОРЮВАЛЬНИХ КОМПОНЕНТІВ ФІЛІЗЧАЙСЬКОГО РОДОВИЩА ПІВДЕННОГО СХИЛУ ВЕЛИКОГО КАВКАЗУ

***Досліджено розподіл основних рудоутворювальних компонентів Філізчайського родовища південного схилу Великого Кавказу. 3D модель елементів корисних копалин Філізчайського родовища виконана за допомогою програми "Leapfrog GEO". Аналіз карти ізотовщин чітко показує, що найбільшою потужністю характеризується східний фланг більш глибокої, пологоспадної частини покладу, де її потужність перевищує середнє значення цього параметра по родовищу. Встановлено, що розподіли цинку і свинцю практично повторюють один одного. Західна половина корпусу різко відрізняється від східної стабільно високим (більшим за середнє значення) вмістом. Переважна більшість мінімумів концентрації цинку і майже всі мінімуми свинцю розташовані у східній половині, яка зазвичай характеризується низьким вмістом цих елементів. Відповідно до розподілу концентрації міді родовище дуже чітко розділене на дві частини: південно-східна частина є більш товстою та багатшою, а північно-західна частина має відносно меншу товщину та вміст елементу нижчий за середній по родовища. Порівняння карт ізоконтенту срібла та свинцю свідчить про тісний зв'язок обох елементів та подібний характер їхнього просторового розподілу на родовищі. Так само, як і для свинцю, в ньому можна загалом виділити дві частини, які відрізняються одна від одної інтенсивністю мінералізації срібла – північно-західна більш багата і південно-східна відносно бідніша. Межа між цими частинами в основному повторює межу, визначену для свинцю, не тільки за просторовим положенням, але й за основними деталями контуру. Усі максимуми срібного зруденіння розташовані в північно-західній половині поля, більшість з них – на верхніх горизонтах. За ступенем інтенсивності прояву цинкової, свинцевої та срібної мінералізації на родовищі можна виділити дві частини: більш багату західну – де зосереджені майже всі максимуми, і біднішу східну, на яку припадає більшість мінімумів. Границя між ними проходить приблизно в середній частині тіла від верхнього до нижнього горизонтів; вона майже збігається з напрямком її падіння і виділяється складними обрисами. Часта повторюваність ізоліній вмісту цинку і свинцю, близьке просторове розташування центрів їх максимумів свідчить про тісний позитивний зв'язок між ними.***

***Ключові слова:** **Філізчайське родовище, південний схил Великого Кавказу, 3D модель елементів, Leapfrog GEO, розподіл цинку, свинцю, міді, срібла.***