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GENESIS OF GOLD PLACER SYSTEMS AND THEIR REDISTRIBUTION IN THE CONTEXT OF LITHOGENETIC PROCESSES (ON THE EXAMPLE OF THE MAIN RIVERS OF THE NORTH-EASTERN PART OF THE LESSER CAUCASUS, AZERBAIJAN)

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Abstract

The article is devoted to the study of the genesis of gold placers and their redistribution, with an emphasis on the features of gold formation and distribution in the main rivers of the north-eastern part of the Lesser Caucasus (Azerbaijan). Various lithogenetic factors, such as genetic types of sediments, sedimentary processes, and their influence on the migration and concentration of gold in sediments are considered. The study also includes an analysis of the influence of mineralogical and geomorphological features of the region on the process of placer formation. Particular attention is paid to the interaction of gold-bearing minerals with other components of sedimentary rocks under the conditions of geological features of this region. The work is aimed at identifying patterns of gold distribution depending on lithogenetic conditions, which is of practical importance for the effective development of gold-bearing resources.

Keywords: Lesser Caucasus, lithogenetic factors, migration and concentration of placer gold, gold-bearing resources, alluvial type of placers

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Introduction

Lithogenetic factors and conditions of formation of placer deposits include such features, properties or parameters of the sediment-forming environment, the combination or interaction of which allows accumulation of placer-forming minerals in this environment. In the energy sense, the lithogenetic process is an expression of the tendency to leveling of the masses of detrital material on the earth's surface and its distribution. Upon closer examination and at a completely different energy level, the lithogenetic process depends on physicochemical factors, interactions of various geological processes, geological time. In the hypergenesis zone, a whole spectrum of continental deposits is

formed - eluvium, alluvium, deluvium, etc., differing in various features, facies transitions, etc., which we will consider below within the study area.

Geodynamic determinacy of the placer-forming process leads to convergence of all its stages. During the period of activation of ascending movements, primary sources are brought to the day surface. It should be noted that the placers of river valleys are associated with areas of increased permeability, ore-controlling structures. This connection explains the presence of the largest deposits of placer gold and other minerals in the valleys [2, 3, 4].

The territory of Azerbaijan, from the point of view of identifying the accumulation of gold placers, is highly promising. Since this zone is characterized by the formation of modern (Absheron-Quaternary period) alluvial deposits, their accumulation in the corresponding morphostructural elements, preservation and from the point of view of the extensiveness of the original sources, a complex of natural factors, etc.

This issue is devoted to the works of Yu.A.Bilibin, Yu.P.Kazakevicha, Yu.G.Goldfarb, M.F.Veklich, E.D.Izbekov, L.A.Nikolaev, E.V.Shantser, I.S.Rozhkova, N.A.Shilo, S.M.Suleymanov, V.G.Ramazanov, F.F.Abdullaev, A.N.Omarov, Sh.D.Musaev and many other researchers [1, 3. 4, 7].

Materials and discussion

Within Azerbaijan, researchers have identified a number of placer gold occurrences with varying degrees of certainty. In fact, in most river networks that drain numerous ore deposits and occurrences with primary and associated gold, it is theoretically possible to expect a certain accumulation of placer gold.

Placers of gold in the basins of the main rivers of the studied territory are considered, first of all, from the point of view of genesis [1, 4, 7].

Generalized table of genetic types of gold placers of Azerbaijan

Table 1

	Genetic type	Main areas of distribution	Characteristic
1	Deluvial	Foothills and mountain slopes	Formed by the destruction of gold-bearing rocks and their short-term movement down slopes
2	Proluvial	At the foot of mountains, in alluvial fans	Accumulation of material by temporary watercourses, poorly sorted
3	Alluvial	The beds of modern and ancient rivers	Well sorted, represented by sands, pebbles
4	Eluvial	In the zone of primary gold mineralization	Formed by weathering of gold-bearing veins
5	Morainic	Mountainous areas associated with glaciation	Gold in glacial deposits, poor sorting
6	Colluvial	Landslide and talus zones of mountainous areas	Formed by the destruction of bedrock and the accumulation of gold in rockfalls and taluses

7	Peat and bog	In swampy areas	Accumulated in conditions of slow decomposition of organic matter
8	Karst	In areas of karst development	Gold accumulates in karst cavities washed out by ancient watercourses
9	Man-made	In zones of old mining	Represented by man-made placers formed by waste from mining activities

Gold-bearing placers of the studied zone are genetically classified as eluvial, alluvial, alluvial-proluvial, respectively distinguished by morphology as channel, valley, terrace. From the south-east to the north-west, the granulometric composition of the rock in the range of gold placers changes from boulders, boulder-pebbles to pebbles.

The forms of gold concentration areas in loose deposits - gold-bearing placers are determined by the conditions of their formation. The location of ancient placers depends on the topography of old river valleys, sea coastlines, etc. The most important elements of placer geology are the depth of their occurrence and the nature of the covering strata. The thickness of the latter varies from several meters to hundreds of meters.

The conditions of transportation and accumulation of clastic material during the formation of the identified sediment facies are not the same. In the deposition of loose rocks of the floodplain facies, the transport of small particles suspended in water, including fine gold, plays a major role. In the channel facies, debris accumulates that move along the bottom of river beds and experience strong mechanical effects during collisions.

The gold content in placers varies from 0.1-0.20 to 10-20 g3/cm3 and higher. The highest gold concentrations are observed where the placer raft is an outcrop of steeply dipping shale layers; metal particles usually accumulate between the ribbed projections of the latter.

It should also be noted that within the Lesser Caucasus there are three glaciations (M.A. Abasov, B.A. Antonov, 1970): Upper Pliocene, Middle Quaternary and Upper Quaternary. Traces of more ancient glaciations have almost not been preserved, and the last two, due to intensive erosion processes and the small thickness of accumulative glacial forms, are not clearly recognizable. Glacial deposits, which have a limited distribution in the high-mountain regions of the Lesser Caucasus in the upper reaches of the Shamkirchay, Ganjachay, Kyurakchay, Goshgarchay rivers along the Mrovdag-Shahdag ridges, are represented by moraines.

In genetic terms, eluvial deposits are the most homogeneous type of continental deposits and have a simpler granulometric composition. They show an increase in clay content, sand fraction content, increased thickness, structural integrity, and gold content. Placers associated with eluvium are isometric or linear. Such sediment complexes inherit the entire complex of hypergene-resistant or placer-forming minerals from their primary sources, although the primary concentration of the useful component is not preserved in them. The rock-forming minerals that make up eluvium, depending on the conditions of hypergenesis for all types of lithogenesis, represent a hypergene complex. The formation of eluvial placers is accompanied by the transformation of hypogene parageneses into a new hypergene complex with significant changes in the elemental composition. It should be noted that the

inheritance of hypergene-resistant minerals of eluvial placers from primary sources is quite clearly expressed in the gold-bearing eluvium of various provinces of the world. In eluvium, the parageneses of placer-forming minerals of bedrock and deposits are repeated, and it becomes possible to resolve the issue of the relationship of placers with bedrock deposits. An example is the eluvium of Western Australia, in the state of Victoria, where loose deposits are formed during the processing of bedrock deposits exposed on the surface. One can also mention the Luesch deposit in Zaire, where an eluvial deposit formed, composed of products of chemical processing of syenites and carbonatites. Eluvial gold placers, preserved in some areas of the high-mountain region of the central part of the Lesser Caucasus, are noted in relatively flat areas of watersheds.

Placers are noted in local areas of the Soyutly gold-bearing zone and in the area of the city of Keti at the headwaters of the Zarchay River within the Agduzdag gold deposit. According to a set of features, more significant eluvial (deluvial-eluvial) placers covered by modern proluvial deposits are predicted in the area of the Dagkesaman gold deposit in the northeastern part of the Lesser Caucasus. Eluvial and deluvial placers, occurring on leveled surfaces and slopes of hills, have a cloak-like shape. Within the basin of the Kyurakchay River, eluvial deposits are found in watershed parts (along mountain ridges) with a thickness from tens of cm to 5 m. In the area of the Dzegamchay River, Quaternary deposits also consist of eluvial formations. Paleogene deposits in natural outcrops of the Akstafachay River with its tributary the Dzhogaschay River are rare.

Alluvial process and placer formation is another stage of continental rock formation. As a result of this stage, alluvial deposits are formed. These deposits are mainly represented by a complex of mutually connected placers, differing in age, morphology, structure, bedding conditions, industrial value, etc. However, in the valleys of mountain rivers, the process is complicated by gravitational-diffusion exchange phenomena. Alluvial process and associated placer formation are based on the interaction of a solid component with water. During the transformation of this component in the aquatic environment, concentration of ore minerals of industrial content occurs. And it should be noted that the main factors in the formation of ore matter are lithogenetic, hydrodynamic phenomena. On the other hand, the formation of these placers is determined by the tectonic-geomorphological development of the territory. Under equal metallogenic and mineragenic conditions, the absence of such placers indicates the prevalence of downward movements, the development of depressions and tectonic troughs. Detailed lithological study of alluvial deposits is complicated by rapid facies changes in alluvium, in transverse and longitudinal sections, and rhythmic layering of detrital material. Alluvial deposits play a key role in the process of placer formation, as they are the main accumulators of gold and other minerals.

It should be noted that granulometry is determined by the distribution of particles by their diameter and mass and includes various categories, from large fractions (gravel and sand) to small fractions (silt and clay). Different fractions of sediments can have different mechanisms of sedimentation and transportation, which affects the concentration of heavy minerals and the formation of placers. Gravel type alluvial deposits are formed in places with fast water flow, such as river beds or large river channels. These deposits are characterized by the presence of large fractions (from 2 mm and more), such as pebbles and gravel. The predominant fractions in gravel deposits are large (2-10 mm) and medium (10-20 mm) particles. Such deposits contain minimal amounts of small particles. In such deposits, active transportation and sedimentation of larger fractions, such as sand and gravel, occurs, while gold, due to its high density, settles in areas with slow water flow, forming placers. Sandy type

of alluvial deposits are often found in areas with moderate water flow, such as medium-sized rivers, and in some areas of river terraces. These deposits consist mainly of sand fractions, with particle sizes ranging from 0.25 mm to 2 mm. Silt and clayey type of deposits are formed in conditions with very slow water flow, i.e. in the lower parts of rivers. These deposits have the finest granulometry of all alluvium types. We have studied that silt deposits are less effective for gold accumulation due to their fine-grained structure. But we believe that hidden or fine-grained placers can form in such places, which are revealed by deep washing of sediments. Gravel, sand and silt deposits have different ability to retain heavy minerals, which is directly related to their granulometric composition. Understanding these characteristics allows us to more accurately predict the location of gold placers and develop effective methods for their extraction.

The study of ore regions of the world has shown that important objects of placer deposits belong to valley placers. The noted features of placers are reflected in quantitative indicators. Since the reserves of useful components decrease in the direction from valley to other placers, from low to higher, from young to more ancient. A similar pattern is repeated in territories with different tectonic-geomorphological conditions, for example, Alaska, the Urals, the Kolyma and Lena basins. Valley placers are productive alluvial deposits. The complex evolution of the river network in mountainous countries is accompanied by the formation of valley placers, differing in structure, genesis of the constituent rocks, bedding conditions, etc.

Typical distribution of gold in channel alluvium

Table 2

№	**Composition of alluvium**	**Sampling depth, m**	**Average gold content, g/m3**	**Features of gold**
1.	Flat, rounded pebbles	0,4	0,3	Small, rounded
2.	The pebbles are small and slightly rounded.	0,8	0,1	Fine, dusty
3.	Large, rounded pebbles with coarse-grained sand	1,2	0,1	Fine, dusty
4.	Large pebbles with loam	1,4	0,2	Fine, dusty
5.	Pebble with crushed stone and sand	1,8	0,1	Small
6.	Crushed stone with small pebbles	2,2	0,4	Small with quartz

As a result of detailed studies, we compiled a generalized section of alluvial deposits, where alluvial placers are characterized by a clearly defined productive layer (Fig. 1), most often confined to the lower sections of river deposits and the upper destroyed part (karst cavities) of the underlying and bedrock (raft), which is observed in the terraces of the Kurakchay and Goshgarchay valleys.

Alluvial placers of the Kurakchay River valley have a linearly elongated and areal appearance according to the position they occupy in the terrace levels, where the linearly elongated areas correspond to the elementary appearance of the placer, and the areal ones correspond to the complex

appearance.

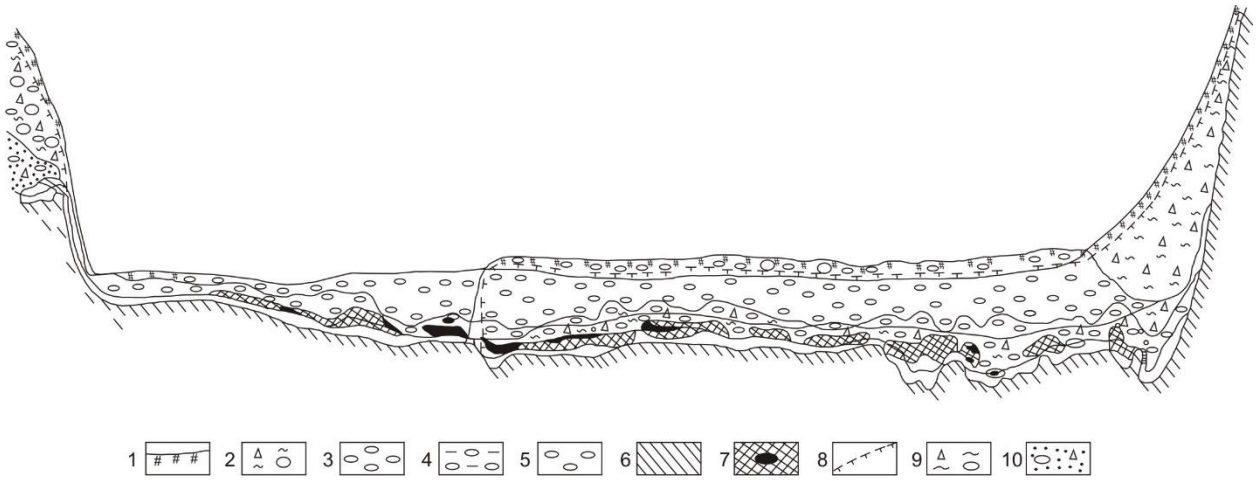

Fig. 1. Generalized cross-section of alluvial deposits of rivers, the position of raft placers in them (compiled by T.G. Takhmazova using materials by V. Ramazanov, F. Abdullaev, A. Omarov): 1-soil and vegetation layer, 2-deluvial rubble, 3-floodplain pebble with gravel with coarse-grained sand and loam, 4-clay of floodplain facies with pebbles, 5-pebbles with sandy loam, 6-bedrock, 7-various gold concentrations, 8-various lithological boundaries, 9-pebbles with rubble, 10-pebbles cemented with loam

The main group of alluvial placers arises in the upper and middle reaches of rivers at the beginning of the accumulation area due to the concentration of useful components. The second group of alluvial placers is formed in the lower reaches of rivers due to the concentration of useful components reaching the mouth of the river and transported in a suspended state. The distance between the sources of the river and the accumulation area, within which the placers are formed, is determined by the structure of the valley, the steepness of its longitudinal profile, the flow rate and speed of the river current, the size and specific gravity of the useful component, and other reasons.

Alluvial placers and the loose rocks that cover them are characterized by the floodplain facies - clays and loams, fine- and medium-grained sands; the channel facies - coarse-grained sands, gravel, pebbles; and the bottom facies - clayey-sandy pebbles with crushed stone, boulders and blocks (Fig. 2).

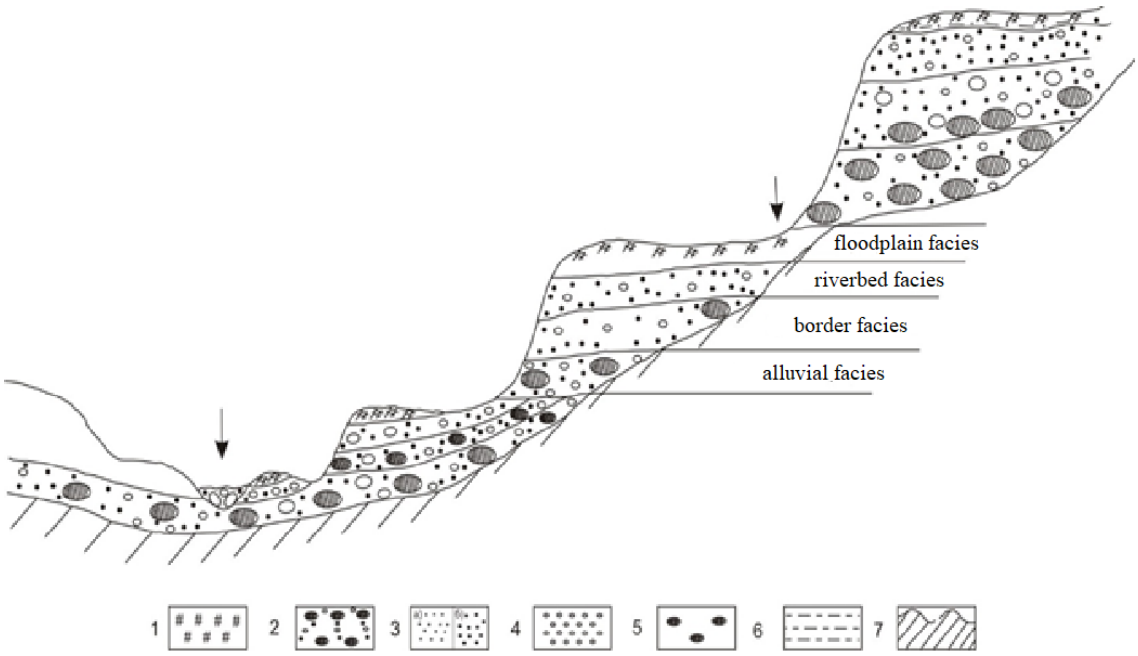

Fig. 2. Generalized lithofacies section of alluvial deposits of the foothill part of the rivers of the Lesser Caucasus (compiled by T.G. Takhmazova based on the materials of F. Abdullaev et al., 2008): 1-soil-vegetation layer, 2-loams, 3-a) sand b) gravel, 4-pebbles, 5-boulders, 6-sandy loam, 7-estimated depth of gold grain penetration

In connection with the characteristics of the gold ore objects of the Tutkhun ore field, it is necessary to briefly dwell on the "gold-bearing conglomerates" identified by previous researchers. They were first mentioned by Z.M. Agakishiev (1973), who discovered chalcedony-like pebbles containing gold from traces to 1.8 g / t in a layer of conglomerates among the Cenomanian deposits of the southern slope of Mount Maly Galaboynu. However, the question of their nature, area of development, and source of gold remained open. Later, V.G. Ramazanov (1976) identified a discontinuous pack of gold-bearing conglomerates above the thickness of the lower Cenomanian conglomerates on the northeastern flank of the ore field, in the area of Mount Beyuk-Boz. According to the author's data, gold-bearing conglomerates are developed here over an area of about 1 km2 and contain from 8 to 10% quartz pebbles with an average gold content of 0.4 g / t. The estimated reserves were estimated at 9.0 tons. The positive assessment of the conglomerates, from the point of view of their gold content, and the analysis of the materials of early studies and field observations allow us to state the following. At the end of the Lower Cenomanian, as a result of the uplift of the region, intensive erosion began, accompanied by the accumulation of a layer of conglomerates and gravelstones in the eastern and northeastern parts of the ore field. An increase in the thickness of the conglomerates is observed from the southwest to the northeast with a difference in their occurrence heights of almost 300 m. The southwestern spurs of the Bolshoi and Maly Galaboynu mountains obviously represented a coastal strip with a very unstable oscillatory regime during this period, accompanied by a continuous advance and retreat of the sea on a small section of it. These processes are also associated with the formation of a thin (up to 20 m) and short (up to 350 m) wedging layer of basal conglomerates above the lower Cenomanian deposits in small depressions of the relief. A thorough examination of the composition of the pebbles showed that chalcedony-like quartz is extremely rare and usually does not exceed 2-5

cm in size, and in the total volume they can hardly exceed tenths of a percent. In composition, dense milky-white limestones prevail among them, followed by tuffs, andesites, and basalts.

Goshgarchay alluvial industrial type of placer differs from Kurakchay by its size in cross-section and confinement to terrace layers, linearly creating an elementary type of placer. The identified alluvial industrial type of placer corresponds to the same subtype of valleys of low, medium and high orders with karst, layered morphology, and also having the appearance of a thickness.

In the Kurakchay River basin, the Quaternary deposits are quite widespread in thickness and varieties compared to other basins on the northeastern slope of the Lesser Caucasus. Modern continental Quaternary deposits, having a fairly wide areal distribution, are represented by deluvial, proluvial, proluvial-alluvial and alluvial facies. Free placer gold with a grain size of >2 is 453 mg, i.e. 43.8%, medium (2-1) 136 mg, i.e. 13.2%; fine (1-0.5) 263 mg, i.e. 25.5%; very fine (0.5-0.25) 130 mg, i.e. 12.5%; and fine (0.25-0.1) 51 mg, i.e. 5%.

The accumulation of gold-bearing deposits in the river valley section occurred in parallel with the processes of karst formation during its slow and long-term development and transportation of gold from the areas of distribution of Jurassic deposits. The influx of ferrous matter and its transformation into nodules of brown iron ore in this area are apparently associated with post-sedimentary mineral neoplasms in the upper parts of the river basin. The presence of nodules of brown iron ore in alluvial deposits of the described nature indicates the possible discovery of karstified relief forms, which, in turn, are favorable for the accumulation of placers of gold and other heavy metals, and the established features of the structure of karst placers allow for more effective exploration and evaluation of them.

Within the Ganjachay River basin, alluvial formations occupy the river bed itself, the floodplain and the first terraces above the floodplain. Higher terrace levels are filled with alluvial-proluvial deposits, which are also observed in the area of the mountain Gey-Gol and correspond to the area of the alluvial fan formed by the Ganjachay River itself. Geomorphological features of the structure and sampling data carried out within the Ganjachay River basin allow us to distinguish two main morphogenetic types of gold-bearing alluvial placers, namely, alluvial valley and alluvial-proluvial terrace. At the same time, in the valley system of the Ganjachay River basin, the valley placer is associated with the zone of deposit development in the riverbed, the modern floodplain.

From the point of view of gold content, the alluvial facies of the Goshgarchay River basin, occupying the 1.5-5 meter New Caspian level of development in the interval of the Gyzyldzha-Bayan ss. Here, placer gold is concentrated in accumulative terraces. As established by prospecting work for placer gold (F.F. Abdullaev et al.), the gold content in alluvial sand and gravel deposits in the passed pits fluctuates within a wide range - from 20 to 600 mg / m3. At the same time, the number of gold signs and their sizes increase from top to bottom (i.e. to the raft), covering the upper "layers" of alluvial deposits of obviously potentially gold-bearing detrital formations. This conclusion has a more general meaning and applies not only to channel or floodplain alluviums, but also to terrace alluviums, which is confirmed by the study of the gold content of the Gyzylgaya terrace, which showed an average content of free gold of up to 180 mg/m3. A gold nugget measuring 8 x 4 x 2 mm and weighing 989 mg was also found here. In the loose mass containing the nugget, 7 gold marks with a total weight of about 200 mg / m3 were also determined. According to the materials of the driven pits up to 5 m deep, in addition to very interesting quantitative data on the "total" and free gold content of floodplain and channel alluvial deposits, the appearance of gold marks against the background of small

(0.05-0.25 mm) grains, often large (1-2 mm), established mainly in the lower intervals of the driven pits, is of great interest.

In the Goshgarchay River valley, individual signs weighing up to 30-50 mm each were found in separate modern alluvial deposits in the form of braids and traps. Placer gold in the alluvium of the Goshgarchay River with a content of 0.5-900 mg/m3 and a size of 0.001-1.0 cm is concentrated in terraces and in the river bed.

Within the Shamkirchay River basin, Quaternary deposits are developed in depressions, plains, valleys and alluvial fans of lateral tributaries. The morphology of the Shamkirchay River valley and its individual sections is determined by structural and lithological-petrographic features. Placer gold is found starting from its confluence with the Gedabaychay River, which indicates its erosion and deposition from the copper-pyrite deposit of the same name. The second section of the valley where placer gold is concentrated is the middle course of the river in the north-eastern direction. And the third part of such a cluster is the lower course. Gold is confined to both channel alluvial deposits and the upper reaches of terraces to large boulders with sandy-gravel-loamy deposits, and its main accumulation is found in the mid-mountain part of the river before the intersection with the Lesser Caucasus fault. Free placer gold of medium size (2-1) is 57.3%, fine (1-0.5) 22.7%, very fine (0.5-0.25) 12.0%, and fine (0.25-0.1) 8%.

With an area of 250 km2 and a length of 50 km, the Jagirchay River occupies part of the territory of the Shamkir uplift, encompassing the Gedabey ore region. In the upper part of the basin, accumulative floodplain terraces up to 3-5 m high are developed, and in the middle parts there are low-power terraces, which are composed of alluvial, alluvial-proluvial deposits, consisting of boulders and pebbles with gravel-sand filler.

The geological structure of the Akstafachay River basin includes Cretaceous (Coniac, Santonian), Paleogene-Neogene and Quaternary deposits. The latter are dominant and their productivity is associated with alluvial, alluvial-proluvial facies, which are represented by pebbles, gravels, loams, sandstones, sandy loam and occupy the modern riverbed and the lowest terraces and fill the surfaces of the Kura Depression.

Along the Soyutluchay section, the floodplain, channel alluvium and the adjacent deposits of the first floodplain terrace cover a width of about 30-60 m. They are developed in the form of fragments alternately on both banks of the river with a width of 40-50 m. Along the left slope of the Soyutluchay River between the villages of Seidlyar and Damirchidam M.D. Gavrilov, at an altitude of 25-30 m above the river bed, outcrops of ancient alluvium were found among the deluvial deposits.

Eluvial, deluvial, alluvial and mixed genetic types have been discovered in the Zarchay River basin. In the upper reaches of the river at the elevation of 2396.0 m, at a depth of 3 m from the surface, a “humus darkening” has been noted in the deluvial deposits, which is associated with the interglacial period and confirms the existence of a double glaciation in this area. Their thickness is from 1-2 to 3-4 m. Based on the obtained placer data, the gold content fluctuates from 7.6 to 90 mg/m3, reaching 144.8 and 181.1 mg/m3 in two samples. It was established that alluvial-deluvial deposits contain up to 100 mg/m3 of gold in the depth interval from 0.2 to 3.0-4.5 m.

Deluvial and solifluction deposits also occur in the process of gold placer formation. The lithogenetic meaning of deluvium lies in the paragenetic series of all these deposits. Since the deluvial process is part of denudation, the identified genetic type or facies complex has structural features and

bedding conditions, and corresponds to a certain stage of the general development of lithogenesis. Thus, the distribution of these placer complexes in each specific ore region is determined primarily by the scale of the primary mineralization, and then by the relationship of the river network with ore-controlling structures or the position of placer-forming ore formations in the relief. Deluvial deposits and associated placers characterize the features of the spatial development and scale of that part of the primary mineralization that is subject to slope denudation, exaggerating the areal dimensions of the ore fields. Thus, deluvial metal content is much more pronounced in area than primary. The development of the deluvial process ends with fluvial processing of the facies complex in the upper reaches of the rivers. This determines the features of their spatial position, structure, etc. The weak processing of this material is also characteristic.

The proluvial-alluvial industrial type of placer is widespread in the foothill plains with different thicknesses, it includes placers of the Akstafachay and Tovuzchay rivers (Fig. 3). The Akstafachay placer is characterized by alternation in the section of unsorted and well-differentiated sediments with high clay content of deposits and relatively low gold contents. In contrast to locally preserved eluvial placers, proluvial and deluvial placers in the Lesser Caucasus have significant development. Significant gold content of the proluvial-deluvial type of deposits is noted in the area of the Agduzdag deposit, on the slopes of watershed ridges. Proluvial-deluvial placers are also characteristic of cinnabar.

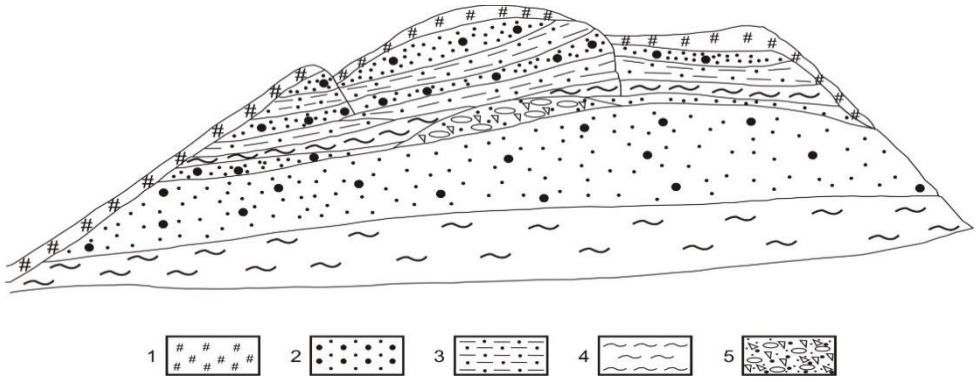

Fig. 3. Schematic section of proluvial-deluvial deposits of the Tovuchay River basin (compiled by T. Takhmazova based on materials by F.Abdullaev, A.Omarov, A.Hasanov et al., 2008): 1-soil-vegetation layer, 2-sandy-gravel, 3-sandy loam, 4-clay, 5-lenticular accumulations of pebbles

In order to most substantiate the assessment of the degree of gold-bearing capacity of eluvial-proluvial-deluvial placers directly on the areas of known ore fields, under certain conditions, along with the slurrying of loose material containing many fragments of rocks and minerals of the mineralized zone, it seems advisable to carry out small-scale sampling of a potentially promising layer of detrital formations with subsequent crushing of the entire material in order to determine the total gold-bearing capacity. Along with chemical analysis, a certain amount of crushed material should be subjected to washing and mineralogical analysis for gold and associated minerals.

Documentation of placers during all works is much less qualitative. Numerous workings on placers are short-lived, the distribution of components is not visually observable, schematic information about it is received only after processing samples and is not used promptly. Percussion-rope drilling

gives only an approximate idea of this composition. The available data on placers require genetic interpretation.

In the section of the Tutkhun ore field, exploration work for gold should pay serious attention to the volcanogenic-siliceous layer of the lower Cenomanian. It is exposed below the productive horizon. In the Gazykhanly area, for its assessment, it is necessary to study the magmatism, the phase of the intrusion, and establish its identity with the Tutkhun. The Novo-Kazykhanly zone, exposed only at the river's edge, also requires study by mining workings.

In order to obtain the most reasonable estimate of the degree of gold content in eluvial-proluvial-deluvial placers in the area of the Agduzdag deposit, on the slopes of watershed ridges directly on the areas of known ore fields, under certain conditions, along with slurrying of loose material containing many fragments of rocks and minerals of the mineralized zone, it seems advisable to carry out small-scale sampling of a potentially promising layer of clastic formations with subsequent crushing of the entire material in order to determine the total gold content. Along with chemical analysis, a certain amount of crushed material should be subject to washing and mineralogical analysis for gold and associated minerals.

The Tutkhun-Zarkuli area is the least eroded and the magnitude of post-ore erosion does not exceed 100 m. Consequently, productive mineralization can be expected at depths of at least 500-600 m from the modern surface. In combination with other factors - the presence of large tectonic faults, hydrothermal processing of rocks along them, gold finds in concentrates and its detection in bedrock - allows us to recommend drilling operations at the Tutkhun-Zarkuly ore occurrence.

Conclusion

The study of the genesis of gold placer systems and their redistribution allowed us to identify key patterns in the formation and evolution of placer gold in this geodynamic setting. It was established that the sources of placer gold are both primary gold deposits and destroyed ancient placers that were subjected to repeated redistribution under changing hydrodynamic conditions. Lithogenetic factors controlling the morphology, granulometric composition and degree of roundness of placer gold were identified, which allows us to clarify the mechanisms of its transportation and sedimentation. The results obtained are important for predicting promising gold placers in the region, as well as for optimizing geological exploration.

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