Features of gold placer formation in the Ukrainian Crystalline Shield and Southern Ukraine

I. LOMAKIN, E. SARVIROV, V. KOCHELAB
MariGeoEcoCenter of the NAS of Ukraine
55-b Oles' Honchar str, Kyiv
UKRAINE

Abstract: The presence of numerous native gold deposits of the Ukrainian Crystalline Shield (UCS), as well as the spread of placer gold manifestations, determines the high probability of the formation here of gold placers with industrial parameters. The main factors and geological conditions that contribute to the formation of gold placers are manifested at the UCS. An important reason for the failures of previous geological works is the outdated scientific and methodological platform, which involved the search for typical gold-bearing deposits with metal of gravity size classes. They did not take into account the possibility of significant movement of placer gold in the geologically clay water flow and the formation of long-distance placers. The traditional Schlich method used in the study did not make it possible to determine the actual gold content when particles with a size smaller than 0.25 mm predominate in the sample, which is precisely the particle size of the primary sources of the UCS. The applied means of research could not be effective in the absence of the necessary analytical base for determining the gold content, modern methods of studying the geological structure and tectonics of the territories. The negative results did not provide any real grounds for further specialized large-scale research and prospecting for placer gold. Today, it is getting obvious that placer gold of small and fine classes can easily move over considerable distances in the water flow and form accumulations not only in boulder-pebble material, but also in pelitic sediments. Due to repeated block movements, erosion and redepositing of gold-bearing accumulations in secondary reservoirs could occur. In this aspect, neotectonic studies (using materials from space surveys) become the main predictive and prospecting method for identifying promising areas of placer gold concentration in the region. When carrying out fieldwork, drilling and modern methods of laboratory analysis of gold samples should be used. The results of many years of research give hope for the discovery of real placer gold deposits in the Northern Black Sea region in the near future.

Key Words: Ukrainian Crystalline Shield, gold ore deposits, gold placers, small and fine gold, prospecting concept.

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1 Introduction

The issue of insufficiently substantiated and, in our view, underestimated gold-bearing prospects in the Ukrainian Crystalline Shield (UCS) and its adjacent regions remains pertinent within the current context of the geological exploration of Ukraine's subsoil for gold resources.

In terms of their formation, natural gold deposits in this area fall into two primary categories: ore and placer. Geological exploration activities at various stages have confirmed the presence of ore gold within the UCS. Extensive mining, drilling, and related operations have been conducted at numerous indigenous gold deposits in the UCS. However, a critical shortcoming of previous research lies in the incomplete investigation of regulated stages in the study of ore assets. Gold exploration across all regions was essentially halted in the late 1990s, a period when global gold prices reached their lowest. Consequently, no gold deposits within the UCS were explored to the extent necessary to enable their industrial development.

The situation regarding the study of placer gold-bearing deposits within the UCS and its surroundings is even less favorable. Targeted geological prospecting for placer gold in the UCS was infrequent, conducted on a limited scale, and often employed less than ideal methods. It's worth noting that direct indications of placer gold within loose sedimentary rocks of the Meso-Cenozoic era are widespread in the region, but no accumulations of placer gold with industrial potential have been identified. Geological work related to the study of gold placers in Ukraine was discontinued due to the absence of positive results. In our view, this was a result of employing an incorrect prospecting model for gold accumulations within the UCS and its surrounding. A crucial oversight was the failure to consider that primary sources of gold in the UCS consist predominantly of free gold particles

belonging to small and fine classes, even smaller. The work mainly utilized a simplistic testing method focused on isolating relatively large gold particles, leading to significant underestimations of the actual gold content, with particles smaller than 0.25 mm being lost.

The urgency of further geological study of gold ore and placer deposits, aimed at rapid industrial development, is underscored by the current situation on the global gold market, which has evolved over the past 23 years. Gold prices have risen approximately 5.5-6 times since 2000, attracting substantial investments into the gold mining sector worldwide and fostering advancements in exploration and exploitation technologies for gold-bearing resources. Consequently, in countries with gold reserves, previously deemed unpromising, some sites are being actually developed. At this stage, their exploitation yields considerable economic benefits. Turkey, Finland, and Sweden serve as vivid examples of developed countries successfully reviving their gold mining industry [24]. In a short span of time, they not only revived long-dormant mines but also significantly intensified geological exploration. Legislative improvements have contributed to successful activities in this field, resulting in the development of new deposits and a substantial increase in gold production.

The primary objective of this article is to examine the theoretical foundations underlying the formation of gold placers and to identify the presence and characteristics of the conditions and factors influencing them within the Ukrainian Crystalline Shield (UCS), its slopes, and adjoining regions. To achieve this, a critical analysis of existing information concerning placer gold in southern Ukraine is necessary. This analysis should encompass data related to its distribution, quality, and the extent of its study, with an assessment of the reliability of geological data on the gold content of placer deposits.

Revisiting the previously utilized concept of gold placer formation within the UCS and its periphery is imperative, considering the unique properties of gold and the geological processes that shape the accumulation of gold deposits.

2 Materials and Methodology

Over the past five decades, a broad spectrum of researchers has addressed the challenges associated with placer gold in the UCS. Notably, significant contributions have been made by academic and industrial institutions in Ukraine. Regrettably, there is still scarcity of comprehensive analytical works summarizing the data on UCS placer gold. While there are publications that provide overviews and summaries of information [4, 17], they often overlook crucial aspects of the formation and evolution of Ukrainian placers. Additionally, there is a study that delves into the digital modeling of heavy mineral placer formation processes, offering insights into theoretical aspects of placer formation [15].

A wealth of valuable geological information concerning gold placers can be found in the reports and archival materials of state geological exploration enterprises, specifically within the geological databases of UkrGeoInform. Numerous descriptions of placer gold from various sites located within the UCS and its slopes can be found in specialized scientific publications and geological records. Abnormally high concentrations of placer gold have been observed in samples from alluvial, diluvial, eluvial, and other types of loose sedimentary formations in this region. Placer gold has also been identified in man-made tailings from the concentration of titanium-zirconium placer deposits. Furthermore, during the examination of bottom sediments in the basins of the Dnipro and Southern Bug rivers, the water area of the Sea of Azov, along the Odesa coast, and the northwest shelf of the Black Sea, samples containing placer gold were collected. All these observations collectively indicate that the process of gold placer formation has been widely manifested within the UCS and its vicinity, particularly in the southern regions.

To explore the fundamental potential for placer formation in any given region, it is essential to evaluate the presence of mandatory general conditions, understand their characteristics and extent as they relate to that particular area: 1) existence of native primary sources of gold; 2) presence of favorable exogenous factors that contribute to the denudation and erosion of these native sources, ultimately leading to the creation of near-surface gold placers; 3) natural conditions and processes that determine the breakdown and transport of primary placers, their subsequent erosion, and the migration and accumulation of placer gold in redeposited locations.

The manifestations of these processes and factors are prevalent throughout the UCS and its adjacent regions. In the following sections, we will delve into some of their distinctive features.

Availability of Primary Gold Sources. The State Fund of Mineral Deposits in Ukraine has documented several dozen gold deposits, with a combined estimated potential of over 2.4 thousand tons of gold metal [1, 24, 25]. Prominent examples include Klyntsivske, Yuriivske, Balka Zolota, Sergiivske,

Balka Shyroka, Mayske, Savranske, among others. Furthermore, there are likely undiscovered and unexplored gold ore occurrences that could serve as native gold sources. All of them have the potential to be the origins of placer gold when exposed on the Earth's surface. Therefore, the UCS is distinguished by the presence of substantial sources capable of generating gold placers (see Fig. 1).

Exogenous Processes Contributing to Placer Formation. It is evident that the primary source must be situated within the denudation and erosion zone to give rise to gold-bearing placers. The gold ore objects within the UCS, formed in the Archaean-early Proterozoic era at significant depths (4-7 km), have been brought to the Earth's surface due to extended geological history marked by vertical block‘s tectonic movements. The geological sections from drilling provide clear evidence that nearly all the known gold deposits within the UCS had reached the Earth's surface during the Meso-Cenozoic era. This suggests that certain ore bodies and gold ore zones underwent erosion under surface conditions, with gold particles eventually reaching sedimentation zones. Presently, the original ore-bearing rocks of the foundation are typically covered by various facies of loose Paleogene, Neogene, and Quaternary deposits. These sedimentary layers can vary in thickness, ranging from tens to hundreds of meters, concealing the ore bodies below.

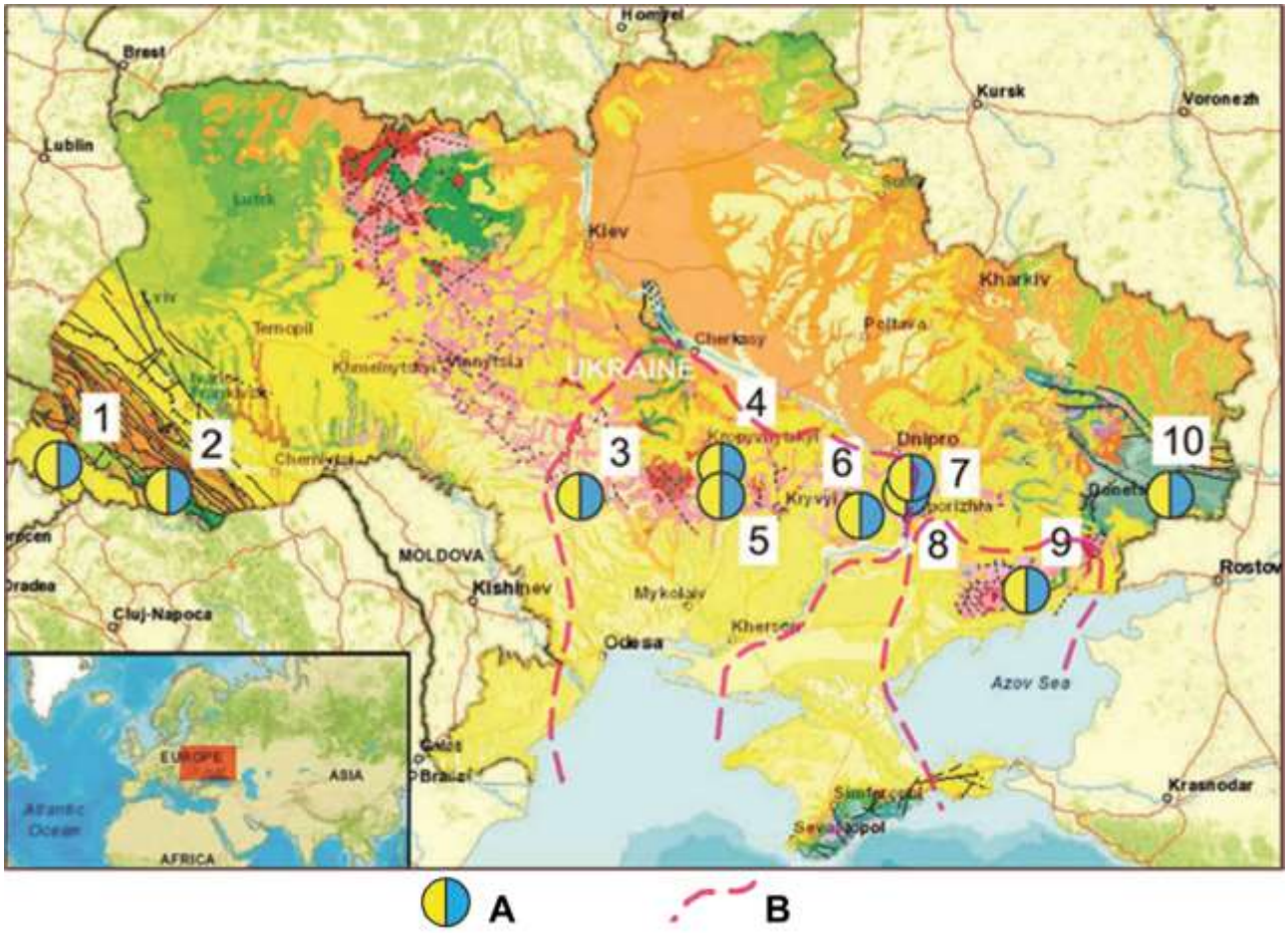

Fig. 1: Schematic representation of the locations of gold ore deposits in Ukraine (A) and the areas where placer gold is distributed (B) within the Ukrainian Crystalline Shield (UCS) and its southern region. Source: https://geoinf.kiev.ua (with added annotations). 1 - Mugiivske, 2 - Saulyak, 3 - Mayske, 4 - Klyntsi, 5 - Yuriivka, 6 - Balka Shyroka, 7 - Balka Zolota, 8 - Serhiivka, 9 - Surozh, 10 – Bobrykivske deposit

The geological phenomenon of placer formation, which encompasses denudation and erosion of gold-bearing primary rocks, as well as the transport and accumulation of gold particles, is evidently influenced predominantly by fluvial processes. These processes are closely linked to the flow of water, both permanent and intermittent. As a result, the development of continental sedimentary layers containing heavy mineral placers occurs primarily within river basins, valleys, and low-lying landforms

on the Earth's surface. The density and configuration of the river network, along with changes in topography, are strongly influenced by discontinuous tectonics, especially the spatial distribution of tectonically weakened zones. These zones exhibit more intense denudation and erosion processes. The specific character of the landscape formed is contingent on the vigor of fluvial processes. The degree of water flow activity determines the predominance of erosion or accumulation activities, as well as certain types and configurations of landforms. The dynamic behavior of surface water movement is contingent on the scale of the erosion base, which is linked to vertical tectonic shifts. While the formation of fluvial terrain takes into account the significant influence of climatic factors, such as the quantity of atmospheric water reaching the Earth's surface and the lithological composition of the eroded rocks, it's crucial to recognize the pivotal role of "active" tectonic block movements. These movements regulate the flow of surface water, define the direction of watercourses, and drive geological processes related to rock erosion, the transport of materials, and the accumulation of loose sediments.

Following the formation of gold ore deposits and completion of the consolidation stage of the Eastern European Platform (EEP), the Ukrainian Crystalline Shield (UCS) emerged as a prominent crystalline foundation protruding above the surrounding landscape. Notably, Wend deposits are scarce within the UCS. Nevertheless, remnants of these ancient formations persist in the form of well-preserved structured algae remains in the Precambrian basement rocks, found at depths ranging from 70 to 2100 meters. These remains are typically located in stratified zones and areas with increased permeability in the fractured metapores of the Archaean and Proterozoic regions [7].

During the Paleozoic era, the UCS alternated between periods of continuous and intermittent landmass existence, taking on the form of a tectonic plateau-like uplift within the southwestern part of the EEP. Under the influence of a warm, arid climate, a kaolin weathering crust developed on the surface of the ancient crystalline rocks of the UCS. The rise of the UCS was accompanied by denudation, which served as a source of erosion for terrigenous material. This process contributed to the formation of extensive Paleozoic sedimentary strata in nearby regional structures, particularly within the Dnieper-Donetsk depression (DDD) and the Scythian Plate.

The Carboniferous period witnessed significant relief dissection and the extensive erosion of eroded material. This is evident from the prominent prevalence of terrigenous alluvial-delta formations in the Carboniferous deposits of the DDD. It is reasonable to assume that during this time, a substantial river system flowed through the southeastern regions of the shield in the southeast direction [7].

During the Mesozoic era, due to the prolonged and differential block-like uplift of the Ukrainian Crystalline Shield (UCS), the Precambrian gold-bearing rocks and gold ore deposits gradually entered the zone of hypergenesis, erosion, and denudation. As a consequence of this geological transformation, the processes leading to the formation of gold placers commenced. The earliest documented occurrences of placer gold are found in alluvial deposits dating back to the Early Cretaceous period (Aptian-Albian) [6, 13]. This timeframe is considered the most probable onset of the gold placer formation stage. We have no knowledge of placer gold deposits in older alluvial deposits. It can be affirmed that the formation of gold placers within the UCS has been an ongoing process for over 125 million years.

The deposition of gold into these sedimentary formations primarily occurred as a result of weathering processes acting on gold-bearing rocks. Simultaneously, there was likely a redistribution of gold due to transformations in the oxidation zone, ultimately leading to the accumulation of free metallic gold. For instance, during exploration activities, a relatively small eluvial placer was discovered in the weathering crust on the southern flank of the Klintsiv gold ore deposit.

Gold infiltrated the loose sedimentary layer in various forms, including individual, discrete, free clastogenic particles, as well as aggregates and concretions of gold bound with minerals like quartz, sulfides, clay minerals, and others. The tiniest gold particles had the capacity to move within clay solutions in the form of suspensions. There's also a possibility that gold was transported out of the hypergenesis zone in dissolved form. As a consequence of the erosion and denudation of primary crystalline rocks, short-wear placers were formed.

Substantial placer formation also took place in the primary deposits during the Paleocene-Eocene period. Remnants of these near-surface placers are currently recognized in the deposits of the Eocene Buchach series [2, 14]. For instance, noteworthy examples include placers in the Central Dnipro region, located within the submerged paleovalley of the Sura River, situated in close proximity to the Sergiivske and Balka Zolota gold deposits. (Based on materials from KP "SouthUkrGeology," V.V. Sukach, N.M. Gaeva, etc., 1999). The alluvial deposits of the Buchach series in this area rest directly on the kaolin crust formed through weathering of the crystalline basement rocks. These deposits are subsequently overlain by marine lagoonal and shallow-water facies of the Kyiv series.

However, it's worth noting that the testing and sample enrichment method employed did not allow for an accurate assessment of the content of TFG (total fine gold), which predominantly constituted the placer. This assertion is substantiated by the geological report's findings. It has been established that gold derived from the primary sources of the UCS, including gold ore bodies and gold-bearing crystalline rocks, predominantly consists of free gold particles. These particles are characterized by their small size (ranging from 0.25 to 0.1 mm), thinness (less than 0.1 mm), and a dust-like appearance, referred to as STDG (small, thin, dust-like gold).

Geological exploration conducted by the Crimean branch of UkrDGRI (Yu.O. Novikov, 2009) in the Azov region has revealed the presence of alluvial placer gold, specifically in the Pliocene-Lower Quaternary deposits that constitute the terrasouval. This placer, known as Balka Nimetska, is situated within the Sorokin gold ore zone, which encompasses the partially explored Surozh gold ore deposit.

As previously mentioned, there have been relatively few targeted geological prospecting efforts for placer gold within the Ukrainian Crystalline Shield (UCS) territory. However, the aforementioned examples serve as a compelling evidence that the processes conducive to the formation of primary gold-bearing placers have indeed been distinctly identified within the UCS and its adjacent slopes.

Conditions Influencing the Potential Transport and Accumulation of Placer Gold. The presence of native placer gold has been documented in contemporary sedimentary formations within numerous small and large rivers that traverse the Ukrainian Crystalline Shield (UCS). Gold deposits have been identified in the alluvial deposits of various rivers, including Irsha, Teteriv, Ros, Sinyukh, Sob, Zhovta, Saksagan, Ingulets, Dnipro, and others [11]. It is worth noting that we exclude consideration of gold placers found in the modern alluvial deposits of the Dniester River [10, 22], as we believe their primary sources are not directly linked to the gold ore deposits of the UCS.

In the coastal regions of the Black and Azov Seas, which are considerably distant from the recognized original sources within the Ukrainian Crystalline Shield (UCS), there have been numerous instances of obtaining samples containing STDG and dispersed placer gold in the bottom sediments [8, 9, 18, 21, 23, 26-30]. These findings provide further confirmation that a significant portion of gold can be transported over substantial distances in suspension within clay-laden water flows and subsequently deposited. These observations strongly suggest that the erosion of gold-bearing rocks originating from primary placers and intermediate reservoirs, as well as the transportation and subsequent redeposition of placer gold, continue to occur in the present day. It is crucial to highlight that the primary repository for solid sediment runoff from Cenozoic river systems is water reservoir of the Black and Azov Seas.

Throughout the complex and varied geological history of the region, the geometry and distribution of watercourses within the Ukrainian Crystalline Shield (UCS) underwent multiple alterations [3]. These changes contributed to the intricate geological structure of the loose sedimentary layers and the redistribution of gold placers. The positioning of ancient valleys was notably influenced by fault zones along which the block movements occurred. During the Mesozoic era, stability of the structural layout of the region and the fact that valleys had already incised into the solid bedrock foundation meant that the positions of these valleys remained relatively constant.

Nevertheless, the development stages of these ancient valleys could vary. Alterations in the erosion base level, stemming from vertical tectonic movements and eustatic fluctuations in sea levels, could result in different scenarios. The river valleys might experience standard river processes of erosion and sediment deposition, or portions of a valley could temporarily transform into lakes or bays due to marine ingression. After the sea level regressed, a river would resume its course in the same location. Consequently, as these processes alternated over time, previously formed alluvial gold-bearing deposits could undergo erosion, removal, and reaccumulation in more favorable areas.

In the Pliocene epoch, a neotectonic activation stage triggered significant alterations in the structural and tectonic layout of the Ukrainian Crystalline Shield (UCS). This led to the creation of weakened zones with new orientations and the emergence of a

reconfigured river valley network. As a result, many watercourses abandoned their ancient valleys. An illustrative example highlighting the pivotal role of tectonic factors in shaping the river network and, consequently, sedimentation patterns is the frequent relocation of the Dnipro River valley. Consequently, numerous ancient river valleys within the UCS are presently situated along modern watershed areas and are concealed beneath younger sedimentary deposits, rendering their identification and geological mapping a challenging endeavor. Nevertheless, certain regions of the UCS have retained their original river network configuration. These areas are closely associated with highly elevated basement blocks that lack pre-Quaternary loose sediments, such as the Ovrutsky graben, the Novoukrainka district, and the Pryazovsky massif [3].

The intricate geological history of the sedimentary cover within the Ukrainian Crystalline Shield (UCS) during the Meso-Cenozoic era brought about successive shifts in the dominant exogenous processes. Preexisting deposits within river valleys, including gold placers, underwent erosion and redeposition due to these multifaceted and often shifting erosion and accumulation processes. These phenomena could transpire repeatedly. The initial near-surface gold placers within the Lower Cretaceous and Buchach alluvial deposits were preserved as vestiges primarily because they were shielded from deterioration by overlying sedimentary layers. The transformations in the river network's configuration and the frequent alteration of exogenous processes significantly complicated the geological structure of the sedimentary layer.

3 Discussion of Results

In light of the aforementioned aspects of the Ukrainian Crystalline Shield's (UCS) and its neighboring regions' development, which played a pivotal role in shaping the geological structure of the sedimentary layer, it is evident that substantial primary sources of gold and the manifestation of wear placers have been firmly established. The intricate geological composition of the sedimentary layer and the covering of primary placers by more recent sedimentary deposits pose inherent challenges in the pursuit of identifying and studying promising placer areas. Deciphering the specific migration pathways and pinpointing the accumulation zones of small, fine, and dispersed placer gold is a significant and complex undertaking.

It is worth noting that the information regarding the geological structure, specifically the gold content within the sedimentary strata of the Ukrainian Crystalline Shield (UCS) and its adjacent regions, is derived from existing geological studies conducted in previous years. It is crucial to recognize that earlier assessments of the complex sedimentary stratum, as part of deep geological mapping efforts, were focused primarily on identifying relatively large gold deposits. Methodologically, the emphasis was on searching for "classic" placer deposits characterized by a coarse-grained productive layer, often with visible gold in the basal portion of the alluvial section. The study of the gold content in relatively fine-grained alluvium facies was conducted somewhat superficially or was even totally disregarded. The testing and sample processing methods employed at that time did not permit an accurate estimation of the quantity of small, thin, dust-like gold (STDG) within the samples, despite the high qualifications of experts conducting the work.

Consequently, this led to unavoidable inaccuracies in establishing the genuine extent of gold content within the region. As a result, the presently available information regarding actual gold yields is approximate and somewhat biased. It does not provide a precise representation of the genuine situation and, as such, has preliminary informational value. This perspective has been expounded upon in our prior discussions [18-20].

The mobility of particles primarily consisting of STDG (small, thin, dust-like gold) and smaller particles, transported by clay-laden water streams, is exceptionally high. Consequently, during the formation of primary placers in close proximity to their original sources within river valleys, only a portion of gold that entered the sedimentation area and comprised relatively large particles (exceeding 0.25 mm) had settled. Smaller particles were deposited both in association with gravity gold and transported over extensive distances by clay flows, giving rise to distinctive "plumes" and long-transport placers downstream. The deposition of STDG was especially inclined towards clayey and fine-grained alluvium facies and extended throughout the vertical alluvial section of the placer, rather than just in the immediate vicinity. The most favorable conditions for the deposition of STDG from the water flow were hydrodynamic barriers characterized by a sudden drop in flow velocity. Such barriers could occur, for instance, when tide enters a broad, marshy valley of a primary river, when water flow converges into a lake or sea lagoon, or when it encounters underwater obstacles. Various other factors also contribute to the deposition of STDG, including the nature of riverbed (whether it is covered with vegetation or characterized by ridges), the presence of geochemical barriers, which can be indicated by the presence of

carbonaceous materials, marcasite concretions, glauconite layers, and so forth.

Due to recurrent alterations in the river network's configuration, frequent incursions and recessions of the sea along river valleys, fluctuations in the erosion base level, and shifts in the position of regional watersheds, a portion of the primary placers underwent erosion, resulting in the removal and redeposition of gold-bearing material into secondary reservoirs. These processes of erosion and redeposition could occur repeatedly. At present, we can observe either remnants of primary placers in paleovalleys, which are exposed through drilling, or the most accessible placer formations consisting of gold that has been redeposited from pre-existing placers.

Hence, all the necessary conditions for the formation of gold placers within the Ukrainian Crystalline Shield (UCS) are present. The region features gold ore sources, established placer deposits with gold content close to industrial levels, but genuine placer deposits have not yet been conclusively identified. We primarily attribute this situation to the conceptually flawed methodology of exploration efforts and the imperfect techniques employed for testing and analytical work. With such methods, there was limited assessment of STDG accumulations, resulting in inevitable errors in evaluating the potential of placer gold and even the possible oversight of significant objects.

To objectively address the status of placer gold within the Ukrainian Crystalline Shield (UCS) and its adjacent regions, it is imperative to conduct geological prospecting work while considering the following aspects:

There are two primary types of gold placers with potential industrial significance – these are primary placers of short transport and placers of long transport.

The first type of placers is situated in close proximity to gold ore deposits and manifestations, generally within a range of no more than 20-30 km from the primary power sources. Near transport placers should theoretically exhibit relatively high gold content. Simultaneously, gold-bearing deposits that contain STDG are not limited solely to the lower sections but are also irregularly distributed throughout the alluvial section, often favoring the fine-grained clay facies of the alluvium. To locate these deposits, it is essential to analyze the positioning, morphology, and geological profiles of river paleovalleys.

The second type of placers, known as distant transport placers, involve the accumulation of gold particles resulting from the erosion of older gold-bearing placers. These placers exhibit uneven distribution of gold both in terms of plan and section and generally have relatively lower gold content in samples, even though their overall resource potential can be considerable. Gold is primarily associated with sediments in areas of gentle water currents. These placers have a broad potential distribution range, spanning tens to hundreds of kilometers from the primary sources. The positioning of such placers can be influenced by both the presence of paleovalleys and the current river network valleys.

To locate these distant transport placers, it is essential to employ neotectonic analysis methods to identify zones and regions where gold accumulation is likely. Geological information stored in geological archives can be a valuable resource in identifying indications of possible accumulation of small, fine, and dispersed gold classes.

Certainly, it is essential to bear in mind and, most importantly, emphasize that the primary zones of Quaternary sediment accumulation, particularly those containing gold, tend to be concentrated in the immediate vicinity of modern water bodies of the Black and Azov seas. In numerous locations in these areas, preliminary studies have already uncovered direct indicators of gold-bearing placers with relatively high gold content in individual samples.

It is worth mentioning that the preferred approach should involve the utilization of contemporary chemical-analytical methods for ascertaining gold content in samples, complemented by the conventional mineralogical analysis of gravity concentrates.

The primary challenges in the geological examination of gold placers in this region encompass technical aspects, such as the requirement for modern equipment, and scientific-technological considerations, involving the application of new approaches and contemporary testing methods, as well as utilization of the Earth’s remote sensing data. Naturally, no less important is the problem of restoring the lost professional staff of geological specialists.

4 Conclusions

1 The presence of evident indications and prerequisites for placer gold in the Ukrainian Crystalline Shield (UCS) and its neighboring regions strongly suggests the likelihood of discovering industrial placer deposits in this area.

2 The generally unfavorable evaluation of the potential for industrial gold placers based on past research results does not accurately reflect the prospects for gold placers in the region. This discrepancy is primarily a result of using incorrect

methodology and techniques for studying placers, especially when dealing with a significant predominance of small, fine, and dispersed gold (SFDG). Consequently, the resulting assessment provided a distorted image of placer gold distribution, significantly underestimating its potential.

3 It is imperative to reevaluate previous research findings and conduct forward-looking prospecting work aimed at comprehensive study of gold content of the sedimentary strata, with a particular focus on small, fine, and dispersed gold. This effort should be concentrated in two main directions. First, to predict areas and investigate primary placers closely linked with river paleovalleys that once drained regions containing ore deposits and ore fields. Second, to identify migration routes and areas where gold accumulates in secondary deposits, with an emphasis on thorough neotectonic analysis.

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