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THE ORE-BEARING POTENTIAL OF THE ZHOVTOVODSKA AREA IS AN ATTRACTIVE OBJECT FOR FOREIGN INVESTMENT

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Amber, lithium, titanium and gold have always been promising for investment by both local and foreign investors. The materials describe an investment-attractive geological object that was put up for auction. The history of exploration and geological structure are considered, and a description of the mineral is provided.
***Key words*:** Investments, Yellow Waters, quartzite, gold.

РУДОНОСНИЙ ПОТЕНЦІАЛ ЖОВТОВОДСЬКОЇ ДІЛЯНКИ - ПРИВАБЛИВИЙ ОБ'ЄКТ ДЛЯ ІНОЗЕМНИХ ІНВЕСТИЦІЙ

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Бурштин, літій, титан та золото завжди були перспективними для капіталовкладень, як місцевих так і зарубіжних інвесторів. В матеріалах розглянуто інвестиційно привабливий геологічний об'єкт який було виставлено на торги. Розглянуто історію вивчення та геологічну будову, подано опис корисної копалини.
***Ключові слова*:** Інвестиції, Жовті води, кварцити, золото.

Introduction

Ukraine is rich in natural resources, its subsoil contains world-class wealth, and even the war has not stopped investors from being interested in objects for future development. Unfortunately, the long-standing subsoil use rules need to be changed and improved in line with the current state of economic development and cooperation with foreign partners.

The rules governing the use of subsoil in Ukraine have long been in need of modernization and changes that would facilitate the development of the industry and its investment attractiveness. The subsoil use reform has been in the works for quite a long time and, in fact, was adopted under martial law. Nevertheless, we have achieved dramatic changes, which are due to the joint efforts of industry experts, government officials, business representatives and leading non-governmental organizations. After all, when Ukraine gained independence, our economy had not yet been formed as a

market economy and, accordingly, the extractive industry was oriented to the Soviet model of economy. As a result of this influence, the subsoil use rules that were the basis of the legislation until recently, unfortunately, became a prototype of the Soviet model. They did not meet the challenges and needs of business and the time in which the global market was developing, let alone international standards [1]

General characteristics of the object.

The Zhovtovodske gold deposit is located in Pyatikhatsky district of Dnipropetrovska oblast, 8 km north of Zhovti Vody, along the southeastern outskirts of Zhovtove village in a submeridional direction.

The Zhovtovodske area consists of three sections: Northern, Central and Zhovtianska. Geomorphologically, the territory is located within the Prydniprovska Upland and is characterized by moderate relief fragmentation. The most significant element of the relief is the valley of the Yellow River, on the left slope of which Zhovtovodska area is located. . There is a system of gullies mainly of the north-eastern direction. The maximum absolute elevations of the relief are +160, +170 m, and the minimum elevations are +120, +130 m.

The geological structure of the Zhovtovodske area consists of Precambrian crystalline formations overlain by Cenozoic sediments. Among the rock associations of the crystalline basement of the Kryvyi Rih-Kremenchuk zone, which were uncovered by wells within the Zhovtovodske area (from east to west), three main complexes are distinguished: - plagiogranitoids of the Dnipropetrovs'k complex (AR2dp); - metamorphic and metamorphosed rocks of the Kryvyi Rih series (PR1kz); - granitoids of the Kirovohrad complex (PR1kg). The plagiogranitoids of the Dnipropetrovs'k complex limit the Kryvyi Rih-Kremenchuk deep fault zone to the east and are composed mainly of plagioclase granites and migmatites with biotite, and in leucocratic varieties with muscovite.

The metamorphic and metamorphosed rocks of the Kryvyi Rih series (PR1kz) include the Saksahansk and Gdantsivska Suites. The Saksahansk Formation (PR1sx) is represented by ferruginous (mostly magnetite) quartzites with shale interbedded, sometimes amphibolites. The quartzites are represented by amphibole-magnetite varieties; less often by amphibole-hematite-magnetite and magnetite varieties. Shale layers are represented by garnet-amphibole varieties with a small amount of biotite. The degree of regional metamorphism of these rocks corresponds to the epidote-amphibolite facies. Chloritization is the most common superimposed process; in some intervals, chlorite replaces garnet and amphibole by 70-90%. The Gdansk Suite (PR1qd) is represented by graphite-bearing schists - biotite, sericite-biotite and garnet-sericite-biotite - which are interconnected by gradual transitions and often change each other in section and along strike. Their distinctive feature is the presence of free carbon

(graphite, graphite) and disseminated syngenetic sulfides. The contacts between the Saksagansk and Gdansk rocks are exclusively tectonic. Metasomatic processes are intensively manifested in the contact zone with a thickness of 20-50 m.

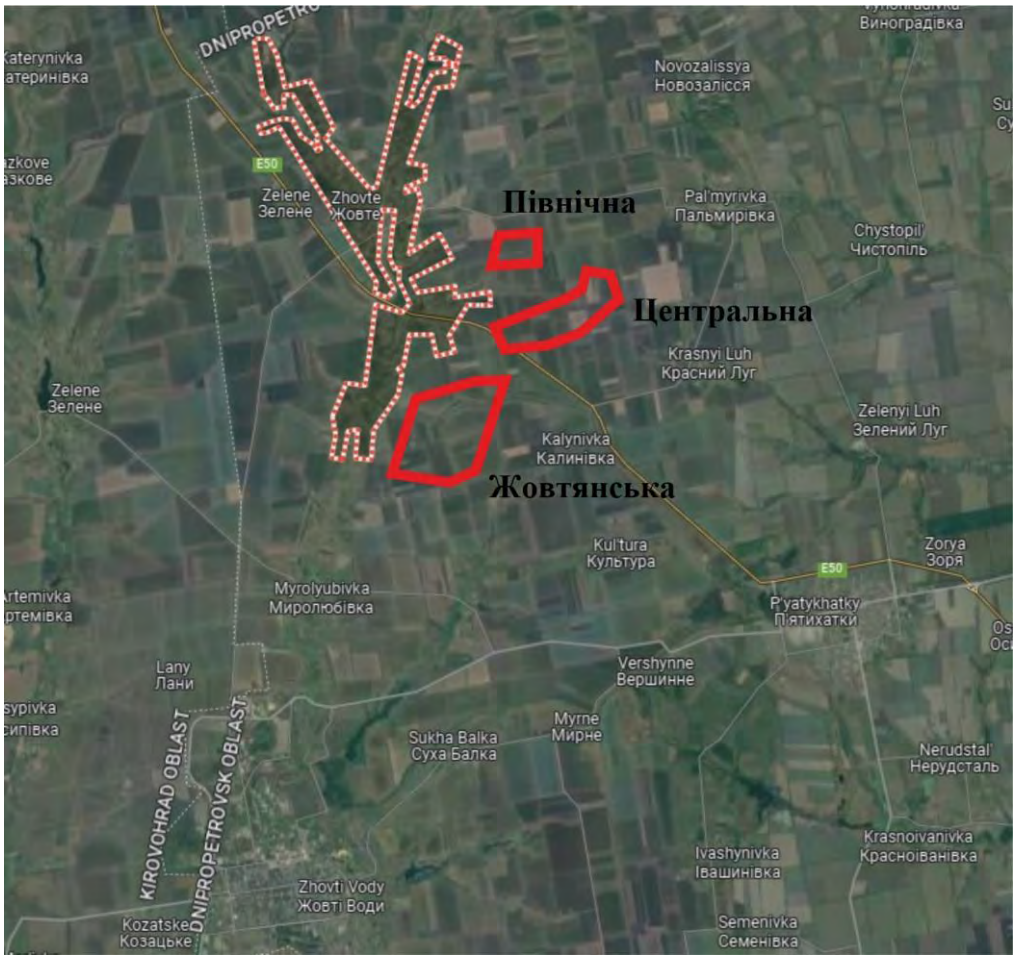

Fig. 1. Map of parts of the Zhovtovodske area on the Google Earth map

It should be noted that virtually all gold mineralization found within the Zhovtovodskoye area is spatially confined to this tectonic contact zone. Thus, the rocks of the Gdantsivska and Saksaganska Suite in the zone of their tectonic contact and the development of superimposed hydrothermal and metasomatic transformations can be considered as a single ore-bearing complex. [2]

Cenozoic formations are represented by Neogene and Quaternary sediments. The surface relief of the crystalline basement played an important role in their distribution. The Neogene sediments, together with the Quaternary sediments, form a continuous cover that overlies the rocks that lie below the section. The lower part of the section is represented by sands of coastal and shallow water facies - very fine-grained and fine-grained, rarely medium- and coarse-grained. The sands are light gray, greenish gray and yellowish gray in color, often with pale pink and crimson-red spots and stains. The thickness of the sands is 10-15 meters.

Above, there are layers of greenish and yellowish-gray sandy clays with crystals and drusy gypsum intergrowths, with manganese films along the cracks. The clays are 1.8-12 meters thick. The sandy clays are overlain by a thickness of red-brown clays, very dense, viscous, plastic. The red-brown clay layer is widespread throughout the site and is absent only in places of its modern erosion; clay thickness is 3-8 m.

Quaternary sediments are represented by yellow-brown loess-like loams. They are lighter in color and do not contain flint-carbonate beds. Their thickness is 1-5 m.

In tectonic terms, the Zhovtovodske area is a fragment of the central part of the Kryvyi Rih-Kremenchuk fault zone, which is the eastern boundary of the West Ingulets interblock (suture) zone that separates the Kirovohrad and Prydniprovia megablocks of the Ukrainian Shield. The Kryvyi Rih-Kremenchuk fault has several convergent subparallel faults, which in turn are accompanied by numerous smaller (local) faults. The latter are located subparallel to the main faults or are combined with them at an acute angle, usually cut folded structures and have a short length. Such local discontinuities are fixed by bodies of aplite-pegmatoid composition, zones of cataclastic rocks, often together with low-temperature metasomatism (quartzing, chloritization), without significant displacement of the blocks relative to each other. They greatly complicate the geological structure of the area, making it scaly. Other discontinuous faults include diagonal and latitudinal and sublatitudinal faults. The diagonal faults are oriented at an acute angle to the main strike of the structure, have a predominantly northwestern strike and are accompanied by quenching and sulphidization zones. Latitudinal and sublatitudinal faults are classified as shear and thrust faults by the nature of rock block movement. Latitudinal and sublatitudinal faults are the most recent in time, they displace not only the submeridional and diagonal tectonic fault zones, but are also recorded in the granite frame of the Kryvor zone.

In 1988, the Kryvyi Rih Geological Research Institute started exploration and appraisal works at the Popilnistivske iron quartzite deposit, which included its southern extension, the Zhovtovodske extension, within which the Zhovtovodske area is located. The main goal was geological and industrial assessment of ferruginous quartzite and the presence of other minerals.

According to the spectro-gold analysis, the gold content in metasomatically altered rocks ranged from 0.1 to 1.0 g/t. In order to determine the spatial parameters of gold mineralization and estimate its parameters within the Central-Zholtovodskoye area within an area of 100x800 m, 9 holes with a total volume of 2078.5 m were drilled in 1989-1994, 641 spectroscopic analyses were performed, based on the results of which 240 samples were selected for sampling analysis, which were analyzed at the Central Research Institute of Geology (Tula, Russia) and the Novomoskovsk Geological Research Institute laboratory. The work carried out has identified gold

mineralization with gold grades ranging from 0.1 to 4.4 g/t at an exposed thickness of 3.1 to 12.5 m.

The main mineral resource of the Zhovtovodske area is ferruginous quartzite, which has been discovered by wells within the Kryvyi Rih-Kremenchuk deep fault zone, as well as to the west of it, where a number of deposits known as Right Bank Magnetic Anomalies are located. Within the area, ferruginous quartzites are traced along the entire strike of the structure. The average mineral composition of unoxidized ferruginous quartzites is as follows: quartz - 39-51.6%, magnetite 20-45.1%, hematite - up to 9%, carbonates - 1.5-16.1%, silicates - 5.2-24.2%. According to chemical analysis, the content of total iron is 24.3-35.6%, and the content of iron associated with magnetite is 10.2-28.16%. According to preliminary studies, the reserves of unoxidized ferruginous quartzite in the C2 category amount to 54.1 million tons (Feag. - 30.7, FeMg. - 20.5%); inferred resources - 67.0 million tons.

Zircon mineralization is present among ferruginous quartzites in the areas of alkaline metasomatism. The main zircon-bearing mineral is malacon. The largest occurrences of zircon are found in the northern part of the Gannivske ferruginous quartzite deposit, where its content reaches 0.2%. Drilling operations carried out in 1998-2005 confirmed the presence of gold mineralization and outlined the dip and strike of the ore bodies. The latter are complexly constructed formations in the form of elongated lenses, seam-like bodies of unstable thickness, and interlayers; they are oriented sub-concordant with the general direction of the Kryvyi Rih-Kremenchuk deep fault.[3]

Geological prospecting and a set of mineralogical and geochemical studies of gold mineralization at the Zhovtovodske area resulted in the discovery of two types of gold mineralization - gold-sulfide-quartz type, the maximum distribution of which is recorded within the southern part of the site. Gold mineralization of this type is characterized by the development of quartz-sulfide and carbonate-quartz-sulfide mineral aggregations, which cement the brecciation zones and manifestations of near-ore metasomatic quartzing and sulfidization of host rocks (mainly ferruginous and silicate quartzites). The argillite-secondary quartzite type is most common within the central part of the site. It is characterized by a significant distribution of light and dark brown clay formations with quartzite fragments, often with scattered inclusions of fine-grained pyrite. The clay aggregates consist mainly of kaolinite with variable amounts of quartz, disseminated pyrite (up to 3-10%) or (in case of hypergene oxidation of the latter) iron hydroxides. Gold is free and easy to concentrate. Most of the gold grains are 0.1 mm in size; the sample is about 700.

Typical geochemical associations are represented by abnormally high contents of titanium, niobium, and yttrium. Based on the results of prospecting works (Butyrin

V.K. 2001-2006), the Company estimated inferred and indicated resources for each of the three parts of the Zhovtovodskoye area and for the area as a whole. Prospective and inferred gold resources were estimated to a depth of 0-300 meters and to a depth of 0-500 meters.

In addition, the results of the work carried out have shown that, in addition to gold mineralization, niobium mineralization may be of practical interest within the Zhovtovodskoye area. Increased grades of up to 20 g/t and moderate anomalies (up to 30-50 g/t) of niobium were found in certain intervals of geological sections uncovered by drilling within all prospective parts of the site. However, the maximum concentrations of niobium (at this level of exploration) were found within the central part. Inferred resources (P3) of associated niobium within the blocks of gold mineralization were calculated. Zhovtovodske area, located in Pyatikhatsky district of Dnipropetrovska oblast, is proposed for geological exploration, including pilot development of the main minerals - gold ores and associated minerals - niobium ores.

In 2020, the State Service of Geology and Subsoil of Ukraine held an electronic auction for the sale of 13 special permits with deposits of gold, groundwater, amber and manganese ores. The gold mining lot - Zhovtovodske area - was purchased for a period of 5 years by Spys Ukraine LLC, which paid UAH 5.73 million for the lot at a starting price of UAH 4.4 million. However, the won special permit has not yet been obtained amid an ongoing court dispute over claims filed by landowners within the subsoil use area. In addition, amid emotional protests from local residents, the company is actively developing the Zhovtovodske gold deposit. Therefore, the issues of settling procedural and legal issues of subsoil use are more relevant than ever. [4]

Conclusions.

Thus, a significant range of minerals within the Zhovtovodske area allows for its integrated development, namely, the extraction of ferruginous quartzite with the concomitant extraction of gold, zirconium and niobium. The complex nature of ore deposits makes the Zhovtovodske area an attractive target for foreign investment.

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