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THE REGIONALIZATION OF TERRITORIAL COMBINATIONS OF MINERAL DEPOSITS AND MINING TERRITORIES OF UKRAINE

М. Я. Сивий, Н. О. Лісова, Б. Б. Гавришок. ПРО РЕГІОНАЛІЗАЦІЮ ТЕРИТОРІАЛЬНИХ ПОЄДНАНЬ РОДОВИЩ КОРИСНИХ КОПАЛИН ТА ГІРНИЧОПРОМИСЛОВИХ ТЕРИТОРІЙ УКРАЇНИ. В статті зроблено спробу взаємоув'язки геологічної, економіко-географічної та промислової регіоналізації поєднань розвіданих родовищ корисних копалин України та сформованих на їх основі територіально-виробничих комплексів з мінерально-сировинною орієнтацією. Запропоновано власний варіант економіко-географічної регіоналізації територіальних поєднань родовищ корисних копалин, яка ґрунтується на даних Геоінформ про сучасний стан мінерально-сировинної бази країни. Для районування території України за мінерально-сировинними ресурсами взято за основу економіко-географічні форми зосередження родовищ корисних копалин, які виділялись з допомогою методів картографії і генералізації, а також форми гірничопромислової регіоналізації. Стосовно останніх, через розбіжності в означеннях окремих термінів серед наукового загалу, запропоновано власну класифікацію гірничопромислових територій за масштабами виробництва та площами, на яких воно зосереджене. Розкрито закономірності територіальної локалізації угруповань родовищ корисних копалин та сформованих на їх основі мінерально-сировинних комплексів України. В територіальній структурі мінерально-сировинних ресурсів України виділено чотири економіко-географічні зони: Придніпровсько-Приазовську, Східно-Українську, Донецько-Слов'янську та Прикарпатську, яким відповідають однойменні гірничопромислові зони. У межах економіко-географічних зон виокремлено й охарактеризовано дрібніші таксони: макрорайони, райони, макрокущі та кущі; відповідно, у межах гірничопромислових зон виділяються гірничопромислові райони, вузли і центри. Охарактеризовано мінеральну специфіку зазначених угруповань та їх складових частин, зазначено їх економіко-географічні особливості, сучасний стан освоєності ресурсів мінерально-сировинної бази, що дозволяє визначати перспективи подальшого розвитку сформованих територіально-виробничих комплексів мінерально-сировинної спрямованості, оптимізувати їх структуру та пропонувати об'єкти для першочергового інвестування.

Ключові слова: мінерально-сировинні ресурси, економіко-географічна регіоналізація, гірничопромислова регіоналізація, гірничопромислові центри, вузли, райони.

М. Я. Сивий, Н. О. Лісова, Б. Б. Гавришок. О РЕГИОНАЛИЗАЦИИ ТЕРРИТОРИАЛЬНЫХ ГРУППИРОВОК МЕСТОРОЖДЕНИЙ ПОЛЕЗНЫХ ИСКОПАЕМЫХ И ГОРНОПРОМЫШЛЕННЫХ ТЕРРИТОРИЙ УКРАИНЫ. В статье сделана попытка взаимосвязки геологической, экономико-географической и промышленной регионализации объединенных разведанных месторождений полезных ископаемых Украины и сформированных на их базе территориально-производственных комплексов с минерально-сырьевой ориентированностью. Для районирования территории Украины за минерально-сырьевыми ресурсами взяты за основание экономико-географические формы сосредоточения месторождений полезных ископаемых, выделяемые с помощью методов картографии и генерализации, а также формы горнопромышленной регионализации. Из-за расхождений в определениях отдельных терминов, предложена собственная классификация горнопромышленных территорий за масштабами производства и площадями его развития. Определены закономерности территориальной локализации группировок месторождений полезных ископаемых и сформированных на их базе минерально-сырьевых комплексов Украины. В территориальной структуре минерально-сырьевых ресурсов Украины выделены четыре экономико-географические зоны: Приднепровско-Приазовская, Восточно-Украинская, Донецко-Славянская и Прикарпатская, которым соответствуют одноименные горнопромышленные зоны. В пределах экономико-географических зон выделены и охарактеризованы более мелкие таксоны: макрорайоны, районы, макрокусты, кусты; соответственно, в пределах горнопромышленных территорий выделяются горнопромышленные районы, узлы, центры. Охарактеризована минеральная специфика означенных группировок и их составных частей, определены их экономико-географические особенности, современное состояние освоенности ресурсов минерально-сырьевой базы, что позволяет определять перспективы дальнейшего развития сформированных территориально-производственных комплексов минерально-сырьевой направленности, оптимизировать их структуру и предлагать объекты для первоочередного инвестирования.

Ключевые слова: минерально-сырьевые ресурсы, экономико-географическая регионализация, горнопромышленная регионализация, горнопромышленные центры, узлы, районы.

Problem formulation. Our studies conducted over the past two decades have made an attempt to combine geological and geographical approaches to define and characterise an extensive and still not

properly developed problem as *geography of Ukraine's mineral resources* [21, 22, 23, 24, 25]. The research has investigated the constructive and geographical basis for the mineral resource study,

the historical peculiarities of the exploration and development of Ukrainian mineral and resource potential, the conditions of the mineral resources formation. In addition, it provides the description of the main groups of mineral raw materials, sets the problem of their efficient use and environmental protection in mining regions. In this context, it is necessary to summarize the information about the principles of mineral deposit distribution, about the formation of industrial raw material complexes based on their combination in order to optimize the structure of such associations and to resolve the issues of the efficient use of mineral raw resources.

The aim of the study is to zone the country's area on the basis of combining explored mineral deposits with industrial complexes of mineral resource orientation, to characterize the peculiarities of the mineral specialization of the defined economic and geographic structures where mineral raw material are situated; to determine their potential and industrial prospects.

Analysis of the latest research and publications. Researches concerning the geography of mineral resources are conducted mainly in several inter-related and interdependent directions: natural geography, economic geography, and geoecology. The natural geography direction is represented mainly by works where paleogeomorphological and paleolandscape criteria for search and exploration of mineral deposits [3, 16] and landscape research of mining areas are considered [6, 17, 18, 20, 27, 28]. The economic direction is represented by the following works [2, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 23, 24, 25, 26, 29, 30, 31]. The geoecological (environmentally oriented) direction has developed mainly due to the needs to study the processes accompanying the exploration, extraction and primary processing of minerals [1, 6, 17, 18, 19, 20, 27, 28]. We have been developing the constructively geographical approach to the study of mineral resources focused on a comprehensive analysis and synthesis of the state and development of the mineral and raw material potential of the regions. Zoning of the territory of Ukraine basing on mineral resources was carried out by I. Horlenko [4] and other researchers [13, 15], however, since then, there have been significant changes in the area and component structure of the country's mineral resources, dozens of new deposits have been explored, priorities in the use of mineral resources have changed, etc. Consequently, we suggest zoning the territory of Ukraine on the basis of the combination of mineral deposits according to the latest data of Ukraine State Geological Information Fund (Geoinform) concerning the state of its mineral resources base [9] which will enable us to optimize the structure of the mining industry, will ensure the effective use of mineral raw materials and

will determine the prospects and directions of Ukrainian mineral resource complex development.

Presenting main material. Economic, geographical and mining regionalization of the complex mineral deposits is laid on the basis of mineral resource zoning of Ukraine territory (Fig. 1). The figure shows their corelation with geological regionalization.

Economic and geographical forms of the mineral deposit concentration are distinguished by means of cartography and generalization methods in order to create scientific foundation for efficient location and territorial organization of the industrial production. They are characterized in following works [4, 15, 21, 24]. Such forms may coincide with geostructural elements of different scales, but this is not a prerequisite for their selection.

In order to determine the role of deposit location in industry development, industrial complexes of mineral resource orientation which include centers, hubs, agglomerations, regions, zones (mining regionalization) are defined. Though there is a certain consensus among the scientific community on the geological, economic and geographical regionalization of complex mineral deposits, industrial or mining regionalization causes continuous disagreements in the interpretation of certain terms [25]. For example, the terms "mining territory", "ore mining territory", "mining region", "ore mining region" and others are found. Their interpretation is ambiguous in both geographic and geological literature.

In our opinion, the term "*mining territory*" means territories of different size where mining, enrichment and processing of minerals of any status - international, state or local - is done. These may be areas where only large-scale mining is carried out without enriching or processing them, though these processes almost always accompany each other. For instance, brick factories produce bricks from the materials extracted from the deposits nearby; in quarries with limestone, sandstone or granite extraction, crushed stones are produced; sand quarries are used to enrich sands; in the quarries of the facing stone, the process of cutting blocks and grinding them is done. At the same time, the term "*ore mining territories*" is a synonym, it can either be abandoned or used in parallel.

On the one hand, "mining regions" may mean various territories in the Ukrainian geological and geographic literature. Y. Ivanov [6] considers "a mining region" as a part of a mining basin (for example, in Lviv-Volyn basin there are Chervonograd and Volyn mining regions) and mining areas of the local level (Rozdil sulfur deposit, Stebnyk salt deposit).

On the other hand, the "mining region" has a completely different content, for example, there are

well-known names of the mining regions such as Krivyi Rih Mining Region, Donetsk Mining Region, Nikopol Mining Region, Africa's largest mining regions (Zimbabwe, Botswana and South Africa), large mining regions: Silesia, Kuzbass; mining areas of Donbas and others. Thus, mining regions mean areas different in size, in density of industrial (mining) distribution and in mineral resources. There-

fore, mining regions may mean both areas small in size and with small amount of mining enterprises (Boryslav, Stebnyk mining regions) and the whole industrial agglomerations such as Krivyi Rih Basin, Kursk Magnetic Anomaly, etc. In addition, geologists use the term "ore mining area", meaning, in fact, "mining region" or "mining area" (for example: Irshansk titanium-apatite ore mining area).

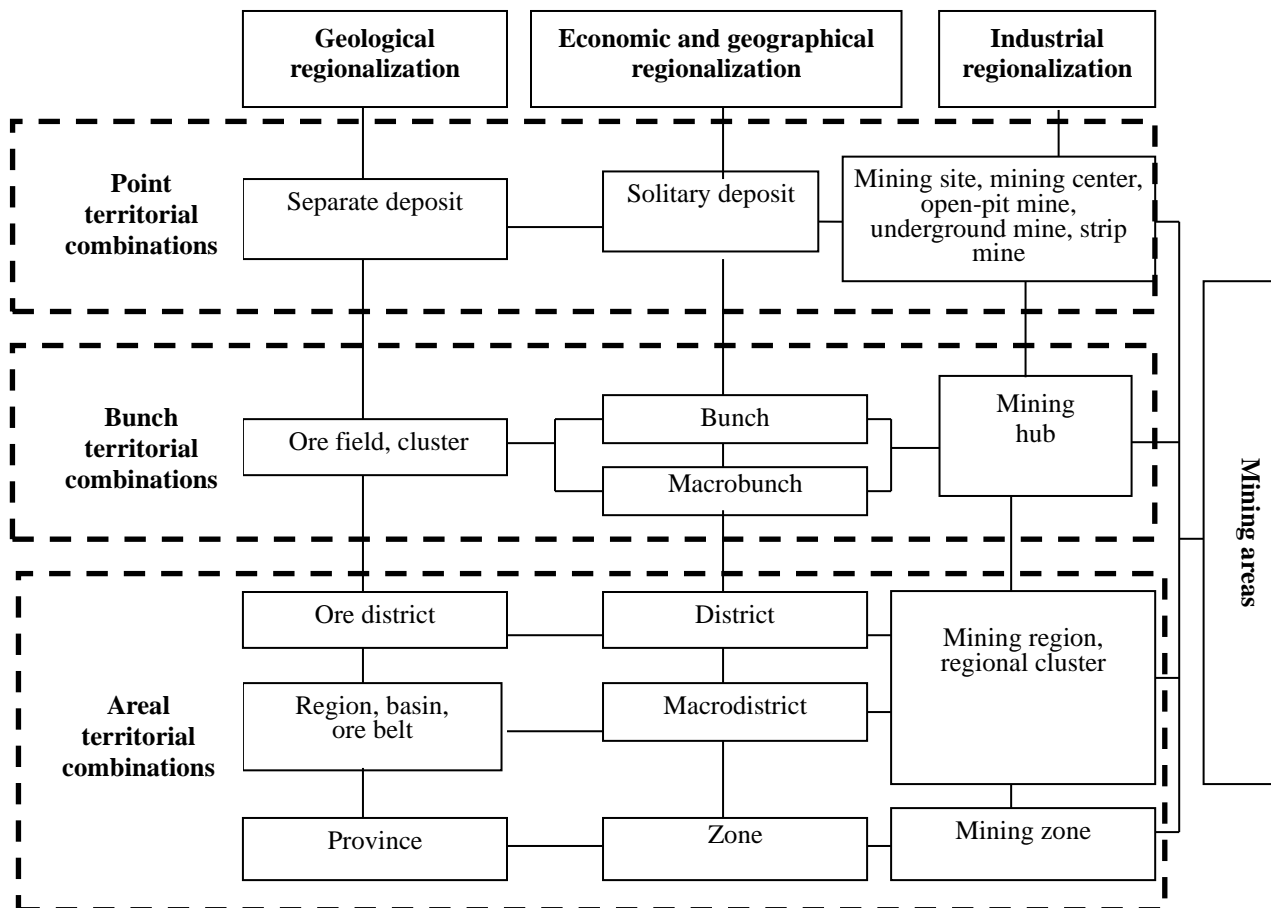


Fig. 1. Territorial combinations of mineral resources

As a result, we suggest distinguishing all mining areas by the scale of mining production and the size of area on which it is situated, and, accordingly, they should be defined as mining sites, mining centers, mining hubs, mining regions, and mining zones (Fig.1). Mining agglomerations should be considered as specific mining areas.

A typical *mining site* can be considered a separate mining enterprise (open-pit mine, underground mine, strip mine) which exploits the mineral deposit, the slope mine. *Mining centers* are usually places with several quarries or mines developing a single deposit and compactly situated in a small area.

Mining hubs are formed on the basis of the contiguous mineral deposits that make up a bunch or macro bunch. An example of such formations can be Hlukhivtsi-Turbiv mining hub the basis of which is kaolin deposits and the facing granite deposits of Koziatyn-Illintsi macro bunch which are exploited

and enriched by Hlukhivtsi mining and processing plant, Turbiv kaolin factory, Zhezheliv quarry. The term 'mining hubs' (and not regions, despite the traditionally established name), in our opinion, should be used to define the concentration of several mining companies (mines) that develop individual slope mines within one coal deposit (coal deposits, unlike ore deposits, occupy comparatively significant areas). The examples of these are Chervonograd mining hub, within which the coal deposits of Mezhyrichia and, partly, of Zabuzhia are exploited, and Novovolynsk mining hub mines of which develop Volyn deposit. Consequently, a mining area of about 180 square kilometres (Chervonograd mining hub) where the mines develop virtually only one deposit, cannot be called a 'mining region' as the region occupies more than 3000 square kilometres, according to the generally accepted economic and geographical regionalization [25]. It would be quite

logical to correlate the mining regionalization with the economic and geographical one (Fig.1) what is suggested by our research.

Mining regions are regarded to be formed on the basis of mining of mineral deposits combined into regions and macroregions (or basins, areas, according to geological regionalization). The examples of these can be Kryvyi Rih mining region formed on the basis of iron-ore deposits of Kryvyi Rih macroregion (Kryvyi Rih basin) and Sloviansk-Artemivsk mining region where deposits of rock salt, coal, refractory materials, etc. are developed.

The *mining zones* are considered to be vast mining areas which coincide with zones, the largest taxon of economic-geographical regionalization. They can cover several industrially developed mineral basins (coal, brown coal, salt, sulfur, etc.) or mining regions. In Ukraine, the mining zones are Donetsk-Sloviansk, Pre-Carpathian (Prykarpaty), Eastern Ukrainian, and Pre-Dnieper-Pre-Azov (Prydniprovsk-Pryazovsk).

Mining agglomerations are part of the mining regions or coincide with them and represent the territorial concentration of industrial mining centers and bunches in a relatively small area [7, 10, 14]. According to M. Enright [26], regional cluster is close to the agglomeration and means a spatial cluster of interrelated enterprises that are similar in their specialization (“geographical agglomeration of firms engaged in one or several related industries”). Basically, the examples of such mining agglomerations can be Horlivka-Yenakiieve, Lysychansk-Rubizhne, Torez-Snizhne [10] and others in Donetsk and Sloviansk-Artemivsk mining regions. Kryvyi Rih agglomeration is formed in Kryvyi Rih mining region.

Therefore, the structure of mineral resources of Ukraine has been defined to include four economic and geographical zones: Donetsk-Sloviansk, Pre-Carpathian (Prykarpaty), Eastern Ukrainian, and Pre-Dnieper-Pre-Azov (Prydniprovsk-Pryazovsk) (Fig. 2, 3). The location of zones, a brief description of their mineral specialization and formed on their basis mineral complexes is provided below.

Pre-Dnieper-Pre-Azov polycomponent zone.

The zone stretches along the right bank of the Dnieper River, near Zaporizhia city, continues on the left bank and reaches the Azov coast. It is located within Ukrainian Shield, this fact determined the peculiarities of the mineral deposits explored here. According to the predominance and significance of the leading mineral resources, the zone can be considered the ore one. It is located on the territory of four oblasts: Cherkasy, Kirovograd, Dnipropetrovsk and Zaporizhia and is characterized by a combination of numerous mineral raw materials the leading of which are iron and manganese ores. Their deposits

are of state importance occupying the first places by the level of industrial development. In the component structure of the zone, the following deposits are of great importance: brown coal, rare and non-ferrous metals, graphite, kaolin, non-metallic raw materials for metallurgy, and building materials.

We have singled out Kryvyi Rih, Nikopol-Tokmak, Zvenyhorodka-Dnieper macroregions and Pre-Azov region in the area of Pre-Dnieper-Pre-Azov zone (Fig. 2, 3).

Kryvyi Rih macroregion (over 450 square kilometres) covers Kryvyi Rih iron ore basin and Kremenichuh iron-ore region (according to geological regionalization) and is the main region of iron ore stock and mining in Ukraine. The macroregion is multicomponent with the significant predominance of iron deposits. Ore mining and processing is done at 5 mining and processing plants: Central, Inhulets, Southern, Novokryvorizh, Northern and two mine groups. In terms of mine concentration, quarries and mining and processing plants, no other mining area of the world can compete with this region. Kryvyi Rih mining agglomeration was formed on the basis of the mining enterprises of Kryvyi Rih basin (Fig. 3). The industrial complex of Kryvyi Rih basin can extract more than 190 million tons of raw ore per year and produce about 70 million tons of marketable mineral products.

In the area of the macroregion there are also deposits of uranium (Zhovtorichensk deposit), nickel (Devladove deposit) and aluminum (Vysokopillia deposit), non-metallic raw materials: indurated talc (Valiavkynske, Inhulets deposits), mineral pigments (saturnine red, sienna, colcothar), decorative stone (jaspilites, crocodylite, dolomite marbles), refractory clay (Saksahan deposit), dolomite for metallurgy (Frunze deposit), graphite, building and glass sand, granite, etc. The development of non-metallic raw materials is regarded as insufficient.

Kremenichuh monocomponent bunch is located within Poltava oblast and is the northern extension of Kryvyi Rih iron ore basin. In the bunch area, six iron ore deposits are compactly located (from south to north): Horishni Plavni, Lavrykiv, Yerystovo, Bilanovo, Nova Haleshchyna and Manuilivka. There are Poltava mining and processing plant and Kremenichuh mining hub which operate on the basis of the first two deposits (Fig. 4).

Nikopol-Tokmak monocomponent macroregion covers Nikopol manganese ore basin located in Dnipropetrovsk and Zaporizhzhia oblasts in the area of more than 5 thousand square kilometres. The ore area is divided into separate reserves combined into deposits: Zelenodolsk, Nikopol, Ordzhonikidze, Marhanets, Velykyi Tokmak. Only Nikopol deposit is being developed. The eastern part of the deposit is developed by Marganets mining-and-processing

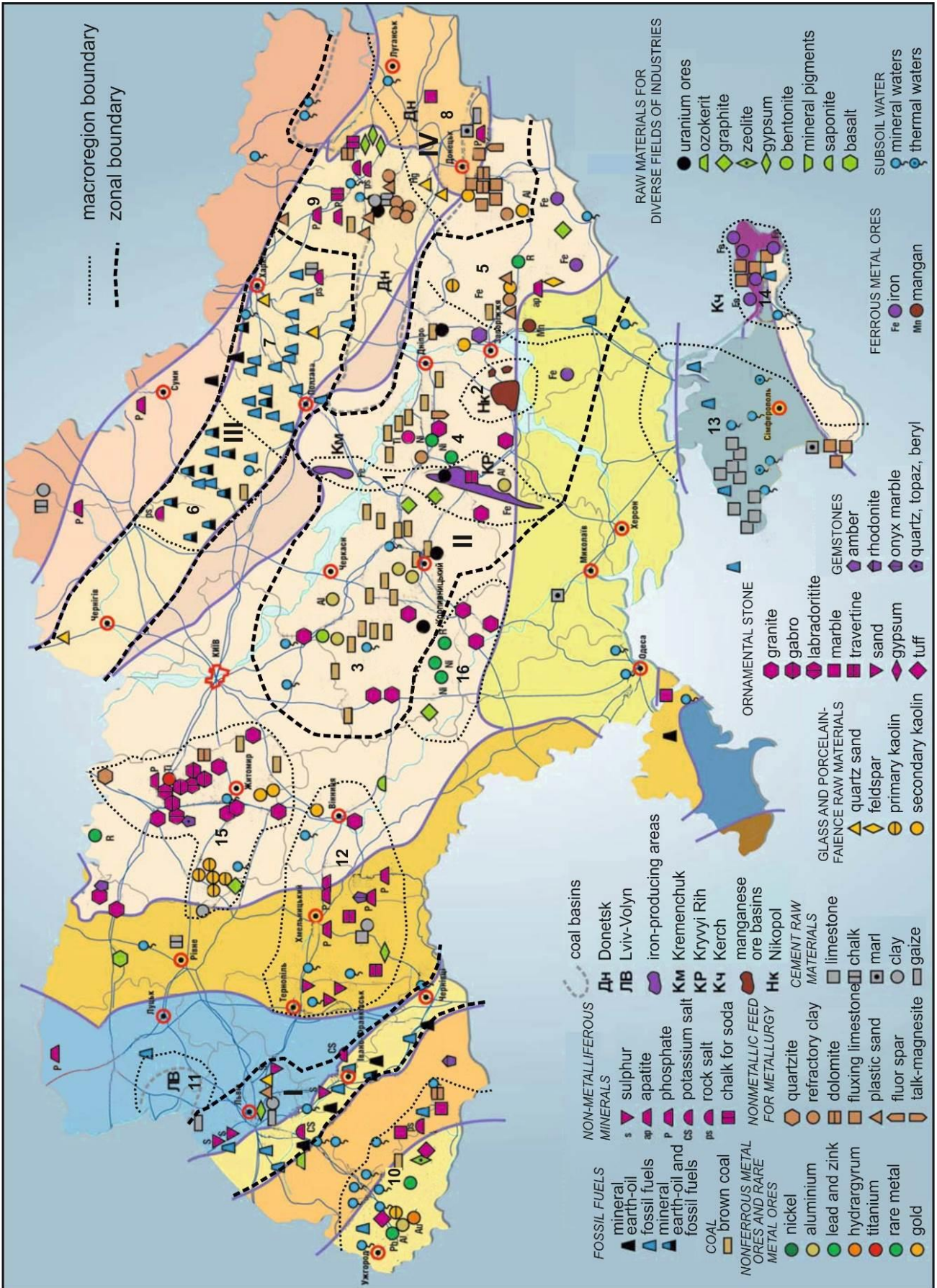
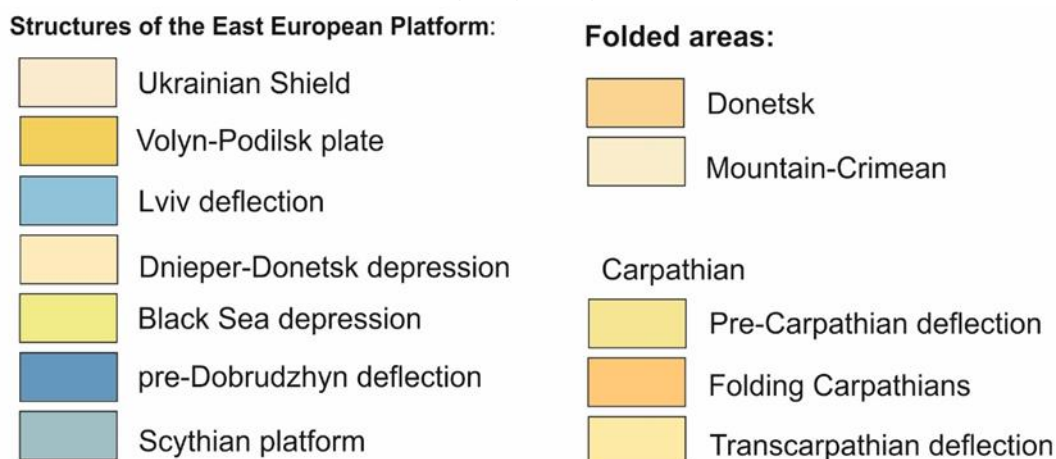


Fig. 2. Economic and geographical mineral resources zoning scheme of Ukraine territory

Legend for Fig. 2:



The numbers on the map indicate:

I – Pre-Carpathian zone; II – Pre-Dnieper-Pre-Azov zone: 1- Kryvyi Rih macroregion, 2- Nikopol-Tokmak macroregion, 3- Zvenyhorodka-Dnieper macroregion, 4- Oleksandriia region, 5- Pry-Azov region; *III – Eastern Ukrainian zone:* 6- Shebelynka-Okhtyrka macroregion, 7- Romny-Pryluky macroregion; *IV – Donetsk-Sloviansk zone:* 8- Donetsk macroregion, 9- Sloviansk-Bakhmut macroregion; *separate territorial combinations:* 10. Trans-Carpathian macroregion, 11- Lviv-Volyn macroregion, 12- Podillia macroregion, 13- Crimea macroregion, 14- Kerch macroregion, 15- Zhytomyr region, 16- Pobuzhia region

plant, the western part is done by Ordzhonikidze plant. Generally, mining is carried out at 7 mines and 8 strip mines. Ore beneficiation is carried out at four concentration mills, namely at Hrushivka I, II, Chkalovske, Oleksandrivka.

Manganese ore reserves of this macroregion are internationally significant as raw materials are exported to Russia, Czech Republic and Slovakia. On the basis of manganese deposits, Nikopol mining hub was formed. The macroregion future belongs to further development of the world's largest manganese reserves in Velykyi Tokmak deposit. Other mineral resources of the macroregion (construction materials) are of local importance.

Zvenyhorodka-Dnieper polycomponent macroregion covers the main area of distribution of brown coal deposits of the Dnieper basin within Cherkasy, Kirovograd and Dnipropetrovsk oblasts. The leading minerals of the macroregion are brown coal, titanium, nickel-cobalt, uranium, gold, terres rares, graphite, bentonite clays, kaolins, nonmetallic raw materials for metallurgy, building materials.

Within the macroregion, Oleksandriia polycomponent region, Verkhniy (Upper) Dnieper and Synelnykove macrobunches have been singled out.

Brown coal deposits, not being developed currently, dominate in the *Oleksandriia region*. The Eastern Mining and Processing Plant exploits four uranium deposits, namely Vatutine (Smolinska mine), Michurine and Central (Inhulsk mine) and Novokostiantynivka (Novokostiantynivka mine); Dashukivka Bentonite Company “Dashukivka Bentonite” develops a large Cherkasy bentonite clay deposit of state importance; Vatutine refractory clay

plant develops Murzynske deposit; numerous deposits of building materials are exploited, in particular, facing granites (Kapustyn, Bohuslav), silicious raw materials (Konoplianske, etc.). Balakhivka graphite deposit has been prepared for exploitation. On the basis of the deposits of the economic and geographical region, mining region of the same name has been singled out. In its area, there is Kropyvnytskyi mining hub where uranium, secondary kaolin, marl, granite, sand and loam deposits are developed (Fig. 4).

Verhniy (Upper) Dnieper macrobunch unites a group of brown coal deposits (not developed), titanium, nickel, talc-magnesite, refractory clays, moulding sand, etc. Vilnohirsk mining and metallurgical combine operates on the basis of the unique by its reserves Malyshevsk compound deposit of titanium-zirconium ores. The plant supplies raw materials for Zaporizhia Titanium Magnesium Combine and, in addition, it develops high-alumina raw materials (disthen-sillimanite ore) and moulding sands. Explored within the macrobunch industrial deposits of nickel-cobalt ores (Sukhyi Khutir, Devladove deposits), talc-magnesite (Pravdyne deposit) are currently not developed. Deposits of facing granites such as Kudashivka, Bovtyshka are being developed. The industrial development of the deposits of macrobunch became the base for the development of the mining hub with the same name.

Synelnykove macrobunch is located to the south-east of the city Dnipro within Middle-Dnieper megablock of Ukrainian Shield and has more than a dozen mineral deposits, three of which are gold deposits (Serhiivka, Balka Zolota, Pivdenne), uranium

(Surske), brown coal (Pavlivske, Synelnykove), primary kaolin (Biliaivka), fluxing limestone (Dnipropetrovsk), refractory clay (Pervozvanivka), moulding sand (Khoroshe, Sukhachivka, Taromske deposits), facing granites (Yantsivske), etc. Almost all the deposits listed above are not currently developed, except for the deposits of facing stone and kaolin (Biliaivka Mineral Beneficiation Plant develops reserves of Biliaivka kaolin deposit).

Pre-Azov region genetically belongs to Pre-Azov megablock of Ukrainian Shield which determined the specificity of the mineral deposits formed here. The leading minerals are ores of iron, uranium, terres rares, graphite, kaolin, refractory clays. Within the region, Polohy-Huliaipole macrobunch and Bilozerske hub are relatively clear distinguished (Fig. 3).

Polohy-Huliaipole macrobunch, located to the south-east of Zaporizhia city, has more than a dozen deposits of the main minerals such as iron (Vasynivske, Huliaipole deposit), secondary kaolins (Polohy-2), molding sand (Polohy, Orikhiv), refractory clay (Polohy-1), brown coal (Orikhiv-1), apatite and rare-earth metals (Novopoltavka), feldspar (Balka Velykoho Taboru), gaize (Novosemenivka), glass sand. Mining company "Polohy chemical plant Coagulant" develops deposits of kaolin, refractory clays and molding sands and provides metallurgical enterprises of Pre-Dnieper and Donbas regions with raw materials. Orikhiv open-pit mine develops a deposit of molding sands.

Bilozerske monocomponent bunch is situated to the south, a little apart from the rest of the region. The main mineral raw materials of the bunch are iron ores of three deposits, namely North Bilozerske (Pivnichnobilozerske), South Bilozerske (Pivdennobilozerske) and Pereverzivske only the second of which is developed. Zaporizhia Iron Ore Plant, which operates on the basis of the deposit, annually extracts up to 3 million tons of high-grade iron ores that do not require beneficiation. Bilozerske bunch is one of the most promising areas in Ukraine (after Kryvyi Rih basin) by its industrial potential. Deposits of other minerals explored within the bunch include the deposits of building sand and brick-tiled raw materials.

Donetsk-Sloviansk polycomponent zone is located within Donetsk, Luhansk and, partially, Dnipropetrovsk oblasts and belongs to the Hercynides of Donetsk folding structures and sediments of the Dnieper-Donetsk depression. We have divided the zone into two macroregions: Donetsk and Sloviansk-Bakhmut (Fig. 2, 3).

In general, a large number of complex forming mineral deposits of international and national importance are very densely concentrated within the zone, some minerals (coal, rock salt) are character-

ized by a basin type of distribution. The unique combination of various types of raw materials (fuel, chemical, technological, non-metallic for metallurgy and building) has resulted in setting up a complex of mining, concentration and processing enterprises for fuel, energetic, metallurgical, chemical and construction industries. As a result, industrial agglomerations and industrial hubs were formed within Donbas (Fig. 4).

Donetsk macroregion. The deposits of the macroregion are concentrated within Donetsk and Dnipropetrovsk oblasts. The main minerals of international and national importance are coal, refractory materials, flux and cement raw materials.

Pavlohrad-Petropavlivka monocomponent bunch, located in the western part of the macroregion, includes coal deposits of Western Donbas and the hub with the same name of national importance formed on its base.

In the southern part of Donetsk macroregion, **Dokuchaievsk multicomponent macrobunch** is clearly defined. It includes compactly located deposits (except for coal) of fluxing limestone, dolomites and refractory materials. In the area, Illich Iron and Steel Works (Mariupol Metallurgical Plant) develops rich deposits of fluxed limestone (four deposits), Dokuchaievsk Flux and Dolomite Plant develops dolomites from Olenivka, Stylske and Novotroitske deposits, Velykoanadolsky Refractory Materials Plant and Donbaskeramika Company develop deposits of primary and secondary kaolin. In addition, within the macrobunch there are deposits of refractory clays (Zatyshok), alumina raw materials (Kalinino-Shevchenkivske), rare metals (Mazurivske), all of which currently are not developed, and numerous deposits of building materials (glass sands, gaize etc.).

The small monocomponent **Amvrosiivka bunch** includes mainly compactly located deposits of cement raw materials (totally, 5 deposits of marl, chalk, clay), which are developed by the open joint-stock company "Doncement". On the basis of the deposits of Dokuchaievsk macrobunch and Amvrosiivka bunch, the corresponding mining hubs have been formed.

Sloviansk-Bakhmut macroregion is located in the north-western part of Donbas within Donetsk (partly), Luhansk and Kharkiv oblasts. The macroregion is characterized by a unique combination of many complex minerals of international and national importance. Most of them serve as the foundation for forming various combinations of industrial enterprises: mining, processing, mining and chemical, industrial complexes of mineral resource orientation. First of all, these are deposits of coal, rock salt, refractory materials, cement raw materials, the level of development of which is quite high. In

addition, rich deposits of mercury, uranium, gypsum, phosphorites, molding sands, dolomites, chalk, ochre, brown coal (all deposits are not fully developed) are compactly located here.

A number of mining enterprises such as Vesco private joint-stock company, Chasovyi Yar Refractory Materials Plant, Kurdiurmivka Acid Product Factory, Druzhkivka Mine Group, Companies: "Vohnetryvnerud", "Pivdenno-Okhtiabrsk Clays", "Donbas Clays", Krasnohorivka and Kindrativka Refractories Plants function on the basis of the refractory clays of *Chasovyi Yar macrobunch* (14 deposits, 10 of which are developed). Raw materials are supplied to the enterprises of Ukraine, Great Britain, Italy and others.

Raw materials (chalk, clay) of Kramatorsk complex deposit are used by Kramatorsk Cement Plant-Pushka.

Deposits of molding sands (totally 5 deposits, for example, Husarivka, Bantyshevsk, Chasovyi-Yar) are developed by Husarivka Mining and Processing Plant, Chasovyi Yar Refractory Materials Plant, Druzhkivka Mine Goup.

Gypsum deposits (11 deposits) are mainly developed by the German construction company "Knauf" and the French company "Lafarge" which produce construction mix, gypsum crushed stone, packaged gypsum and other products, as well as provide Ukrainian construction, ceramic, porcelain, slate and cement plants with raw materials. The further improvement includes investment projects of the development of mining and industrial complexes which means industrial exploitation of East-Vidradne and Zaitseve-2 gypsum deposits. The large Artemivsk rock salt deposit is developed by 5 mines of the State Enterprise "Artemsil".

Mykytivka mercury field (7 deposits) was intensively developed until 1995 by Mykytivka mercury plant. The field is now suspended.

The deposits of uranium (Krasnooskolske deposit), brown coal (large Novodmytrivka deposit), phosphorites, dolomites, ochre and some others can be regarded as insufficiently developed. *Rubizhne polycomponent macrobunch* and *Rovenky mono-component bunch* [19] are singled out in the area. The first one includes deposits of coal, natural gas and building materials of local importance while the second one contains deposits of coal.

On the basis of the characterized territorial combinations of mineral raw materials, the following mining hubs have been formed: Kramatorsk-Kostiantynivka, Bakhmut, Lysychansk-Rubizhne, Rovenky (Fig. 4).

We also distinguish *Luhansk polycomponent bunch* stretching straight to the north of Luhansk, along the Russian Federation border to the north-

west almost to Lysychansk. It is comprised of coal deposits, explored gas and gas condensate deposits (15 deposits).

Eastern Ukrainian polycomponent zone is located on the left bank of the Dnieper River and extends over the territory of five oblasts: Chernihiv, Sumy, Poltava, Kharkiv and partly Dnipropetrovsk. The zone belongs to Dnieper-Donetsk depression and is characterized by the predominance of oil and gas deposits over non-metallic mineral deposits. Its area is 78 thousand square kilometres, the total number of oil and gas deposits includes more than 430. Still, there are certain principles of their territorial concentration, particularly, in the northern part of the zone (Chernihiv oblast) a significant amount of oil deposits with a high content of dissolved gas has been investigated, in the south-east, oil deposits are replaced by gas condensate and gas deposits. The development of oil and gas deposits in the zone is very high as they have been exploited for a long time and many of them have already exhausted their reserves. Public joint-stock company "Ukrnafta" processes gas at Hnidyntsi and Kachanivka gas processing plants. JSC "UkrGasVydobuvannia exploits Shebelynka gas processing plant, Yabluniv gas processing department, process shop of condensate stabilization "Bazylivshchyna". Oil refining is carried out at Kremenchuh oil refinery of Transnational financial and industrial oil company "Ukratnafta".

Within the zone, we distinguish two macroregions: Shebelynka-Okhtyrka and Romny-Pryluky, the latter one includes several bunches (Fig. 2, 3).

Shebelynka-Okhtyrka polycomponent macroregion is located in the south of the zone within Kharkiv, Dnipropetrovsk, Poltava and, partly, Sumy oblasts. The bunches that form it are predominantly monocomponent and are represented by gas and gas condensate deposits and by small amount of oil deposits in the north. Thus, in Kharkiv oblast 45 oil deposits and 45 gas deposits are explored, in Poltava oblast 30 oil deposits and 70 gas deposits are explored. The main gas deposits are Shebelynka, Yefremivka, Western-Khrestyshche, Medvedivka, Melykhivka etc. Other minerals found in the macroregion are rich deposits of rock salt (Yefremivka), chalk (Shebelynka deposit), glass sands (Berestovenka, Novoselkivske deposit), bischofite (Poltava), mineral pigments, building materials (construction sand, brick and tile, expanded clay raw materials, etc.). On the basis of the bunch exploitation, the oil and gas industrial hubs are formed (Fig. 4). Myrhorod resort of the national level functions on the basis of mineral waters of Myrhorod deposit.

Pereshchepyno bunch, located at somewhat isolated position, occupies Novomoskovsk district of Dnepropetrovsk oblast and is composed mainly of

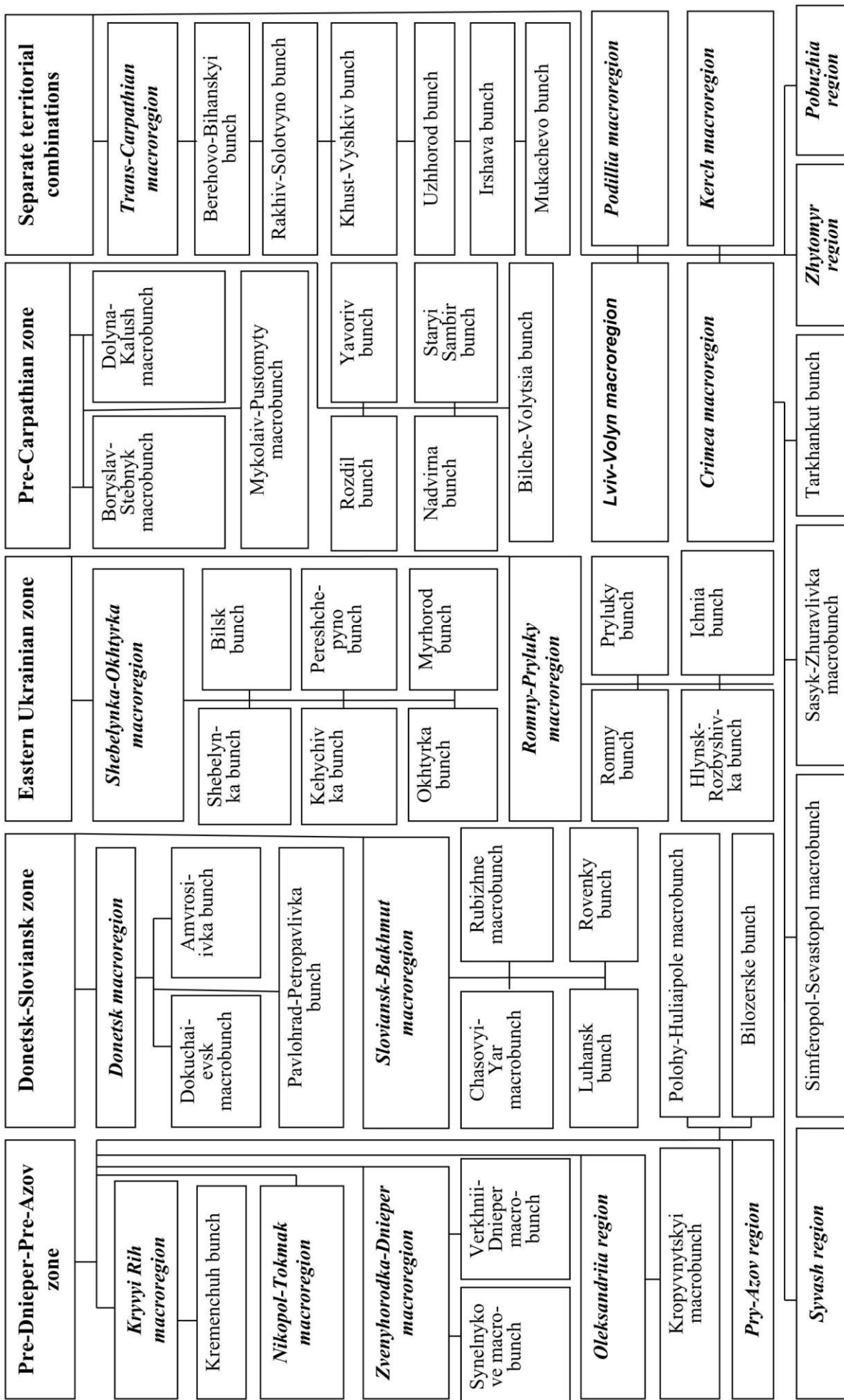


Fig. 3. Economic and geographical regionalization of mineral deposit combinations of Ukraine

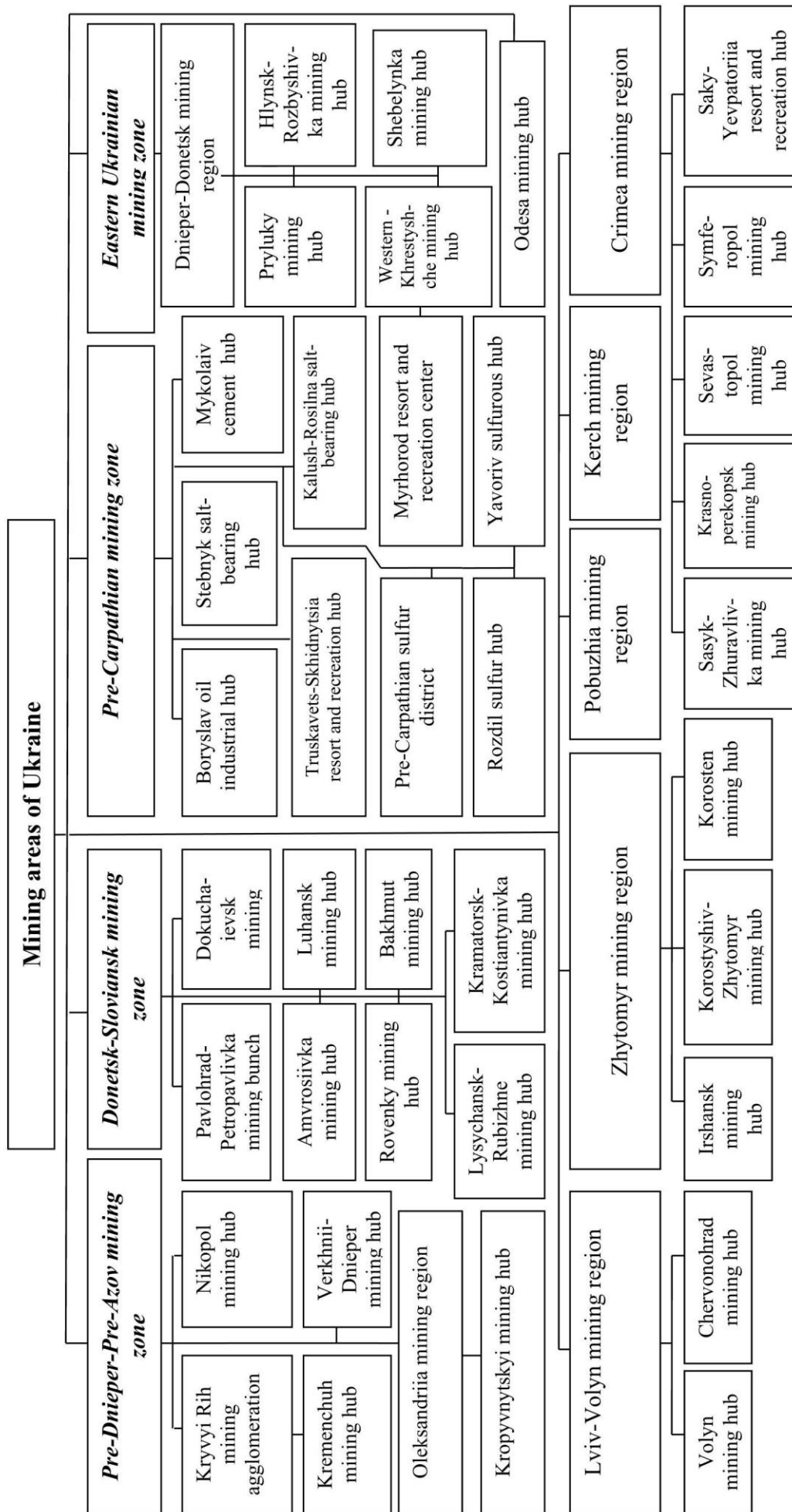


Fig. 4. Mining regionalization of mineral deposit combinations of Ukraine

gas and gas condensate deposits (totally, above 2 dozen deposits) the development of which will have an impact on the fuel balance in Pre-Dnieper area. Deposits of refractory raw materials, currently not developed, also belong to the bunch.

Romny-Pryluky macroregion occupies the northern part of the zone (the territory of Chernihiv, Sumy and Poltava oblasts) and has 30 oil and condensate deposits and 40 gas deposits in Chernihiv oblast alone. A significant amount of deposits is concentrated in the south-western part of Sumy oblast and north-western Poltava oblast (*Romny and Hlynsk-Rozbyshivka bunches*). The most significant oil extraction is done at Leliaky, Hnidyntsi, Anastasivka, Hlynsk-Rozbyshivka, Kachanivka deposits which form the foundation for the oil industry development in Ukraine. In the northern bunches (*Pryluky, Ichnia*), oil and oil and gas condensate deposits strongly predominate.

In addition to oil and gas deposits, the macroregion contains deposits of brown coal (Sula-Udai deposit), rock salt (Romny), bischofite (Novopodilske), and building materials.

The development of oil and gas deposits has entailed the formation of Pryluky and Hlynsk-Rozbyshivka mining hubs, which specializes mainly in oil extraction.

Pre-Carpathian zone is located within Lviv and Ivano-Frankivsk oblasts and is geographically connected with Pre-Carpathian foredeep and nearby areas of East European Platform. The zone contains several large territorial mineral deposit concentrations (according to the geological regionalization): the Pre-Carpathian oil and gas region, the Pre-Carpathian sulfur-bearing basin, the Pre-Carpathian salt-bearing basin, the Dniester gypsum-bearing area, etc. Thus, the zone is multicomponent with a high level of deposit concentration and development of mainly international and national importance. A bunch form of deposit distribution is typical of this zone (Fig. 2, 3).

As a result of intensive mining and processing activities, the following mining hubs are formed on the basis of the bunches: Yavoriv sulfurous, Rozdil sulfurous, Boryslav oil industrial, Mykolaiv cement, Stebnyk salt-bearing

Dolyna-Kalush polycomponent macrobunch includes rock salt and oil deposits (more than 14), most of which have already been exhausted and are not developed now. Currently, the production is suspended. The development of two groups of contiguous deposits of potassium and potassium-magnesium salts has also been suspended: Kalush-Holyn and Markova-Rosilna. The deposits of ozokerite (2 deposits) are singled out, but they are not developed either.

On the basis of the macrobunch deposits, a

powerful industrial complexes of mineral resource orientation used to work. Now Dolyna gas processing plant, Dolyna salt plant, "Karpatnaftokhim" LTD in Kalush are supplied with local raw materials.

Boryslav-Stebnyk macrobunch is similar in mineral raw materials component composition and the specialization of the mining industry to the previous one. The macrobunch is located on the territory of Lviv oblast. The area contains oil and gas condensate deposits such as Boryslav, Skhidnytsia (both are developed), Oriv-Ulychne, Yankivske (totally 14 deposits) which have formed Boryslav oil industrial hub. At the turn of the nineteenth and twentieth centuries, there were plenty of different oil refineries, as well as ozokerite deposits. Since 1996, ozokerite extraction has been stopped, oil extraction continues today.

Most oil and gas deposits are associated with salt-bearing deposits which overlap oil-bearing rocks. Stebnyk salt-bearing hub with Stebnyk, Dobrohostiv, Drohobych deposits of potassium and sodium salts was formed on the basis of 15 salt deposits in Lviv oblast, as a result Stebnyk mining and chemical enterprise "Polyminerall" functioned here (mines, mineries, beneficiation plants). Now the production in Stebnyk have been suspended.

A number of mineral water deposits have been explored within the area of the macrobunch (Truskavets, Skhidnytsia), on the basis of which some well-known resorts and even Truskavets-Skhidnytsia recreation hub have been formed.

Two bunches of mineral deposits - Rozdil and Yavoriv - are located within Pre-Carpathian sulfur-bearing basin. *Rozdil bunch* includes Rozdil, Podorozhnie, Liubyni and Teisariv sulfur deposits. Until recently, State Enterprise Rozdil Mining and Chemical Enterprise "Sirka" functioned on the basis of the first two deposits (mining operations were ceased in 2000), consequently, Rozdil sulfur hub was formed here. *Yavoriv bunch* located in the north-west of the basin includes Yazivske and Nemyriv sulfur deposits, oil deposits (Kokhanivske), natural gas (Svydnytsia, Retychynske, Kokhanivske, Vyshnia), construction materials. Until 2001, State Enterprise Yavoriv Mining and Chemical Enterprise "Sirka" and the corresponding sulfur mining hub functioned on the basis of sulfur deposits. Both hubs are part of the Pre-Carpathian sulfur region.

Mykolaiv-Pustomyty macrobunch with the area of more than 1000 square kilometres is located on the territory of the corresponding districts of Lviv oblast. Here there is a dense concentration of construction raw material deposits: cement (Dobriany, Rozvadiiv, Kahuiv, Piskiv which have limestone, gaize, clay), sand (Velyki Hlibovychi), gypsum (Dniester gypsum region), brick and tile, quar-

rystone and rubble, limestone, peat (totally, more than 2 dozen deposits). On the basis of these deposits, Mykolaivcement PAT (CRH Ukraine) functions. There are numerous quarries of construction materials. Mining and processing enterprises of the bunch can be included into Mykolaiv cement hub (Fig. 4).

Bilche-Volytsia bunch belongs to Bilche-Volytsia oil and gas region and is located in Lviv oblast. It contains mainly gas and gas condensate deposits (about 3 dozens) some of which are developed. It also includes deposits of peat, brick and tile raw materials.

Saryi Sambir bunch (Lviv oblast) contains oil deposits: Strilbychi, Saryi Sambir, South Monastyrrets etc. (totally 5 deposits) and deposits of construction raw material.

Nadvirna bunch is located in Ivano-Frankivsk oblast. It is based on oil, oil and gas condensate, gas condensate deposits which occupy the southern part of Boryslav-Pokuty oil and gas region with 10 deposits totally: Pniv, Hvizdets, Monastyrchany, Bytkiv-Babchynske. In the territory of the bunch, there are deposits of ozokerite (Starunia and Dzvyniach) and menilitic shale. Nadvirna oil and gas production division works on the raw materials of the mentioned deposits.

The development of mineral deposits of Pre-Carpathian zone resulted in the formation of a large industrial complexes of mineral resource orientation called Pre-carpathian mining zone.

The description of the other areas of Ukraine with mineral resource, which are not included in the characterized zones and which occupy a little isolated position, is not provided here due to the limited size of the article. It is described in [24].

Conclusions. 1. Three approaches to zoning areas with combined mineral deposits are analyzed

and applied: geological, economic and geographical, and industrial which enables us to correlate them for defining the structure of mineral resource complexes of certain regions.

2. We have suggested the variants of economic-geographical and mining regionalization of industrial complexes of mineral resource orientation basing on the data of the Ukraine State Geological Information Fund (Geoinform) concerning the current state of mineral resources in Ukraine.

3. Our own interpretation of the main definitions of mining regionalization is provided what serves as clarifying the existing differences in their understanding.

4. The principles of Ukrainian localization of mineral deposit combination and the mineral resource complexes formed on their basis are singled out. Four mineral resource zones are identified: Pre-Dnieper–Pre-Azov, Eastern Ukrainian, Donetsk-Sloviansk and Pre-Carpathian which correspond to four mining zones and several territorially separated structures: Trans-Carpathian, Lviv-Volyn, Podillia, Kerch, Zhytomyr, Crimea macroregion, and Pobuzhia region. Within the zones, economic-geographical substructures are distinguished: macroregions, regions, macrobunches, bunches, centers and mining structures – regions, hubs, centers.

5. The mineral peculiarities of the mentioned zones and their constituent parts are characterized; their economic and geographical features and the current state of resource development are indicated, which enables us to determine the prospects for further development of the existing mineral resource complexes, optimize their structure and suggest objects of prior investment.

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THE REGIONALIZATION OF TERRITORIAL COMBINATIONS OF MINERAL DEPOSITS AND MINING TERRITORIES OF UKRAINE

The purpose of the article is using the data of Geoinform of Ukraine on the current state of the mineral resource base of the country, to regionalize its territory by combining explored mineral deposits and production-territorial complexes formed on their basis with a mineral raw material orientation.

Research results. The article is written in the context of the constructive-geographical direction of studying the geography of mineral resources, which has been developing in the last decades in Ukraine. In particular, three approaches to regionalization of territorial combinations of mineral deposits are compared and analyzed: geological, economic-geographical and mining, which will contribute to their interconnection in characterizing the mineral-raw materials complexes of individual regions. The authors' own interpretations of discussion definitions of mining terminology are proposed.

Based on the results of previous studies and taking into account the current state of the mineral resource base, economic-geographical and mining zoning of the territory of Ukraine has been carried out for groups of explored mineral deposits. Within Ukraine, four mineral resource zones are allocated: Prydniprovsko-Pryazovska, Eastern Ukrainian, Donetsko-Slovianska and Prykarpatska, as well as several territorially separate structures: Zakarpatskyi, Lvivsko-Volynskyi, Podilskyi, Kerchenskyi, Krymskyi macrodistricts, Zhytomirskyi and Pobuzkyi districts.

A detailed description of the mineral and raw material specifications of these structures and their constituent parts, the features and prospects of their exploitation, the formation of territorial-production complexes of mineral and raw materials orientation are submitted.

Scientific novelty. For the first time, various approaches to the regionalization of territorial groupings of mineral deposits and mining territories are compared, the basic definitions of mining regionalization are presented, and on this basis their own variant of zoning the territory of Ukraine on mineral resources is proposed.

Practical value. The economic, geographical and mining zoning of the territory of Ukraine according to the forms of concentration of mineral deposits and mining areas will help create the scientific basis for optimizing the structure of the mining industry, ensuring the effective use of mineral raw materials, and developing the country's raw material complex.

Keywords: mineral resources, economic and geographical regionalization, mining regionalization, mining centers, hubs, districts.

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