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Land management recommendations for protecting potential copper and silver mining areas in Lubuskie Province, western Poland

Introduction

Lubuskie Province (or Lubuskie Voivodeship) is located in western Poland. It is one of sixteen provinces of the country; its area is almost 14,000 km², with a population of slightly more than a million people. In terms of geological structure, its southern part comprises three major geological units: the north-western part of the Fore-Sudetic Monocline, the Żary Perycline and the northern termination of the Fore-Sudetic Block. Both the Fore-Sudetic Monocline and the Żary Perycline are known places of the occurrences of stratiform Cu-Ag sulfides. However, unlike the adjacent Dolnośląskie Province, where extraction of such ore from the former unit has been continuing since the 1960s (Piestrzyński 1996), Lubuskie Voivodeship is still waiting for its first copper and silver ore mine.

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Within the boundaries of this province there are several known occurrences of Cu-Ag sulfide ore, as shown in Figure 1. They are found in sedimentary rocks associated with the chemically reduced facies of the bottommost Zechstein (Permian age) (Speczik 1995; Oszczepalski 1999). The so-called copper-bearing series consists of the white Weissliegend sandstone, the overlying copper-bearing shale (Kupferschiefer) and the lower part of the Zechstein limestone. Ore minerals can be present in any one or in all of these lithostratigraphic units, and the thickness of orebodies does not exceed several meters. In a vertical profile, the mineralized horizon is located above the oxidized rocks of the Rote Fäule facies; therefore, horizontally, areas with mineralization are adjacent to oxidized fields with a variable position of Rote Fäule (Rydzewski 1978; Rydzewski and Oszczepalski 1984; Oszczepalski 1994; Speczik 1995; Oszczepalski et al. 2016a). This zonality is also presented in Figure 1.

The name “potential Cu-Ag mining areas” (PMAs) is used in this article as a general term covering various types of prognostic locations of possible future extraction of copper and silver ore. In Lubuskie Province, there are seven prospective areas of indicated Cu-Ag ore mineralization (Oszczepalski et al. 2016b), and the recent intense exploration carried out by private investors has led to the discovery of three deposits: Nowa Sól, Żary and Mozów, two of which have already been approved and registered by the Polish government

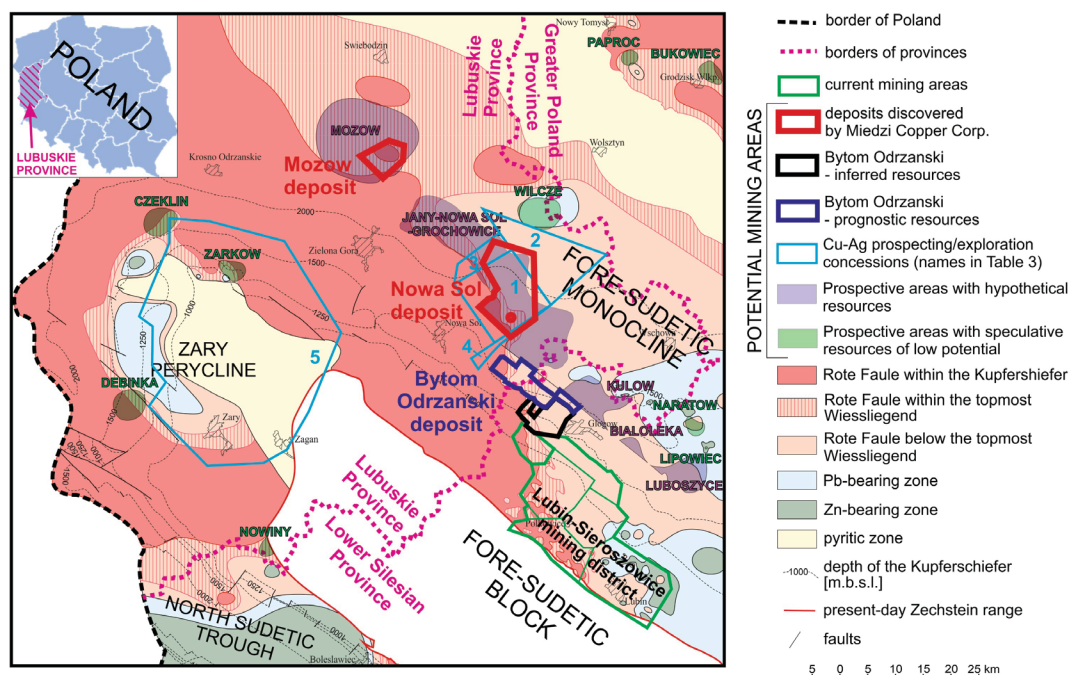


Fig. 1. Potential Cu-Ag mining areas and mineral zonation in Lubuskie Province
 Based on: Oszczepalski et al. 2019a

Rys. 1. Potencjalne obszary wydobywcze Cu-Ag w województwie lubuskim
 na tle mapy strefowości geochemicznej

(Szufflicki et al. 2020). Besides them, the Bytom Odrzański deposit was discovered already in the 1980s, its resources being divided between the province in question and the adjacent Dolnośląskie Province (Gruszecki and Pikuła 2008). Finally, within the boundaries of Lubuskie Province there are currently five active concessions for the prospecting and/or exploration of Cu-Ag ore deposits, granted to private investors by the Polish government. All of the above constitute PMAs as defined by the present paper.

This means that mining activity can commence in this region in the foreseeable future; in fact, work is currently underway to obtain a mining permit for one of the newly discovered deposits (Nowa Sól). However, in order to allow future underground extraction of Cu-Ag ore in Lubuskie Province, it is necessary to make sure that sufficient protection is provided today not just for the officially registered resources, but for all kinds of PMAs, where further deposits may be documented upon detailed exploration. This requires fulfilling a number of requirements, faced both by private investors interested in their development, as well as local government representatives and other officials responsible for the environmental and economic policy of the region. These requirements are discussed in more detail in the following chapters of the paper. Although they are generally well known to Polish specialists in the field, the authors have considered them useful information to prospecting companies; therefore, their detailed description has been provided for potential foreign investors.

1. Characteristics of potential Cu-Ag mining series in Lubuskie Province

1.1. Prospective areas

The prospective areas delineated in the studied region are part of a larger group of 35 areas demarcated in SW Poland, which have been established mostly based on the analyses of historical drill cores, mainly from boreholes of the petroleum industry (Oszczepalski et al. 2019). They are divided into three categories depending on their location relative to known Cu-Ag deposits and the number of positive boreholes identifying a given area. Therefore, areas with hypothetical resources include those directly adjacent to recognized deposits and established based on more than one positive hole. Areas with speculative resources are located distant from known deposits and they consist of two subgroups: those of high potential, identified by more than one positive borehole, and those of low potential, with only a single borehole per area (Oszczepalski et al. 2019). As of the present day, no areas with speculative resources of high potential are present in Lubuskie Province.

All seven prospective areas identified within the boundaries of this administrative unit are listed in Table 1 and presented in Figure 1. Their combined estimated hypothetical and speculative resources (according to definitions given above) amount to as much as about 70 million metric tons of metallic copper and 230,000 metric tons of metallic silver.

Table 1. Prospective areas of Cu-Ag ore mineralization in Lubuskie Province with parameters of the ore-bearing horizon

Tabela 1. Perspektywiczne obszary mineralizacji rud Cu-Ag w województwie lubuskim wraz z parametrami horyzontu rudonośnego

Type of resources	Area name	Size (km ²)	Depth range (MBGL)	Average thickness (m)	Average Cu content (%)	Estimated Cu resources (Mt)	Average Ag content (ppm)	Estimated Ag resources (kt)
Hypothetical	Jany– –Nowa Sól– –Grochowice	320.07	1 600–2 200	1.93	2.25	34.748	96	148.256
	Mozów ¹	213.99	2 300–2 600	2.09	2.71	30.300	50	55.905
Hypothetical: total/average		534.06	1 600–2 600	2.01	2.48	65.048	73	204.161
Speculative of low potential	Czeklin	23.48	1 700–1 800	0.23	10.54	1.423	no data	no data
	Dębinka	25.39	1 400–1 600	2.30	0.69	1.007	44	6.424
	Nowiny	5.72	400–600	0.47	2.64	0.177	100	0.672
	Wilcze	35.58	2 400–2 500	0.23	8.12	1.661	920	18.882
	Żarkow	13.19	1 200–1 500	3.01	1.34	1.330	22	2.184
Speculative: total/average		103.36	400–2 500	1.25	4.67	5.598	271.5	28.162
Hypothetical + + speculative: total/average		637.42	400–2 600	1.47	4.04	70.646	205.33	232.323

¹ Resources of the Mozów area were described as speculative of high potential in (Oszczepalski et al. 2019); however, due to the presence of the Mozów deposit (see subsection 1.2), in the present paper they are categorized as hypothetical, which indicates a higher level of confidence.

Based on: Oszczepalski et al. 2019.

1.2. Ore deposits

The three new Cu-Ag ore deposits of Lubuskie Province include Nowa Sól, Mozów and Żary. They were all discovered recently as a result of the intense prospecting activities of private companies: Miedzi Copper Corp. (Nowa Sól and Mozów) and Amarante (Żary). Nowa Sól and Żary have already been entered into the country's register of mineral deposits, i.e. for each of them, geological documentation was prepared according to Polish legal regulations and approved by the Ministry of Environment in 2019 (Speczik 2019). In the case of Mozów, the geological documentation is already completed but it still has to be approved by the government (Speczik 2020).

The Bytom Odrzański deposit was discovered back in the 1980s. According to the most recent report (Gruszecki and Pikuła 2008), it consists of resources calculated in Polish exploration categories C₁ + C₂ (inferred), as well as prognostic resources (name used by the

authors of geological documentation to distinguish resources located at depths exceeding 1500 m below ground level). The $C_1 + C_2$ part is located entirely in the adjacent Lower Silesian Province, while the prognostic resources are divided between the two provinces. Their calculation was performed when old regulations were still effective in Poland, according to which the maximum allowed depth of a stratiform Cu-Ag deposit was 1500 m below ground level. Therefore, resources located at depths of 1500 to 1730 m were categorized back then as prognostic solely due to their depth (Gruszecki and Piłkuła 2008). The manner of their estimation was identical to the method used for the inferred resources located in the adjacent province.

According to current legal regulations, the depth of 1500 m is still recommended as a maximum for this type of deposits. However, investors can use their own threshold parameters defining a deposit and its boundaries (Ordinance ME 2015). This is allowed when ‘exceptional geological conditions’ take place, and requires proper explanation in the text of geological documentation. This right was exercised successfully in the case of the approved documentation of the Nowa Sól deposit which is deeper than 1500 m, and it was used in a similar manner in the case of Mozów deposit.

The boundaries of the Nowa Sól and Mozów deposits are presented in Figure 1, as is the Bytom Odrzański deposit (inferred and prognostic resources). The exact location of the Żary deposit is still considered confidential by the investor who discovered it; however, it is situated in the Żary Perycline (Figure 1). Table 2 below presents the basic parameters of the deposits (in the case of Bytom Odrzański, only for the part located in Lubuskie Province).

Table 2. General information about Cu-Ag ore deposits of Lubuskie Province

Tabela 2. Ogólne informacje o złożach rud Cu-Ag w województwie lubuskim

Name	Size (km ²)	Depth range (MBGL)	Cu resources (Mt)	Ag resources (kt)
Nowa Sól	119.1	1 780–2 160	10.583	36.410
Mozów	31.5	2 370–2 537	4.586	6.487
Żary	24.3	650–1 100 ¹	1.276	5.800
Bytom Odrzański (prognostic ²)	23.6	1 500–1 730	2.600	6.621
Total			19.045	55.318

¹ Depth of prospecting boreholes; actual depth of the deposit is confidential.

² Term used by (Gruszecki and Piłkuła 2008).

The Nowa Sól deposit is a part of the Jany–Nowa Sól–Grochowice prospective area, which means that upon possible further exploration, its size and copper resources could increase to about 320 km² and 35 million metric tons, respectively, as estimated for that area

in Table 1. The current resources of over 10 million metric tons Cu and 36,000 metric tons Ag are documented in Polish C₂ category, which could be an equivalent of both inferred and indicated resources according to CRIRSCO, depending on the complexity of the deposit (Nieć 2010).

Similarly, the Mozów deposit is located in the larger Mozów prospective area, which means that its current resources of about 4.6 million metric tons of copper are a part of the total estimated hypothetical resources of about 30 million metric tons Cu (see Table 1). The current resources of this deposit are also calculated in Polish C₂ category.

The Żary deposit is documented in Polish D category (Szufficki et al. 2020), which should be considered an equivalent to inferred resources according to CRIRSCO (Nieć 2010).

Overall, the combined resources of all documented deposits in Lubuskie Province are approx. 19.0 million metric tons Cu and 55,300 metric tons Ag. One should also keep in mind that there is still a huge potential for extending these new deposits and increasing their resources, as indicated by the estimations presented for prospective areas in Table 1. Indeed, there may even be connections between the Jany–Nowa Sól–Grochowice and Mozów prospective areas, perhaps including a connection to the Wilcze area in the east as well (see Figure 1), which could result in a further increase in the still undeveloped Cu-Ag resources of Lubuskie Province.

1.3. Active concessions

In Lubuskie Province, there are five active areas of mineral prospecting and/or exploration carried out by private investors (as of December 2020). Such activities are performed based on concessions issued by the government, which will be explained in more detail in subsection 3.2. These concessions, which also constitute PMAs as defined in the present article, are presented in Figure 1, and their list is presented in Table 3. Their combined surface area is about 1,534 km², which is approximately 11% of the size of the entire province.

Table 3. Active prospecting and/or exploration concessions in Lubuskie Province (as of December 2020)

Tabela 3. Aktywne koncesje poszukiwawczo-rozpoznawcze w województwie lubuskim (stan na grudzień 2020 r.)

No. ¹	Name	Size (km ²)	Holder
1.	Nowa Sól	156.49	Zielona Góra Copper (subsidiary of Miedzi Copper Corp.)
2.	Wilcze	148.10	
3.	Jany	35.38	
4.	Zatonie	14.07	
5.	Peryklina Żar	1,179.80	Amarante

¹ Same numbers as in Figure 1.

2. Polish legislation on geological and mining activity

2.1. General regulations regarding mineral prospecting and exploration

In Poland, geological and mining activities are regulated by the Geological and Mining Law Act (GML) (GML 2011). The GML defines the terms and conditions for the initiation, execution and conclusion of activities in the field of geological work and extraction of mineral deposits. It also specifies requirements for the protection of mineral deposits and other elements of the environment.

According to the GML, copper and silver ore deposits are owned by the state; therefore, their prospecting and/or exploration are always done based on a concession. Furthermore, the extraction of minerals from deposits requires a separate mining concession. All geological concessions regarding those types of deposits are issued by the appropriate Minister, currently the Minister of Climate and Environment (MoCE).

In order to be granted a prospecting and/or exploration concession, an investor needs to submit an application to the MoCE. If the performance of geological operations is intended, the concession application must include a Plan of Geological Operations. Before the MoCE grants the requested concession, it must be consulted with local administration – the head of each municipality (or a mayor of the town or of the city) within the boundaries of which the intended activities are to be conducted. These local authorities also review the Plan of Geological Operations. When the concession is granted, its copies have to be promptly delivered to local authorities (head of the municipality/mayor of the town or the city). This means that local government units are well aware of every prospecting/exploration project from its very beginning. However, they have no obligation to protect such PMAs at this early stage.

2.2. Geological documentation and categories of resources

The results of work performed based on a concession for prospecting and/or exploration are presented by an investor in geological documentation, which needs to be approved by the geological administration authority (in the case of copper and silver deposits, the MoCE). Before the documentation is approved, the geological administration authority must send a draft of the decision involving its approval to the heads of local government units in the area covered by the documentation, as well as to the governor(s) of the voivodeship(s) within the boundaries of which the deposit is located. When approved by the MoCE, such documentation may constitute a basis for applying for a mining concession.

The geological documentation of a mineral deposit is prepared in order to establish its boundaries, geological resources, geological setting, as well as to determine the feasibility of extraction of the deposit. The Regulation of the Minister of Environment (Ordinance ME 2015) establishes 5 categories which are used in order to reflect the degree of exploration

of the deposit: D, C₂, C₁, B, A. Polish system of categories is generally based on the level of confidence of the identification of various features of a deposit, such as: geological setting, tectonics, ore grade, ore quality, as well as geological and mining conditions (where the D category corresponds to the lowest level of confidence, and A to the highest). In addition, the Minister's regulation defines the maximum permissible error of estimation of the resources and average parameters of the deposit for each category.

Approved geological documentation in the C₁ category or higher constitutes a principal condition when applying for a mining concession. The C₁ category should be considered as an equivalent of indicated resources according to CRISCO (Nieć 2010). For this category, the error of estimation cannot exceed 30%. An investor who has documented a deposit in the C₁ category or higher has the right of priority to apply for a mining concession. This right is valid for three years. During this period, the investor should receive a positive environmental decision and prepare a mineral deposit development plan, which are obligatory appendices to such an application.

Documented deposits are revealed in local spatial development documents, as well as in spatial development plans of voivodeships. Each deposit must be mandatorily incorporated into municipal spatial management documents within 2 years starting from the date of approval of geological documentation. If the authorities of the municipality do not fulfill this obligation, the governor of the voivodeship does this for them. Governors who fail to do so are fined for every day of delay.

2.3. Environmental aspects of a mining license application

According to a regulation of the Polish Council of Ministers (Ordinance CoM 2019), underground mining facilities with annual production exceeding 100,000 cubic meters of ore must be considered as projects always likely to significantly affect the environment. This applies to all underground copper mines operating in the Fore-Sudetic Monocline in Poland, and will certainly apply to any future mine. Therefore, in order to request a mining license within the boundaries of a documented Cu-Ag deposit (within its whole area or a specified part), an investor must first receive a positive environmental decision from the Regional Director of Environmental Protection. Such a decision is based on an environmental impact assessment report (EIA report), which must be prepared by the applicant. It contains comprehensive information which in general covers the possible environmental impact of the project, and its preparation must include a review of local spatial development documents for municipalities where the ore deposit is located. Before its official approval, an environmental decision has to be made publically available by the Regional Director of Environmental Protection.

Each mining license application must also include a document called the mineral deposit development plan. It must specify the boundaries of the planned mining area, local geological conditions, technical possibilities of ore extraction and expected means of safe

abandonment of the mine. Above all, it should suggest the most rational scenario of mining extraction, in particular involving the complete and rational use of the principal mineral (in this case, the Cu-Ag ore) and the accompanying secondary valuable components (here: Pb, Zn, Au, PGE, Co, Re, Mo, V and Ni). Finally, the plan should present the description of actions that would be undertaken to minimize the possible negative environmental impact of the project. The plan is then sent to the Regional Mining Authority, who have 14 days to evaluate it and issue an opinion.

3. Recommendations regarding land management

As demonstrated by the described regulations, local authorities are informed about the possibility of the occurrence of a new deposit within the boundaries of the administrative unit which they govern. This is done at the very beginning of every mineral prospecting and/or exploration project, when a concession application is being processed. However, it should be noted that, at this early stage, the fact that local authorities receive information about intended geological work is not followed by any further legal actions, until the deposit is documented (its geological documentation is approved). Only such deposits must be revealed in local spatial development documents, and local government units have no duty to protect any other PMAs and to take them into account while establishing spatial development strategies.

Generally, the described course of action provides certain protection of mineral deposits, but it does so at a relatively late stage. Such protection should start much earlier than after approving the documentation of a deposit. Every concession for prospecting and/or exploration should be protected by local government units starting from the day of its issuance, which marks the beginning of a new exploration project. Like for documented deposits, local authorities should avoid such directions of development of these PMAs which might prevent investors from accessing resources once they are documented. Because of that, local governments should monitor any activities taking place within the boundaries of such concessions, in order to avoid their undesired spatial development and land management.

In a specific case, an investor may prepare geological documentation of a deposit in the lower D or C₂ category, and then apply for a new exploration concession to continue work aimed at upgrading it to C₁. Such scenarios are common, since this category enables submitting an application for a mining license. This new exploration concession covers the area of the already documented deposit, as well as its surroundings where the orebody is expected to extend. Therefore, it is extremely important for local authorities to provide protection for the entirety of such a new concession, where a deposit is already present and it will be very likely expanded and prepared for a mining license application.

A concession may not be granted if it prevents the use of real estate in the way which has been defined in local plans. Due to this fact, even if there are clear indicators of prospective

resources in a particular area, it may not be possible to explore them, or their exploration may be pointless, because local plans assume different ways of development of land properties in this area. For this reason, it is important for local authorities to monitor not just concessions granted for prospecting and/or exploration, but also prospective areas, like those listed in Table 1. They can be established based on analyses of historical geological information, or in combination with recent exploration results, and they too should be protected. Such areas are listed by the Polish Geological Institute in periodic reports on prospective resources in Poland, commissioned and funded by the government (Wołkowicz et al. 2011; Szamałek et al. 2020). Therefore, in the case of these PMAs, such protection should begin with the day of their presentation in such reports. Also, while similar reports are published by the Polish Geological Institute once a year for registered deposits (e.g., Nieć and Radwanek-Bąk 2014), similar documents involving prospective resources are less frequent – two most recent ones were released in 2011 and 2020 (Wołkowicz et al. 2011; Szamałek et al. 2020). It would be advisable to publish them on a more regular basis as a valuable source of information for local government units.

4. Protection of natural resources according to the spatial development plan of Lubuskie Province

4.1. The current status

The spatial development plan of Lubuskie Province (Bereś and Olbromska-Matusiak 2018) was prepared in 2018. It establishes major directions of development for the region in areas such as industry, transport, environmental protection, etc. It also contains several aspects related to the protection of natural resources, listing a total of 404 documented deposits of all kinds present within its boundaries. These numbers are based on the Annual Report of Mineral Reserves/Resources as of 31 December 2016 (Szufficki et al. 2017), prepared by the Polish Geological Institute, as well as the data provided in 2017 by the Chief Geologist of Lubuskie Province. For comparison, according to a more recent list (as of 31 December 2019), there are a total of 472 documented deposits within the boundaries of Lubuskie Province (Szufficki et al. 2020). The list of mineral deposits presented in the spatial development plan does not address copper and silver, because, as of 31 December 2016, in Lubuskie Province there were no such deposits documented and approved by the Ministry of Environment. Moreover, the analysis of local conditions concerning current and future mineral extraction focuses solely on natural gas, crude oil and lignite deposits. Three regions of potential extraction of lignite from undeveloped deposits are highlighted in the plan and presented on the map of natural resources of Lubuskie Province.

The plan states that the scope of protection of mineral resources should be determined on the basis of instructions provided by the Polish Geological Institute (Nieć and Radwanek-Bąk

2014). According to them, the protection and rational management of resources should encompass:

- ◆ protection of land on which the deposits are located against development which might prevent potential investors from the use of documented resources and mining activity,
- ◆ protection of mineral resources against unjustified losses,
- ◆ complete extraction of ore from the deposit, including accompanying valuable components,
- ◆ optimal use of mineral resources in terms of production and utilization of rational raw materials,
- ◆ limitation of waste production,
- ◆ limitation of mineral extraction through recycling and the use of substitutes.

The plan presents a list of deposits which should be the subjects of such protection; they include those which fall under the mining ownership of the state (lignite and hydrocarbons), as well as selected few covered by land property rights (those of major significance to the region) – the largest deposits of sands, gravels and clays.

The authors of the plan declare that the exploration of prospective areas of copper and silver resources, registration of new Cu-Ag deposits and their mineral extraction constitute one of 49 potential development directions for Lubuskie Province (development direction no. 6 in the “Natural System” subgroup called “Rational Management of Mineral Resources”). Indeed, the map of mineral resources presents prospective areas of copper and silver ore. It is worth pointing out that the prognostic part of the Bytom Odrzański deposit is included among them. Figure 2 below shows the boundaries of areas presented in the spatial development plan, compared to those seen in Figure 1, as well as Cu-Ag prospecting and exploration concessions.

The very presence of prospective areas in this plan is a positive sign, since, as mentioned earlier in the article, it is not obligatory to include such elements in spatial development documents. However, although acknowledged by the authors of the plan, these areas are completely omitted in their analysis of strategic resources of the voivodeship.

Some of these prospective areas differ from those presented in Figure 1 and in Table 1 of the present article, as they are based on earlier evaluations (Oszczepalski et al. 2016a) which predated the most recent research results, especially the documentation of the Nowa Sól, Mozów and Żary deposits. Most notably, the large Jany–Nowa Sól–Grochowice area did not exist during the preparation of the development plan. This is because the Nowa Sól deposit was a true *greenfield* discovery, located in an area with no historical drilling results. It was only after the documentation of this deposit that it became possible to add a new prospective area around it and merge it with several smaller areas shown in the development plan, which were known from previous studies of historical boreholes located further away (Oszczepalski et al. 2016b). On the other hand, the performed drilling operations allowed delineating the Mozów deposit inside the previously known Mozów prospective area, which had been established based on available historical data. This proves that the relationship between the shapes and sizes of prospective areas and registered deposits is bilateral.

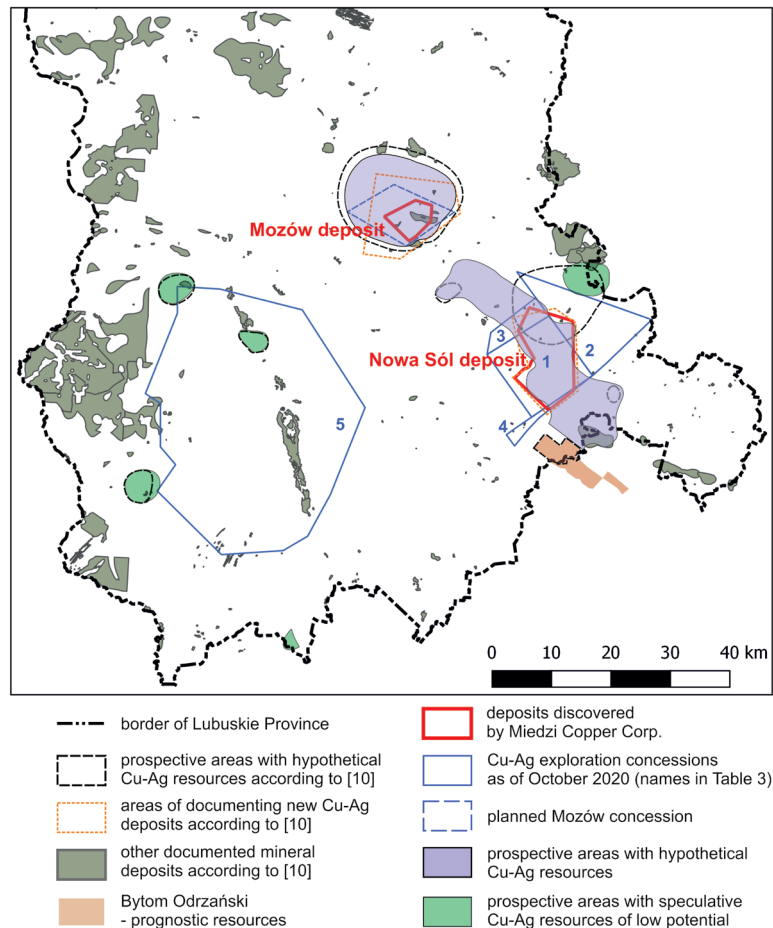


Fig. 2. Mineral deposits and prospective areas according to the spatial development plan of Lubuskie Province (Bereś and Olbromska-Matusiak 2018); a comparison with the areas presented in Figure 1

Rys. 2. Złoża kopalin i obszary perspektywiczne wg planu zagospodarowania przestrzennego województwa lubuskiego (Bereś i Olbromska-Matusiak 2018); porównanie z obszarami przedstawionymi na rysunku 1

4.2. Possible areas of improvement

The “Rational Management of Mineral Resources” development direction of the plan specifies the principles of protection of registered deposits, based on the instructions of the Polish Geological Institute (Nieć and Radwanek-Bąk 2014). It is understandable that the Nowa Sól, Mozów and Żary deposits are not included in the plan, as they were not yet officially registered during its preparation. The plan does show the “areas of documenting new Cu-Ag deposits” in the vicinity of current Mozów and Nowa Sól deposits (Figure 2).

This proves that its authors were aware of the continuing exploration in these areas. On the other hand, while the “Peryklina Żar” concession (see Figure 1 and Table 3) was already active during that time, it is not presented in any maps of the development plan. Also, regardless of their presence on the attached maps, PMAs such as prospecting/exploration concessions or prospective areas with Cu-Ag mineralization are not included on the list of protected items in the plan.

Figure 2 provides a good illustration of the manner in which PMAs of various types overlap and complement each other. For example, the Mozów deposit, which represents the highest level of confidence in terms of the degree of mineral exploration, constitutes a part of a larger planned concession area. This concession, which may one day result in increasing the size of the deposit, currently covers a part of the even larger Mozów prospective area (listed in Table 1), which represents a lower level of confidence. Also, the Nowa Sól deposit is located partially within four active concession areas, which themselves are partially overlapped by the Jany–Nowa Sól–Grochowice prospective area (Table 1), extending further towards the north-west and the south-east.

In order to facilitate future extraction of copper and silver resources, it is necessary to make sure that sufficient protection is provided today not just for documented (registered) deposits, but also for prospective areas and active prospecting/exploration concessions, where new deposits may be discovered in the future. Such protection should also follow the instructions of the Polish Geological Institute (Niec and Radwanek-Bąk 2014). The spatial development plan of Lubuskie Province (and those of other provinces) should be updated on a regular basis, as new concessions are being issued by the state and new geological data is acquired by prospecting companies. Such plans should also take into account prospective areas identified by the Polish Geological Institute in reports prepared for the government (Wołkiewicz et al. 2011; Szamałek et al. 2020). In fact, these reports, preferably prepared on a more regular basis, should constitute compulsory source material for local authorities during the preparation of land use documents. The introduction of this principle would require amending the geological and mining law act and/or the spatial planning and land use act.

Conclusions

Lubuskie Province is an exceptional region in Poland, in that it has numerous PMAs, including some registered Cu-Ag deposits, but none of them are subjects of mining extraction yet. Therefore, it is necessary to ensure that such extraction could be initiated in the future without major obstacles.

Polish law provides a certain degree of protection of ore resources, which covers only deposits documented by investors and officially approved by the state (in the case of Cu-Ag ore – the MoCE). This protection is manifested by the consideration of those areas in the spatial development plans of specific provinces. Their presence in these plans is intended to

prevent them from such directions of spatial development which would make their extraction impossible or more difficult.

Unfortunately, no such protection is provided for PMAs which are not yet recognized by the government as ore deposits. They include prospecting and exploration concessions, where geological operations aimed at the documentation of new deposits are underway. In the case of copper and silver, these concessions are granted by the MoCE, which always consults local authorities before making its decision about permitting such activities. Therefore, the heads of municipalities already have at their disposal comprehensive information about any areas which, as a result of the investors' actions, might turn (in part or in their entirety) into mineral deposits in the foreseeable future.

Additionally, a situation may take place in which a deposit has already been documented in the D or C₂ category, and then an investor has been granted a new exploration concession for the area of the deposit and its surroundings. This is intended to upgrade the category to C₁, which is the one enabling a mining license application. Such a situation would require the protection of this new concession as a whole, since there is a high probability of expanding the already known deposit and increasing the scope of its identification to a point where a mining license application will be possible.

Apart from active concession, the PMAs also include areas of prospective ore mineralization, established based on the analyses of historical materials, e.g. old drill cores. There is a high likelihood that some of them may become subjects of prospecting and/or exploration concessions due to their already prognostic nature (Gruszecki and Piłkuła 2008), as it was the case for several such areas in Lubuskie Province. Furthermore, the issuance of such concessions may indeed result in the identification of new deposits approved by the state, which has also been observed for the region in question.

Such protection of all PMAs, including prognostic areas, as well as active prospecting and/or exploration concessions, should be guaranteed by the law. It would require amending certain regulations related primarily to spatial development, which would enable providing the possibility of proper "evolution" of these areas into proper deposits and eventually mines, ensured at a much earlier stage than today.

These amendments should specifically involve the inclusion of all PMAs in local planning documents. Therefore, the authors of such documents, prepared for the whole province or an individual municipality, should always consult the lists and maps of prospective areas published in the reports of the Polish Geological Institute. Said reports ought to be prepared on a much more regular basis, similar to currently issued annual reports, which include registered deposits. Local planning documents should also mark the locations of any prospecting or exploration concessions currently active in the region. By virtue of these documents, all of the abovementioned areas should be excluded from such directions of land development which could prevent future mining extraction.

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**LAND MANAGEMENT RECOMMENDATIONS FOR PROTECTING POTENTIAL COPPER
AND SILVER MINING AREAS IN LUBUSKIE PROVINCE, WESTERN POLAND**

Keywords

deep copper and silver deposits, Fore-Sudetic Monocline, protection of mineral resources,
potential Cu-Ag mining areas, Lubuskie Province

Abstract

The protection of copper and silver ore resources in the Polish Lubuskie Province requires certain steps to be taken, the suggestions for which are presented in this article. It addresses both known and newly discovered ore deposits, as well as prospective areas and places of ongoing exploration, which throughout the paper are collectively recognized as potential Cu-Ag mining areas. The example of Lubuskie Province was chosen as an exceptional region with multiple known areas of copper and silver ore potential, but no active mining operations until now. The study focuses on the nature and location of all potential mining areas in Lubuskie Province, and subsequently suggests the means of their protection which can be implemented today, as well as in the future. Such means should be introduced by way of new or amended legal regulations. Certain major changes to Polish law are necessary to provide sufficient protection of both currently known, as well as possible future deposits, against such use of land which would prevent the extraction of their resources. The study shows that the legal regulations effective in Poland today are insufficient or too vague, as they do not include any provisions concerning prospective resources, as well as areas of active mineral exploration, instead focusing solely on officially registered mineral deposits. Therefore, the proposals of new solutions providing better protection of all potential Cu-Ag mining areas are presented in this article.

**REKOMENDACJE DOTYCZĄCE ZAGOSPODAROWANIA PRZESTRZENNEGO W CELU OCHRONY
POTENCJALNYCH OBSZARÓW GÓRNICWA MIEDZI I SREBRA W WOJEWÓDZTWIE LUBUSKIM**

Słowa kluczowe

głębokie złoża rud miedzi i srebra, monoklina przedsudecka, ochrona zasobów geologicznych,
górnictwo rud miedzi i srebra, województwo lubuskie

Streszczenie

Artykuł przedstawia zagadnienia ochrony zasobów mineralnych, omawiając przypadek złóż rud miedzi i srebra w Polsce. Praca dotyczy znanych i udokumentowanych złóż, obszarów perspektywicznych, a także wszystkich terenów, na których prowadzone są obecnie prace poszukiwawczo-rozpoznawcze. Przykład województwa lubuskiego w Polsce został wybrany ze względu na znane obszary występowania mineralizacji Cu-Ag w tym rejonie, gdzie nie prowadzona jest żadna działalność wydobywcza. Opracowanie skupia się na charakterystyce i lokalizacji wszystkich udokumentowanych wierceniach wystąpień rud Cu-Ag w regionie i równolegle analizuje sposoby ich ochrony, które można wprowadzić w życie dziś lub zastosować w przyszłości. Sugerowane rozwiązania mogłyby zostać wdrożone poprzez zmianę obowiązujących regulacji prawnych lub stworzenie zupełnie nowych przepisów. Opisane w pracy propozycje są niezbędne do dostatecznej ochrony złóż już udokumentowanych, jak i obszarów, w których odkrycie złoża jest możliwe w przyszłości, przed takim zagospodarowaniem terenu, które mogłoby utrudnić lub uniemożliwić ich przyszłą eksploatację. Przepisy prawne obowiązujące obecnie w Polsce nie są wystarczające lub są nie w pełni sprecyzowane, ponieważ nie obejmują ochrony obszarów perspektywicznych, jak również terenów, na których aktualnie prowadzone jest wydobywanie, skupiając się wyłącznie na złożach udokumentowanych i zatwierdzonych przez organy administracji geologicznej. Dlatego w pracy zaproponowano nowe rozwiązania zapewniające lepszą ochronę wszystkich potencjalnych złóż rud miedzi i srebra.

