

ANALYSIS OF CRITERIA FOR CLASSIFYING SELECTED GYPSUM DEPOSITS IN POLAND AS STRATEGIC DEPOSITS

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Abstract

With the entry into force of the Act of 16 June 2023 amending the Geological and Mining Act and certain other acts, a new solution was introduced to the issues related to the protection of mineral deposits, namely the possibility of granting the status of a strategic deposit to deposits or parts thereof. A strategic deposit is a mineral deposit which, due to its significance for the economy or security of the country, is subject to special legal protection. It should therefore be recognised that deposits with such status will be considered the most important and valuable for the needs of the Polish economy.

For a mineral deposit to be considered a 'strategic deposit', the legislator has specified that it meets two basic criteria. The first refers to the state of land use, which must allow access to the deposit. On the other hand, the second criterion is alternative, so the deposit must be of fundamental importance for the national economy or raw material interest, have an above-average volume of resources, or be characterised by unique parameters.

Given the above, in the author's opinion, the selected gypsum deposits, i.e. Borków-Chwałowice, Leszcze, Uników-Galów and Winiary may meet the criteria for being recognised as strategic deposits, which entitles the minister responsible for the environment to initiate the procedure specified in Article 94 of the Geological and Mining Act.

Keywords: the National Raw Materials Policy, protection of mineral deposits, strategic deposits, natural gypsum, geological resources

1. INTRODUCTION

Mineral deposits are an important element of the natural environment from the point of view of the national economy, and the possibility of obtaining them ensures the security of raw materials of a given country. This is of particular importance in the context of two key features of mineral deposits, i.e. their resources are non-renewable and their use brings significant economic benefits. Unfortunately, the legal regulations in force to date have not provided sufficient protection for mineral deposits, which has been pointed out by many experts for over last years [1, 2, 3, 4, 5]. With the entry into force of the amendment

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to the Geological and Mining Act on October 28, 2023, a new status was introduced, i.e. "strategic deposit". A strategic deposit is a mineral deposit which, due to its importance for the economy or security of the country, is subject to special legal protection. It should therefore be recognized that deposits with such status will be considered as the most important and most valuable for the Polish economy.

The main element of this protection is the obligation to take into account certain restrictions in the spatial planning process [6]. This applies to both voivodeship spatial development plans as well as general municipal plans and local spatial development plans. This is particularly important in the context of these last two documents. The commune is obliged in the local spatial development plan to introduce a ban on permanent development, which would result in the exclusion of the possibility of mining the mineral deposits in the future. This is undoubtedly a limitation of the commune's authority in the scope of choosing the directions of development of areas within the territory covered by its borders [7].

2. STRATEGIC DEPOSITS AS A NEW FORM OF DEPOSITS PROTECTION

The authority competent to issue a decision on the recognition of a given mineral deposit or part thereof as a strategic deposit is the minister responsible for environment. If the deposit is covered by mining property, the minister must initiate proceedings within 1 month of issuing the decision on approval of the geological documentation or an addendum thereto, if the deposit may meet the statutory strategic criteria. With respect to other deposits, the minister may initiate such proceedings when he or she receives information that the deposit may meet these criteria.

For mineral deposits documented after 28 October 2023, the party to the proceedings is only the entity for which the geological documentation or an addendum thereto was approved. In the case of mineral deposits documented before that date, the party to the proceedings is the entity that has the right to geological information or the right to use the geological information contained in the geological documentation of the deposit or in its addendum. However, if such an entity no longer exists and there is no legal successor, then the party to the proceedings is the State Treasury represented by the voivode. When deciding to recognise a mineral deposit or part thereof as a strategic deposit, the minister responsible for the environment relies on the opinion of the state geological service and the opinion of the mayor/city president. The opinion of the state geological service concerns whether the deposit meets the criteria for special legal protection expressed in the recognition of the mineral deposit or part thereof as strategic, as well as what conditions the commune should take into account in the course of fulfilling the obligations related to disclosing the deposit in its planning documents. In turn, the executive body of the commune prepares an opinion on the planned boundaries of the strategic deposit and the method of development of the area on which the deposit is located, taking into account the urban, economic, environmental and cultural conditions of this area.

If the minister responsible for the environment, after receiving the opinions, considers that the deposit does not meet the strategic criteria, he will issue a decision to discontinue the proceedings. However, if, in the opinion of the minister responsible for the environment, the mineral deposit meets the strategic criteria, he will issue a decision to recognise the mineral deposit or part thereof as a strategic deposit. In this decision, he may indicate the conditions that the commune should take into account in the spatial planning and development process, and in particular the need to introduce a ban on permanent development or a ban on other development of the designated area of the strategic deposit in a way that would exclude the possibility of developing this deposit.

A copy of this decision is sent by the minister responsible for the environment to the minister responsible for the management of energy resources, the state geological service and other locally competent geological administration bodies, executive bodies of communes and voivodes.

In addition, he makes an entry in the list of strategic deposits kept separately for each mineral deposit or part thereof.

The procedure for recognizing a mineral deposit as a strategic deposit is presented in Figure 1.

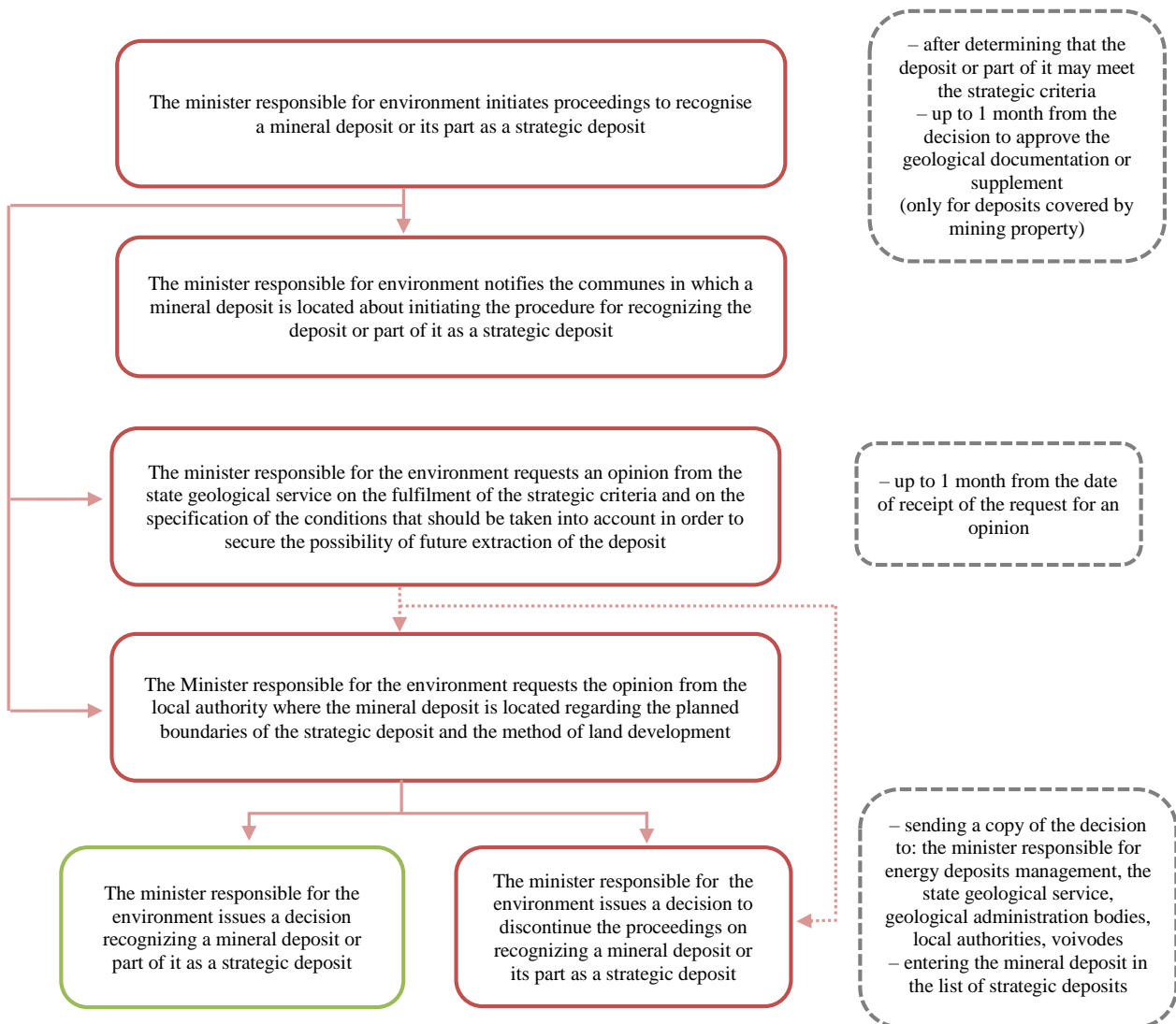


Fig 1. The procedure for recognizing a mineral deposit as a strategic deposit

3. GYPSUM DEPOSITS IN POLAND

According to the Mineral Resources Balance as of 31.12.2023, 16 gypsum and anhydrite deposits have been documented in Poland with total geological resources of 290.4 million Mg [8]. It should be noted that the statistics include two minerals together: gypsum and anhydrite, although they have different industrial applications. Therefore, in order to determine the importance of gypsum deposits, the analysis was limited to this raw material only. Therefore, gypsum resources documented together with anhydrite were separated for the following deposits: Lubichów, Nawojów Śląski and Nowy Łąd-Pole Radłowska

deposits, and the Nowy Łąd deposit was totally omitted. The corrected gypsum deposit resources amounted to 229.7 million Mg, and 88% of these resources are concentrated in the Świętokrzyskie Voivodeship, along the northern edge of the Carpathian Foredeep (especially in the Nida Valley). The summary of gypsum deposit resources in Poland is presented in Table 1.

Table 1. The gypsum and anhydrite deposits in Poland [8, 9]

No.	Name of deposit	Raw material	Year of last document.	Geological resources	Balanced resources (categories of exploration)					Non-balanced resources
					Total	A+B	C1	C2	D	
thous. Mg										
dolnośląskie voivodeship										
1	Lubichów	gypsum + anhydrite	2015	4 371	4 371	2 073	1 099	1 199		
2	Nawojów Śląski	gypsum + anhydrite	1954	362	362			362		
3	Nowy Łąd	anhydrite	Excluded from the analysis							
4	Nowy Łąd-Pole Radłówka	gypsum + anhydrite	1998	4 299	4 299	1 118	554	2 627		
podkarpackie voivodeship										
5	Łopuszka Wielka	gypsum	1993	222	169		72	97		53
6	Siedliska	gypsum	1993	8 695	3 952		823	3 129		4 743
świętokrzyskie voivodeship										
7	Borków-Chwałowice	gypsum	2020	37 618	37 618	1 039	36 579			
8	Gartatowice	gypsum	1691	1 303	1 303		1 303			
9	Leszcze	gypsum	2005	20 683	20 683		20 683			
10	Łatanice-Skorocice	gypsum	1951	14 500	14 500	14 500				
11	Siesławice	gypsum	1973	2 100	2 100		2 100			
12	Skorocice-Chotelek	gypsum	1961	27 413	22 337	3 347	18 990			5 076
13	Uników-Galów	gypsum	2023	37 311	37 311		37 311			
14	Uników-Galów-Szaniec	gypsum	2023	8 605	7 626			7 626		979
15	Winiary	gypsum	1993	52 657	46 496		46 496			6 161
wielkopolskie voivodeship										
16	Wapno	gypsum	1992	9 604	7 683	1 875	1 673	4 135		1 921
Total				229 743						

Currently, gypsum deposits are extracted only using the surface method in two deposits, i.e. "Borków-Chwałowice" and "Leszcze". Annual extraction from these deposits in 2023 amounted to 515 thous. Mg and 258 thous. Mg, respectively, and combined industrial reserves amounted to 43.4 million Mg. Due to the increasingly limited supply of synthetic gypsum (so-called REA-gypsum), which is a by-product of coal combustion in coal-fired power plants, it can be assumed that natural gypsum deposits will play an increasingly important role in the future [10].

It is estimated that the current annual demand for gypsum (i.e. REA-gypsum and natural gypsum) in Poland is approx. 3 ÷ 4 million Mg. Comparing this value with the available industrial reserves of gypsum, the static sufficiency of these reserves is now only 10 ÷ 14 years. It is therefore advisable to

provide selected gypsum deposits with increased legal protection by granting the most important of them the status of strategic deposits.

4. CRITERIA COMPLIANCE ANALYSIS

In order to determine the possibility of granting the status of a strategic deposit to gypsum deposits, an analysis was carried out of their fulfilment of the strategic criteria. The four most important gypsum deposits were selected for the analysis, i.e. Borków-Chwałowice, Leszcze, Uników-Galów and Winiary. These deposits were selected for further analysis due to their large amount of resources and good logistics infrastructure associated with existing active gypsum mines. The existence of active mines significantly increases the chance of developing such deposits in the future compared to green field mining investments.

In order for a mineral deposit to be recognised as a strategic deposit, two basic strategic criteria must be met:

- first: the current state of development of the area must enable access to the deposit,
- second (alternative):
 - the deposit must be of fundamental importance to the national economy or to the national raw material interests or
 - have above-average amount of resources or
 - deposit parameters must be unique.

4.1. First criterium

The first of the criteria considered was the condition of access to the deposit related to the current state of land development. Due to the geological and mining conditions of the gypsum deposits in Poland, this criterion should be considered in terms of the surface mining method, i.e. the complete transformation of the area within the ultimate pit. All of the selected deposits are located for the most part within the administrative boundaries of the Pińczów Commune, and to a much lesser extent in the Busko Zdrój Commune and Chmielnik Commune. The areas above the deposits in most cases are agricultural land of classes IIIa-V with few enclaves of forest land. There is no compact development, and the most important infrastructure is limited to a several hundred-meter section of a public roads together with a mid-pressure gas pipeline (on the Uników-Galów deposit) or a medium-voltage line (on the Winiary deposit). The remaining infrastructure consists of sections of the local water supply network, telecommunications lines or in-field roads. The low degree of urbanization of these areas is the result of the presence of protected areas in the form of a landscape park with a buffer zone and a protected landscape area. All of the analyzed deposits are located entirely within the buffer zone of the Nida Landscape Park and the Nida Protected Landscape Area. However, such a location does not rule out the possibility of mining these deposits, as evidenced by mining operations on the Leszcze and Borków-Chwałowice deposits. In the case of the first deposit, after conducting an environmental impact assessment, the Regional Director for Environmental Protection issued a decision on environmental conditions for gypsum extraction in 2020, and in 2023 the minister responsible for the environment issued a mining concession valid until 2068. Currently (as of September 2024), the procedure for issuing an environmental decision for the second active deposit, i.e. "Borków-Chwałowice", has just begun. Taking the above into account, it can be assumed that the criterion of accessibility to the deposits due to the current state of development of the areas above them is met for all four gypsum deposits.

The location of the selected gypsum deposits is shown in Figure 2 and Figure 3.

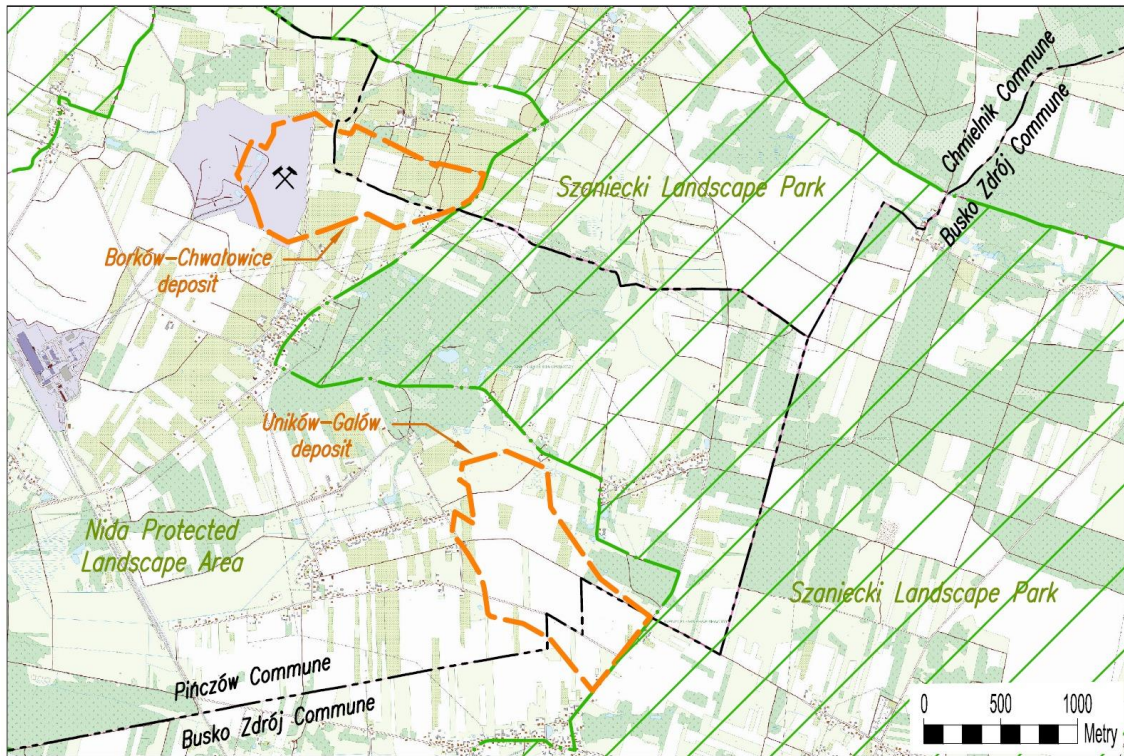


Fig. 2. Location of Borków-Chwałowice and Uników-Galów gypsum deposits

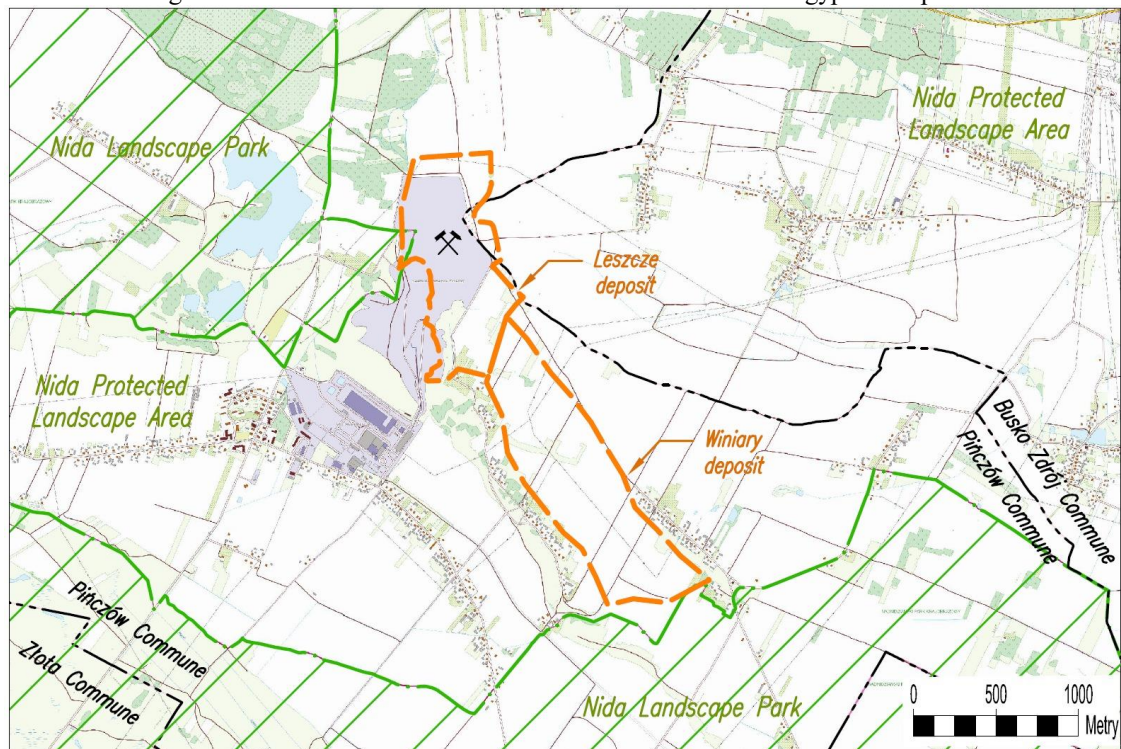


Fig. 3. Location of Leszcze and Winiary gypsum deposits

4.2. Second criterium

To assess the second criterium, three sub-criteria were analyzed. The first sub-criterion was the fundamental importance for the national economy or for the national raw material interests. According to the Geological and Mining Act, gypsum and anhydrite deposits are covered by mining property, and therefore belong to the State Treasury. The importance of these deposits was additionally emphasized by recognizing them as a strategic natural resource of the country, in accordance with the Act of July 6, 2001 on preserving the national character of the country's strategic natural resources, and their prospecting, recognition and extraction as a public purpose within the meaning of the Act of August 21, 1997 on real estate management. In addition, the importance of gypsum deposits for the country's economy was emphasized by including gypsum in the strategic document, the National Raw Materials Policy. In accordance with Annex No. 1 of this document, gypsum and anhydrite are included in the list of strategic raw materials for the Polish economy. The importance of the gypsum-based industry can also be evidenced by economic parameters. In the years 2018-2022, the production of plasterboards, sheets, panels, tiles and similar products made of gypsum or gypsum-based mixtures, not faced or reinforced with paper or cardboard, increased by 96.0%. The value of production sold in the products from other non-metallic mineral raw materials section amounted to PLN 74.1 billion in 2022, of which concrete, cement and gypsum products accounted for 31.1% [11].

Taking the above arguments into account, it can be stated that the analyzed gypsum deposits meet the sub-criterion of basic importance for the national economy or for the national raw material interests. In order to determine the second sub-criterion, a statistical analysis of geological resources of gypsum deposits was used. The median of resources was 8,696 thous. Mg and this value can be described as the "average" size of resources (percentile 50). The analyzed gypsum deposits were characterized by a significantly larger amount of resources, from 20,068 thous. Mg (Leszcze deposit) to 52,657 thous. Mg (Winiary deposit) and all of them were above percentile 70.

The basic statistics of gypsum deposits in Poland are presented in Figure 4.

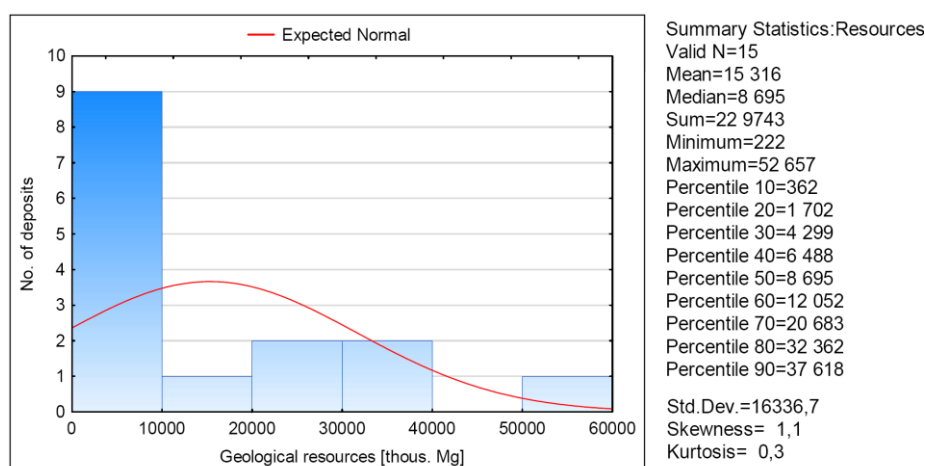


Fig. 4. Basic statistics of gypsum deposits in Poland (parameter: geological resources)

It can therefore be considered that the condition of "above average" resources met for all four gypsum deposits has been met.

To meet the third sub-criterion, the gypsum deposit must be characterized by unique parameters. It has not been defined which parameters should be taken into account. These can certainly be quality parameters of gypsum or geological and mining parameters of the deposit (e.g. thickness of the deposit,

thickness of the overburden, depth of the deposit bottom or indicators of these parameters such as overburden ratio [m/m], resources to deposit area ratio [Mg/ha] etc.).

The most important parameter for gypsum deposits, which determines its economic potential, is the content of $\text{CaSO}_4 \times 2\text{H}_2\text{O}$ (Calcium Sulfate Dihydrate). As a fulfillment of the sub-criterion of the unique parameter, it was proposed to have an average content of $\text{CaSO}_4 \times 2\text{H}_2\text{O}$ above the weighted average for all gypsum deposits in Poland.

The weighted average for all gypsum deposits in Poland was determined based on formula (4.1).

$$\bar{x} = \frac{\sum_{i=1}^n w_i x_i}{\sum_{i=1}^n w_i} \quad (4.1)$$

where:

\bar{x} - weighted average $\text{CaSO}_4 \times 2\text{H}_2\text{O}$ content [%],

w_i - geological resources of particular gypsum deposit [Mg],

x_i - average $\text{CaSO}_4 \times 2\text{H}_2\text{O}$ content in particular gypsum deposit [%],

n – number of gypsum deposits.

The thus calculated weighted average content of calcium sulfate dihydrate in gypsum deposits in Poland was calculated as $\bar{x} = 88.4\%$.

Selected parameters of gypsum deposits in Poland are presented in Table 2.

Table 2. Selected parameters of gypsum deposits in Poland [9]

No.	Name of deposit	Area [ha]	CaSO ₄ x 2H ₂ O content [%]		Gypsum thickness [m]		Overburden thickness [m]		Bottom depth [m]
			Min - Max	Avg.	Min - Max	Avg.	Min - Max	Avg.	Min - Max
dolnośląskie voivodeship									
1	Lubichów	65.3	84.0 - 99.7	92.8	2.5 - 26.2	4.2	15.0 - 370.0		26.4 - 400.0
2	Nawojów Śląski	3.1	n/a	n/a	0.9 - 18.6	22.0	30.0 - 65.0		55.0 - 90.0
3	Nowy Łąd		Excluded from the analyses						
4	Nowy Łąd-Pole Radłowska	25.0	88.5 - 91.0	90.6	6.5 - 34.0	19.2	n/a	n/a	110.1 - 216.9
podkarpackie voivodeship									
5	Łopuszka Wielka	2.5	70.7 - 94.5		3.9 - 7.8	5.9	3.0 - 60.0		3.0 - 65.0
6	Siedliska	14.9	55.5 - 95.8	84.7	16.3 - 29.1	24.3	2.8 - 10.1	8.0	26.4 - 56.6
świętokrzyskie voivodeship									
7	Borków-Chwałowice	80.0	72.2 - 95.1	89.5	0.0 - 51.5	25.3	0 - 26.0	8.0	0.0 - 67.0
8	Gartatowice	39.0	78.0 - 97.5	n/a	n/a	6.0	0.5 - 1.0	1.5	
9	Leszcze	62.7	85.6 - 95.9	89.2	2.0 - 39.0	24.7	0.1 - 22.0	5.0	5.5 - 45.5
10	Łatanice-Skorocice	50.4	83.4 - 98.6	88.7	5.0 - 30.0	14.4	0.0 - 4.0	1.0	n/a - 15.0
11	Siesławice	25.0	76.1 - 95.6	93.8	n/a	5.0		1.0	n/a - 8.0
12	Skorocice-Chotelek	99.4	76.1 - 95.6	89.3	3.0 - 31.5	14.6	0.2 - 20.0	3.6	0.0 - 40.8
13	Uników-Galów	93.0	74.9 - 96.5	89.9	2.7 - 40.0	18.9	0.3 - 20.0	7.3	6.7 - 48.4
14	Uników-Galów-Szaniec	40.2	84.2 - 95.0	89.8	2.7 - 37.3	15.4	1.4 - 7.4	4.0	4.7 - 41.0
15	Winiary	84.3	81.7 - 92.3	87.3	15.5 - 44.4	28.4	0.2 - 22.7	6.6	n/a - 60.9
wielkopolskie voivodeship									
16	Wapno	21.1	92.6 - 98.2	94.8	2.5 - 38.8	n/a	5.0 - 44.0		n/a - 54.1

As can be seen, the average content of calcium sulfate dihydrate in the deposit above the weighted average content of $\text{CaSO}_4 \times 2\text{H}_2\text{O}$ for all deposits among the analyzed deposits are Borków-Chwałowice, Leszcze, Uników-Galów. This parameter is not met by the Winiary deposit (87.3%). In this case, it is necessary to consider the part of the deposit with parameters above the weighted average content of $\text{CaSO}_4 \times 2\text{H}_2\text{O}$.

5. CONCLUSIONS

The legal regulation concerning strategic deposits constitutes the long-awaited, formal protection of the state over mineral deposits of special importance. Despite its shortcomings, it constitutes the perspective on the protection of natural resources expected by the mining industry. Of course, it does not solve all the problems related to the initiation of the investment process in the development of new deposits.

All legal tools for the protection of a strategic deposits have been concentrated in the hands of the minister responsible for environment. His competences include, among others, the interpretation of the fulfilment of the criteria for the strategic nature of the deposit and the issuance of a decision on the recognition of a mineral deposit or its part as a strategic deposit.

The article presents a proposal for the interpretation of the fulfilment of the criteria and sub-criteria based on formal, economic factors and statistical analysis.

Taking the above into account, in the author's opinion, the selected gypsum deposits, i.e. Borków-Chwałowice, Leszcze, Uników-Galów and Winiary meet the criteria to be recognised as strategic deposits and entitle the minister responsible for the environment to initiate the procedure specified in Article 94 of the Geological and Mining Act.

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