“The raw material potential of the Czech Republic”

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THE RAW MATERIAL POTENTIAL OF THE CZECH REPUBLIC

Abstract

This article summarizes the information on raw materials in the Czech Republic. Although mining was significantly reduced not long ago, there are still rich deposits of ores, non-metallic raw materials, as well as energetic and construction ones. Many of them are potentially utilizable in future, especially those which are economically favorable, and their mining is not in any conflict with environmental interests. Deposits are distributed irregularly, and their raw materials are different in both the Bohemian Massif and Western Carpathians. In order to be complete, the text also comprises deposits, which are restricted by environmental limits or their mining promises a low-cost effectiveness. The article is amended with actual statistical data.

Keywords reserves, mineral resources, deposit, ores, non-ore minerals, energy raw materials, building materials

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INTRODUCTION

Although the Czech Republic is rich of mineral resources, deposits are distributed very unevenly and subject to local geological structures. In the Bohemian Massif, the important deposits of gold, silver, copper, fluorite and uranium were extracted in the past; nowadays, brown coal, kaolin and construction materials (gravels, sands and aggregates) are dominant raw materials. The Western Carpathians are characterized by rich deposits of energetic raw materials, especially black coal seams, oil and natural gas. Gravel sands and brick clays are utilized as well. Black coal mining, however, is facing economic problems, especially not very transparent privatization process of Ostrava-Karviná mines. The main priority is damping the extraction without any clear concept of the state energetic policy. Any future mining in abandoned ore deposits is problematic – among main strategic raw materials, it is possible to regard only uranium and possibly lithium in the Krušné hory mountains or gold in the Kašperské hory mountains. The article concerns four essential groups of raw materials – ores, non-metallic raw materials, as well as energetic and construction ones. Statistical results are compiled in tables; those raw materials which have a little strategic importance are not comprised.

1. LITERATURE REVIEW

The Czech territory has a long mining tradition. There is a vast amount of literary sources on this theme, so only a small part of them could be utilized in this article. For example, Měchýř and Matějček (1987) inform about a lingering ore mining before the end of middle ag-

es and show how specialists passed into newly opened collieries and coal pits. Cílek, Kotrba, and Majer (2015) describe the wealth of Czech subsurface; they also depict changes of scenery due to tedious mining. The online article by Měchýř and Matějček (1987) deals with the history of uranium extraction and its current status. Other authors interpret the actual situation in Czech mining and its possible perspectives. While Makarius (Starý et al., 2007) engages in legal aspects of mine working, Starý et al. (2007, 2010, 2016) publish annual reviews of raw material sources in the Czech Republic. The same kind of information is included in articles by the Czech Geological Service (ČGS). Smolová (2008) writes about mining in the Czech territory. Coal extraction is a special theme. Besides Měchýř and Matějček (mentioned above), some other authors deal with Czech coal deposits. Havlena (1964), as well as Roubíček and Buchtele (2002), follow both geologic and technical aspects of coal mining, while the article "Studium vybranych" (2008) studies working conditions and risks in the Upper Silesian basin collieries.

2. GENERALIZATION OF THE MAIN STATEMENTS

Czech mining is not in a very good condition now. The last ore mine was abandoned in 2016 and hard coal mining districts in the Bohemian Massif were in fact liquidated. The last one in the upper Silesian Basin is being damped. While there are promising reserves of uranium, lithium or other ores – as well as hard coal in Frenštát – any mining restoration depends on future economic conditions.

2.1. The potential of raw materials in the Czech Republic

As written above, the distribution of deposits within Czech state borders is very irregular – while ores are bound to the pre-platform units of the Bohemian Massif, non-metallic materials (including energetic and construction ones) prevail in the platform sheet and Western Carpathians. Of course, there are some exceptions; black coal is predominately of the Upper Paleozoic age, but isolated deposits of hard coal are of the Cretaceous (Lower Cenomanian) origin (Havlena, 1964). An important secondary deposit of uranium in the Northern Bohemia is also of the Upper Cretaceous age.

2.2. Czech reserves of ores

There were about 180 mined locations of ores in the past – especially silver and other metals (Starý, 2007). In fact, there were significantly more mines. Their remnants are still visible in mountain terrains; unfortunately, reliable maps do not exist, and most medieval records are not fully clear (Měchýř & Matějček, 1987). Mining in the Bohemian Massif has a long tradition – gold was washed here in the 9th century B.C. and later pitmen extracted deposits of silver, tin, lead, copper, etc. During the period 1948–1989, deposits of ores were still economized, but then their mining rapidly decreased (Starý, 2007). In 1994, gold mining was finished in the Zlaté hory mountains (Starý, 2007), but the real end came as late as 2016, when commercial activities were stopped in the uranium shaft Rožná (Historie a současnost těžby uranu v ČR, 2017).

Table 1. Reserves of selected ores as of December 31, 2016

Source: Česká geologická služba (2016).

Ore	Units of measurement	Explored economic reserves	Prospected economic reserves	Potential economic reserves	Total reserves
Gold	tons Ag	48,740	28,644	161,516	238,900
Lithium	tons Li	52,283	72,490	329,804	454,577
Manganese	103 tons	0	0	138,801	138,801
Tin	tons Sn	0	6,887	180,337	187,224
Tungsten	tons W	8,994	10,640	70,845	90,479

Note: The table summarizes reserves of selected ores in the Czech territory (on the date of 2016).

Table 1 does not include reserves of copper, silver and lead, because these reserves are not economically important. One large scale deposit of gold and tungsten is situated in the Kašperské hory and deemed the most perspective ore deposit in the Czech Republic (Starý, 2007), but the deposit is in collision with ecological intents (Starý, 2016). Mokrsko and Kutná hora are exclusive registered

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deposits of gold – nevertheless, their utilization is also blocked by environmental interests. Classical mining is uneconomic and utilizing the cyanide remains out of the question. A new perspective point of interest – lithium – could be mined at Cínovec (today abandoned). Exclusive registered deposits of tin have only poor ores; however, in future, they may become sources of rare elements – rubidium, cesium and tantalum. The Chvaletice deposit might become an important potential source of manganese (Starý, 2016). If the Czech Republic focuses its energetic concept to nuclear energy, two abandoned and conserved deposits (Rožná, Stráž pod Ralskem) can be perspective sources of uranium, as well as the new deposit in Brzkov (Historie a současnost těžby uranu v ČR, 2017).

Starý et. al. (2015) expect a future uranium recovery from exhausted nuclear fuel and current dumps, while Cílek et al. (2015) state that reserves of the uranium ore amount to 100.000 tons, i.e. the same amount which was extracted in the past.

2.3. Reserves of non-metallic raw materials

In the past, three main raw materials were extracted in the Czech territory – glass sands, kaolin and graphite. No later than during the 13th century, glass sands were worked. Kaolin and graphite are mentioned in the 18th century; at the end of 19th century, the production was significantly increased by construction materials (ČGS, 2016). But generally, it is known that especially stone from local sources was widely utilized during the whole middle ages.

Table 2 does not deal with other non-metallic raw materials, i.e. barite, fluorite (sometimes classed as ores), graphite, diatomite, quartz, feldspars and gemstones because their reserves are for the most part negligible. The largest economic reserves are formed by limestone, kaolin and clays; abundant amounts of gypsum are not considered strategic for its surplus production in the process of desulphurization. By contrast, kaolin is deemed a strategic material.

2.4. Reserves of energetic raw materials

Among main energetic raw materials are referred coal, oil and natural gas – the so-called fossil fuels. Within this category uranium should be mentioned as well, but it is a question of view. The Czech Republic disposes of considerable reserves of coal; uranium is regarded non-commercial (Starý, 2010). A possible future utilization depends on economic aspects; however, environmental interests play their role as well.

Regarding coal, there are huge reserves in the Czech territory; other categories are marginal (anthracite, lignite, bog) (Roubíček & Buchtele, 2002). The main amount of reserves appertains to black coal of the Carboniferous and Permian age. Seams were extracted from many locations in the Bohemian Massif. All these mines are abandoned (including rare deposits of the Cenomanian coal). Seams of hard coal are still worked in the Upper Silesian Basin. The material is well coakable, abundant and of good quality. The main problem is, however, the geology of this area and a considera-

Table 2. Reserves of construction materials as of December 31, 2016

Source: Česká geologická služba (2016).

Non-metallic raw material	Units of measurement	Explored economic reserves	Prospected economic reserves	Potential economic reserves	Total reserves
Bentonite	103 tons	74,648	126,877	105,386	306,911
Clay	103 tons	173,407	397,403	349,246	920,056
Dolomite	103 tons	83,872	348,288	93,222	524,464
Glass sands	103 tons	82,321	25,077	144,939	252,337
Foundry sands	103 tons	12,666	133,342	147,227	406,935
Gypsum	103 tons	119,056	302,990	82,137	504,183
Kaolin	103 tons	221,720	498,980	454,892	1,175,592
Limestones, cement materials	103 tons	1,916,799	1,737,433	755,003	4,105,042

Note: The table summarizes reserves of construction materials in the Czech territory (on the date of 2016).

Table 3. Reserves of selected energetic raw materials as of 31.12. 2016

Source: Česká geologická služba (2016).

Energetic raw material	Units of measurement	Explored economic reserves	Prospected economic reserves	Potential economic reserves	Total reserves
Hard coal	103 tons	1,465,793	5,991,317	8,828,495	16,285,605
Brown coal	103 tons	2,203,911	2,059,859	4,465,466	8,729,236
Oil	103 tons	21,428	3,355	5,816	28,959
Natural gas	103 tons	7,381	2,977	20,481	30,839
Uranium	103 tons	1,337	19,448	114,230	135,015

Note: Table 3 summarizes reserves of energetic raw materials in the Czech territory (as on 2016).

ble depth of mining "Studium vybranych" (2018). Working is thus expensive and less efficient mines are either joined up or abandoned. Other perspective deposits were condemned as economically inexpedient, although the Slaný mine was completely prepared for working (1989) and then quickly liquidated (Likvidace dolu Slaný, 2009). The coal deposit in Frenštát (W. Carpathians) is in collision with environmental interests (Starý, 2010) and its utilization in future is not certain – therefore, it is conserved. Geological reserves are estimated at 1,526 billion tons; 259 million tons are obtainable (Starý, 2016). The Czech Ministry of Industry and Trade decided on depreciating the reserves of deposit Frenštát–West (September 30, 2002) – 147,389,000 tons of free explored economic reserves, 574,189,000 tons of free prospected economic reserves and 54, 191,000 tons of blocked prospected economic ones were converted into noncommercial reserves. According to § 14a, clause 2, letter b) of Act no. 44/188 Coll. (working out is not economically appropriate). The Frenštát deposit is unique from the geological point of view – it is the only large deposit of superior black coal in the Czech Republic, which may be worked in future. The Czech raw material policy protects this location, since it is the last utilizable deposit of black coal (Makarius, 2009). Another possible mining area of hard coal is situated in the Roudnice – Mšeno basin, but various interests collide here as well. Significant reserves of the Miocene brown coal are confirmed in four isolated basins (Cheb, Sokolov and Most; the Zittau Basin meets the Czech territory only marginally and The Cheb Basin is not active. Reserves of Sokolov and Most Basins were blocked by territorial limits of mining (it was a solely political act – Government decision no. 444/1991). Environmental interests were adduced as the main reason. In the case of Sokolov, these limits were discharged in 1993 by the Government resolution no. 511. In the Most Basin efforts to revise the original decision are still stronger – territorial environmental limits block 954 million tons of superior brown coal (Starý, 2007). In the case of Bílina open pit mine, these ambitions were partly successful. Deposits of oil and natural gas are located in the Southern Moravia, the Bohemian massif and the Upper Silesian Basin; nonetheless, these sources have no strategic importance. They are not sufficient and cover about 3–5% of domestic consumption (Starý, 2007).

CONCLUSION

The article on the raw materials in the Czech Republic handles the primary information regarding this theme. There are four basic groups: ores, non-metallic raw materials, energetic raw materials and construction ones. Deposits worked in the past are not economically utilizable (gold, silver, lead, copper, etc.), while the Kašperské hory with reserves of gold and tungsten are favorable, but in a cardinal collision with environmental interests. Deposits of gold in Mokrsko and Kutná hora are in this collision as well. Reserves of lithium in the Krušné hory mountains (Cínovec) are – on the contrary – very prospective. Deposits of non-metallic raw materials (barite, fluorite, graphite, diatomite, etc.) are lean, having no economic importance. Other materials (limestones, cement rocks, kaolin, clay materials) are abundant. Among energetic raw materials the most important is coal – both black and brown. Hard coal is

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worked in the Czech part of the Upper Silesian basin, but its economic significance decreases. The deposit in Frenštát is prospective but blocked because of collision of interests (the same is valid for reserves at Mšeno). Other hard coal deposits are not exploitable. Brown coal is mined in two separate basins in the North-Western Bohemia; however, significant reserves (almost one billion tons) are blocked by territorial mining limits. Mining the uranium deposits depends on a future state energetic policy.

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