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Several Primacies of Jáchymov Town and Their Significance for Geotourism

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Abstract. The contemporary Jáchymov, a small spa town in Krušné hory in the Czech Republic, has always had an important role in the country's economy. Among the many ores in the Jáchymov deposit, silver and uranium have been most important. The discovery of silver ores attracted many people in the past, and soon one of the biggest towns in the country was established. The history of the town is connected with many famous scientists interested in inanimate nature, who either visited Jáchymov or lived there. Among the greatest personalities connected with the history of Jáchymov, there is Georgius Agricola and Marie Curie-Skłodowska. From the historical point of view, Jáchymov aspires to become an important centre of global geotourism in the future.

1. Introduction

Jáchymov (**Figure 1**) owes its existence to the rich deposit mineralization discovered at the start of the 16th century. Silver ore extraction and valuable taler coinage brought about a fast development of the town. The importance and riches of the town have been manifested to date in the many buildings situated in the town's conservation area and its valuable complex of Gothic-Renaissance patrician houses. For many centuries, Jáchymov was an important centre for arts, science and mining education. In the 20th century, this mining town was connected with massive exploitation of uranium mineralization. When uranium extraction was terminated in the early 1960s, the originally mining town became a unique spa town with radon mineral water. The contemporary spa resort tourism is complemented by other less traditional forms of tourism. Geotourism is very popular due to the town's rich history. The Czech Republic is proud of a number of mining localities and their rich history [1- 3].

2. Jáchymov ore deposit

This hydrothermal deposit [4 - 6] is located in the bedrock of the town and its surroundings. As for the metallogenic zoning of the Bohemian Massif, it belongs to the Saxon-Thuringian zone, Krušné hory (Erzgebirges) sub-province. The deposit is bordered by thick faults, which also relates to the distribution of ore veins. The most important veins are the five-element formations (Ag – U – Bi – Co – Ni). Out of



the rich range of elements, extracted were also the ores of tin, lead, copper, iron and manganese. Sunrise and midnight veins were in the centre of focus in the past. Sunrise veins run in the east-west direction, and were not that significant for the deposit. They are low in mineralization, or the mineralization is missing. On the contrary, midnight veins, running in the north-south direction, are the source of ore-bearing mineralization. The vein group may be divided into 3 sub-groups: veins in northwest-southeast direction, north-south direction, and northeast-southwest direction. Contrary to the sunrise veins, the midnight veins are more stable and vary in thickness. The veins have frequent secondary veins, often with richer mineralization than the master vein. The vein system is developed in metamorphic rocks (mica schist series) and granitoids.

3. Brief history of Jáchymov

The first documents in writing about the locality come from 1300 and refer to a settlement called Conradsgrün, when ore mining was still negligible. A rich silver deposit was discovered in 1516 by Štěpán Šlik, which led to the establishment of contemporary Jáchymov town (Sankt Joachimsthal) [7, 4]. In 1520 Ludwig II Jagiellon appointed Jáchymov a free mining town and the town also had the right of coinage. The significance of ore extraction and coinage mirrored in the town development. The documents of the period state that in 1535 there were 1200 houses in the town with more 18000 inhabitants. The Šlik Family lost their rights to Jáchymov in 1547. A prominent decay started to occur at the beginning of the 17th century, when the master silver-bearing veins were exhausted. Only about 2000 inhabitants lived in the town then. The number of inhabitants dropped also because of re-catholicization of Jáchymov. Several years after the execution of Jáchym Ondřej Šlik, their bastion castle Freudenstein burnt up. The mint closed down in 1671. Silver extraction continued only in several mines. Due to silver shortage in the country, the extraction had to be subsidised. For this reason, a state miners' apprentice school opened there in 1716. While the 18th century saw an interest in silver, lead and cobalt ores, the focus in the 19th century was on uranium. In the 20th century, uranium was in the centre of attention, particularly after the Second World War. At that time, first German prisoners of war and later Czech prisoners of conscience had to work in the mines. At that time, many historical monuments were destroyed or in the state of disrepair. When comparing the years 1930 and 1991, one third of the buildings disappeared and the number of inhabitants dropped by more than a half. Already back in 1906 the radon water began to be slowly used for the purposes of balneology. This has lasted to date, with Jáchymov being a spa town.

4. Jáchymov – important discoveries and world-wide primacies

4.1. The discovery of uraninite (pitch ore)

The discovery of the mineral is closely related to silver extraction. The mineral was discovered by miners back in the 16th century and they called it 'Pechblende'. The name captured the fact that the veins were the so-called five element formations (Ag – U – Bi – Co – Ni) containing Ag, Bi, Co and Ni mineralizations in the upper to medium layers, with the uranium mineralization situated below. When the Pechblende mineral was exposed during extraction, it became an indicator of the lack of silver in the given depth [7, 4].

4.2. Work of Georgius Agricola

Georgius Agricola (Georg Bauer) was born on 24 March 1494 in Glauchau. During his life he studied philology, theology, philosophy, and later also focused on natural science and medicine. He studied in Leipzig, Basel, Bologna, Venice and Ferrara. In 1527 he became a physician and apothecary in Jáchymov. During his studies, Agricola realized how insufficient the knowledge on inorganic substances was at that time even though they were used for medicinal purposes. In Jáchymov it was possible for him to study minerals and rocks as well as he learnt about mining, processing and metallurgy. Thanks to the boom of mining in Jáchymov, he met many European experts who came to the town. He transformed the knowledge he acquired into many scholarly works that were very advanced for the era.

They dealt with mineralogy and geology, miners' work, mine workings, mine machinery and ore dressing. His biggest scientific work "De re metallica libri XII" was published shortly after his death. It is an outstanding work dedicated to mining and metallurgy, where the text is accompanied by a number of graphic wood-engravings. The book was used as a textbook for many centuries, has been translated into many languages, and its translations have been published to date. He has been referred to as the Father of Mineralogy. Georgius Agricola died on 21 November 1555 in Chemnitz and was buried in the Cathedral of St Peter and Paul in Zeitz [8, 9].

4.3. *Johannes Mathesius – sermons for miners*

Mining includes a range of activities, which start with mineral resource prospecting and exploration. It was necessary for the people who did the job to be knowledgeable and skilful in many respects. In Jáchymov educational efforts can be traced back to the very start of mining. Surprisingly, the first efforts were lectures by a Lutheran priest Johannes Mathesius (1504 – 1565). He came to Jáchymov at the time of its boom. In 1532 he became the rector of the Latin school in Jáchymov. In 1540 he went back to Germany, where he finished his university studies and he returned to Jáchymov as a Lutheran priest. He spread the teachings of his friend Martin Luther. He got married in Jáchymov and raised 8 children. Despite lucrative offers from Germany, he decided to live in Jáchymov. The priest and theologian got acquainted with mining when he was a child as his father was a not very successful mine owner. He could pursue his interest in the natural science, mathematics and alchemy in Jáchymov, where he also studied the works by world scholars. He started a mineralogical collection, and published his own works amounting to more than 50 books and treatises [7,4].

4.4. *Establishment of the first miners' higher apprentice school*

Although miners were trained in other countries too, the level set by the Jáchymov apprentice school was very high. The apprentice school was established through Charles VI's order of 13 October 1716. At that time, it was the only mining school world-wide. In 1725 a similar apprentice school was opened in Banská Štiavnica in Slovakia. The training lasted for two years in Jáchymov. Each year, four most talented miners were admitted, who at the end of their studies had to pass a public both theoretical and practical examination from mining and metallurgical science. If needed, the employer subsequently sent them abroad to get more experience. In 1733 new instructions were introduced into the training, the author of which was a mining inspector Jan František Lauer. The training included compulsory mathematics, laboratory practicum, and study of Latin textbooks. The apprentice school was closed down on 10 March 1762 through Marie Terezie's patent, and the training was transferred to the university in Prague [7, 4].

4.5. *Production of uranium dyes*

In the 19th century, the extraction of silver ores was falling in Jáchymov, and uranium ore got in the centre of attention. Uranite began to be used as a non-metallic mineral in the production of uranium dyes. At the beginning, the production followed a simple formula and could not be considered industrial production. Thanks to the Czech chemist and later a professor of the Příbram Mining Academy of Adolf Patera, a cheap method for industrial production of uranium dyes was prepared in 1847. The industrial production was started in k. k. Urangelbfabrik in 1855 in the premises of the former, rebuilt Lintacker's silver metallurgical works. At first, uranium yellow was made only, and the dye range widened later on. The industrial use of uranium projected into its price. From 1842 its price began to soar and ten years later, it was more than tenfold. Between 1859 and 1876 Jáchymov metallurgical works produced 67207 kg of uranium dyes at the price of 1.5 million golden florins. The products found their market abroad soon and obtained several awards. The increased production meant that in 1871 the factory had to be rebuilt and the production increased significantly. The factory became the biggest one of its kind world-wide. Most uranium dyes were exported. At the end of the 19th century, the interest in uranium glass dropped. At the start of the 20th century, the building was predominantly used as a spa. It was rebuilt again in 1927. Both uranium dyes and radium were produced there. The production was

terminated in 1939 and the building, which was several hundred years old, was demolished in 1940 [7, 4].



Figure 1. Jáchymov and its Radium-Palace Hotel in the forefront (a postcard from the start of the 20th century). (authors' archive)



Figure 2. Radon water carrier for the first spa J. Prennig – 1906 (postcard) (authors' archive)

4.6. *Marie Curie-Skłodowska – discovery of radium and polonium*

The maiden name of the famous scientist and two Nobel-prize winner was Maria Salomea Skłodowska (1867-1934). She was born in Poland, but she pursued her research in physics and chemistry in France. Among her various accomplishments, she discovered two new elements, i.e. polonium and radium. The last decade of the 19th century brought new discoveries in radioactive radiation (e.g. by W. Roentgen in 1895 or by H. Becquerel in 1896). Building on previous discoveries, the researcher and her husband, Pierre Curie, focused on the research in uranium ore and waste from uranium dye production in Jáchymov. In 1898 they announced the discovery of a new element - polonium (Po), which was named after her home country, Poland. By the end of the year, they announced the discovery of radium (Ra). They introduced the term of radioactivity during their research. She first succeeded in separating a few grams of radium from several tons of waste from the uranium dye production. Jáchymov benefited from the discovery and could produce the element for free. In 1911 Marie Curie-Skłodowska was awarded a Nobel prize for the discovery of radium, polonium and further research of radium. In 1934 she died of aplastic anaemia, which had likely been caused by radioactive radiation, to which she had been exposed for many years [10, 11].

4.7. *Radon spa*

Already back in the 19th century, miners discovered a powerful mineral spring in the Svornost Mine, which flooded the mine gradually. Thanks to Josef Štěp, an engineer, and doctor Leopold Gottlieb radon water began to be used for spa purposes in 1906 (**Figure 2**), when the first thirty guests were treated there. The unofficial spa baths were located in the baker Kühn's house. A bigger building, Radium-Palace Hotel, was constructed as a result of the increase in the number of visitors, and it was opened in 1912. The magnificent hotel belonged among the ten most luxurious hotels in Europe and its clients were world leading personalities. In the course of the years, the accommodation capacity was extended into the surrounding bath houses and private boarding houses. In the 1930s, the annual attendance was about 9000 people. The Second World War and the post-war period stopped the development, and both the town and spa began to decay. During the Second World War, Jáchymov was the hospital town for the German army. When the war ended, the state focused on the extraction of uranium. The town regained its status of a spa town in 1963, when the extraction of uranium was terminated in Jáchymov. The development of the spa continued until 1992, when it became a joint-stock company. The current capacity of the spa is 1100 beds [12, 13, 14].

5. Conclusion

The international significance of Jáchymov is documented by many historical events related to the whole town history. It started with the discovery and extraction of silver ores, which played an important role in the town establishment. The coinage of valuable coins and their economic significance also led to the name of the US currency. As for mineralogy, the deposit belongs to the richest ones world-wide. Over 400 minerals were discovered there in the course of the centuries, which aroused interest of many scientists. The studies led to many scientific works in many scientific disciplines. The deposit rendered a high number of mineral resources during the centuries, which helped economically the whole country. At present, the small spa town Jáchymov makes part of the world spa tourism. New non-traditional forms of tourism, such as geotourism [15, 16], are currently on the increase world-wide. Jáchymov has set on the geotourism journey thanks to a number of enthusiasts and may become one of the world leading destinations in the future.

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