

State of mining, prospecting and research of ore deposits in the Palaeozoic of Moravia and Silesia (with emphasis on the Jeseníky Mts. area)



Stav těžby, prospekce a výzkumu rudních ložisek paleozoika Moravy a Slezska (s důrazem na oblast Jeseníků) (Czech summary)

(1 text-fig.)

JAROSLAV AICHLER¹⁾ - IVAN BUSSINOV²⁾ - FRANTIŠEK KALENDA³⁾ - JAN URBÁNEK⁴⁾

¹⁾ Český geologický ústav, 790 01 Jeseník

²⁾ RD Jeseník s.p., 790 01 Jeseník

³⁾ UNIGEO a.s., 793 76 Zlaté Hory

⁴⁾ Geologie Rýmařov s.r.o., 795 01 Rýmařov

Presented January 27, 1993

Recently only three ore mines are in operation on the territory of Moravia and Silesia: uranium mines Rožná-1 and 2, and Au-Zn deposit Zlaté Hory - west. Prospecting, exploration and research of ore deposits, the exploitation of which was possible only because the mining was subsidized by the Government, have ceased or were strongly reduced. Besides the possibility of unknown large deep-seated deposits the existence of smaller vein and stockwork base metal and gold-bearing ore bodies with higher grades may be expected in the Jeseníky Mts. area.

Despite of the recent situation in the ore mining industry the huge amount of geological information, acquired in the last four decades, is to be preserved, systematically assessed and used in the current and future geological, metallogenetic and environmental research and mapping and land use planning. The possibility of an alternative utilization of the abandoned mines and conservation and/or admission of some valuable ore deposits should be assessed as well as their recent and future environmental impacts.

Introduction

On the territory of Moravia and Silesia in the Czech Republic important deposits of iron, gold, silver and base metals were intensively mined in the past. In the recent history uranium ores have been discovered and mined. Complex geology of the eastern part of the Bohemian Massif and the Brunovistulicum gave rise to many ore deposits and mineral showings related mostly to magmatites and regional metamorphosed sequences.

The territory of Moravia and Silesia belongs, according to Vaněček et al. (1985), to three metallogenic subprovinces and/or regions: East - Sudetic subprovince, Brunnia and West Moravian metallogenic regions.

The East-Sudetic subprovince is characterized by the occurrence of iron, base-metal and gold deposits. Within the Brunnia metallogenic region, a few occurrences of Mo and base metals are known.

The West Moravian metallogenic region is typical of the presence of uranium ore deposits, abundant Pb-Zn±Ag vein ores and iron skarns. Mostly veinlet and disseminated ores which form lenticular bodies of the most important uranium Rožná-Olší district are situated in a fault zone forming the eastern

margin of the Moldanubicum (Arapov et al. 1984). The world-famous historical district of Ag-bearing base metal ores is located at Jihlava (mined from the first half of the 13th century). Tens of ore occurrences of similar type were mined near Telč, Dačice, Velká Bíteš, Tišnov, Štěpánov and Kunštát (Bernard - Pouba et al. 1986).

The mining of hundreds of small iron deposits of different types gave origin to local metallurgical industry in Moravia and Silesia. Five major genetic types of iron ores, of various age, can be distinguished: 1) probably Upper Proterozoic banded magnetite ores of Sydvaranger type (Pouba 1970), 2) magnetite skarns in the Moldanubicum and in the Svatka anticline, 3) Devonian magnetite-hematite ores of the Lahn-Dill type in the Jeseníky Mts. and the Dražanská vrchovina Highland areas, 4) limonite fills of the karst cavities in Devonian limestones, 5) argillaceous iron ores in Cretaceous and Paleogene strata of the Silesian unit of the Western Carpathians (Bernard - Pouba et al. 1986).

The known occurrences of Mn, Ni, Cr, Ti, Al, Sb, Hg, Mo, Sn and W ores of Moravia and Silesia are recently of no economic importance.

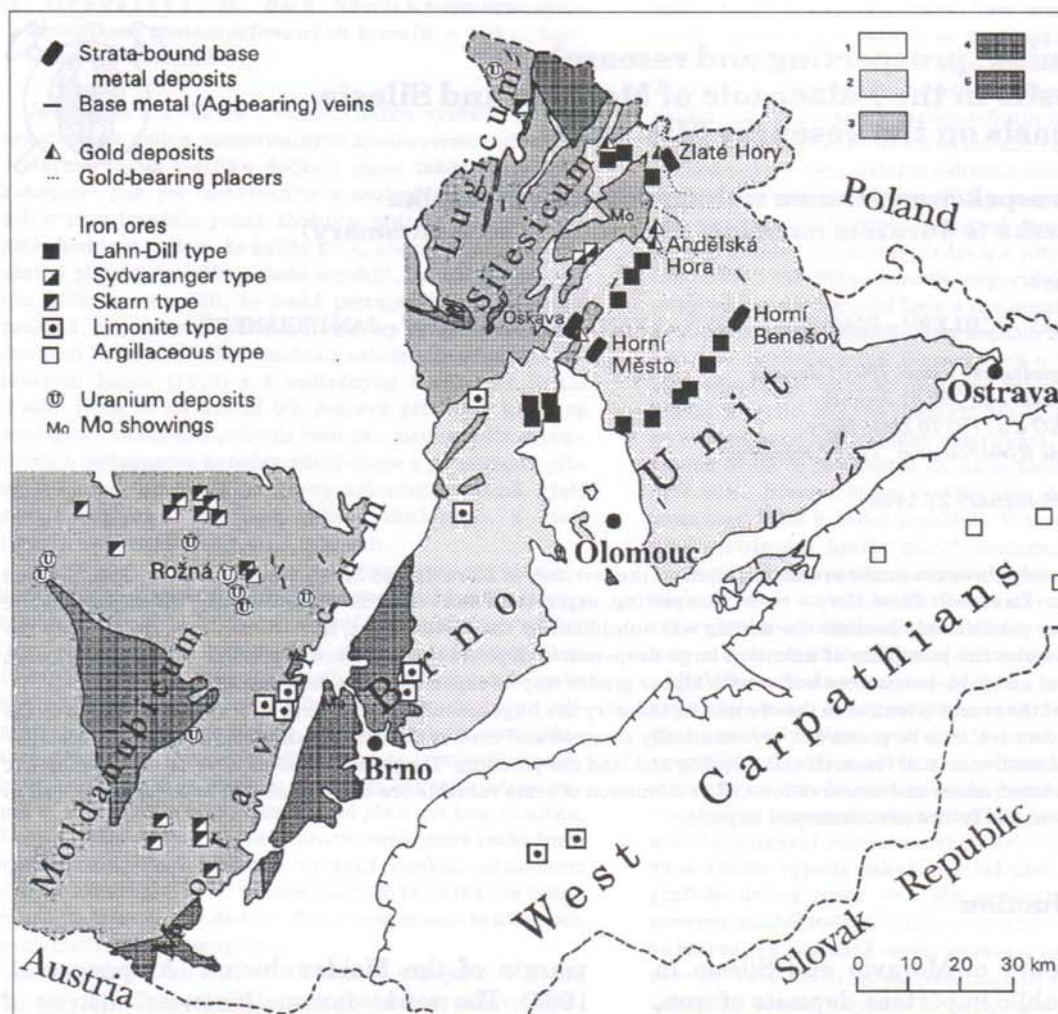


Fig. 1. Ore deposits and main occurrences on the territory of Moravia and Silesia (modified after Ilavský - Sattran et al. 1966 and 1981).

1 - Post-Carboniferous sequences, 2 - Devonian and Carboniferous sequences, 3 - pre-Devonian (Proterozoic) basement, 4 - Variscan granitoids, 5 - pre-Variscan granitoids.

Ore deposits of the Jeseníky Mts. area

The most important ore deposits, mined on the territory of Moravia and Silesia in the 20th century, related to Palaeozoic units, occur within the East-Sudetic subprovince of the Jeseníky Mts. area. Devonian and Lower Carboniferous sequences of the Moravo-Silesian zone were classified by many authors among the Rhenohercynicum. The origin of ore accumulations during the Variscan metallogenic process in the Jeseníky Mts. area is related to: 1) submarine mafic and felsic volcanism (iron ores of Lahn Dill type and stratabound Pb-Zn-Cu-(Au) ores), 2) remobilization and redeposition of metallic ores within sedimentary and volcanic sequences by the Variscan metamorphism and deformation (vein and "stockwork" gold-bearing and base

metal mineralizations), and 3) late synorogenic intrusions (molybdenite occurrences and scheelite-bearing skarns) (Skácel 1987).

Submarine hydrothermal activity and convective hydrothermal systems accompanying Devonian crustal extension, comparable to the modern systems at spreading centres, are assumed to have existed in this region (Orel et al. 1986). An important influence of upper crustal rocks as the source of metals during formation of these deposits and the majority of other types of deposits is indicated by high radiogenic lead of these ores (Vaněček et al. 1985). The sulphur derived from the marine sulphates and the sulphur mobilized by hydrothermal solutions from the neighbouring sedimentary and volcanic rocks are thought to

have played the major role during the formation of the stratabound base metal deposits of the Silesicum (Hladíková et al. 1990).

Strata-bound base metal deposits

The stratabound base metal deposits (Zlaté Hory, Horní Město, Oskava, Horní Benešov,.) occur within and/or in close vicinity of Devonian felsic volcanics and their tuffs. Their submarine exhalative origin within the volcano-sedimentary sequence has been advocated by many authors (Havelka et al. 1963,.). The deposits were largely affected by the Variscan tectonic and metamorphic events. The ores were mostly recrystallized and/or remobilized. Disseminated, streaky and irregularly banded ores are composed of prevailing pyrite, sphalerite, and less abundant galena. Pyrrhotite and chalcopyrite are more common in the Zlaté Hory ore district only, being mostly separated from Pb-Zn ores. Barite often forms separate lenses in the vicinity of stratabound sulphide bodies.

An extensive prospecting, exploration and research focused on search for ore deposits began in the Jeseníky Mts. area during the fifties and continued until the end of eighties. New stratabound copper and base metal deposits, partly with gold, were discovered and a few mines were producing copper (Zlaté Hory - south and Hornické skály) and lead-zinc concentrates (Horní Město, Horní Benešov) accompanied by gold as the by-product. The total potential of mostly low grade sulphide ores within Devonian volcanosedimentary sequences in the Jeseníky Mts. area has been established at about 100 mil. metric tons (13 mil. tons were extracted until now).

Lead-zinc and Ag-bearing veins were also mined in the Culm of the Nízký Jeseník Mts. and the Oderské vrchy Highland (Fulnek, Budišov, Velká Bystrice,.) in the past.

Gold mineralizations

The origin of gold mineralizations in the East Sudetic Subprovince is attributed by many authors to the Variscan regional metamorphism. Flow of the released fluids was controlled by existing PT-gradient during the Variscan tectonic processes. Besides gold in base metal ores occurring mostly in the structure of pyrite and chalcopyrite, some native gold exists in quartz of low to high grade metamorphosed rocks (Zlaté Hory - Marie

Pomocná, Zlatý Chlum, Dobřečov,.) and quartz-carbonate veins with sulphides in black slates (the Andělská Hora ore district).

The gold mining in the Jeseníky Mts. area started probably in the Late Bronze Age. Recorded mining of gold and silver goes back to the 10th-12th centuries. Then, the mining operations were gradually reduced during the 13th-16th century and ceased completely at the end of the 19th century. Proved reserves of about 40 t of gold as metal were established in the Silesicum including the stratabound sulphide ores (43 %), gold-bearing vein and stockwork deposits (53 %) and placers (5 %). Large extensive gold-bearing placers along the slopes of the Hrubý Jeseník Mts. are being presently explored but to certain extent only.

Present state of ore mining industry and its future

Recently, only three ore mines are in operation on the territory of Moravia and Silesia: uranium mines Rožná-1 and Rožná-2 and Zlaté Hory - west, producing Au and Au-Zn concentrates. A program leading to the reduction of the ore mining was launched by the Czech Government in 1990. It was based on economic criteria of mining and processing of the non-ferrous metals. The exploration projects were mostly abandoned and the research programs were considerably reduced. The mining of Cu-ores in Zlaté Hory ore district (ZH-south and ZH-Hornické skály) ceased completely including the capital investment in the hydrometallurgical plant in Bruntál. The Horní Benešov mine was closed in 1992.

The previous extensive prospecting, exploration and research projects in the Jeseníky Mts. area were intended to search particularly for the large volume low-grade mineral deposits whose development and mining was possible only when heavily subsidized by the state. The only attention subsidy wise was paid to the richer ore bodies located in younger structures within the low-grade stratabound sulphide deposits. These richer ore bodies represent only 5 to 10 % of the total low-grade sulphide ores within the separate districts/deposits ranging from 5 Mt (Oskava) to 30 Mt (Zlaté Hory). In addition to as yet unknown large deep-seated ore deposit, some smaller vein and stockwork ore bodies of size 0.1-0.5 Mt of polymetallic ores (of the grade 1-3 % Pb, 4-6 % Zn, 35-50 g/t Ag, $\pm 0.5-2$ g/t Au, $\pm 0.2-1$ % Cu) or gold-bearing ores (50-

100 kt grading 5–10 g/t Au) are likely to occur here.

The future mining of the Zlaté Hory ore district and other deposits, will depend on the metal prices and economic situation of the mining companies. The proved reserves remain protected. The liquidation plans enable the eventual revival of the mines. The use of tailings after mineral processing for the manufacture of prefabricated components and the impact of mining-related pollution have been recently investigated.

Conclusion

Regardless of the present unfavourable situation, an immense amount of geological

information, acquired in the past and particularly in the last four decades by different geological enterprises, Geological Survey, museums and universities, is to be preserved, systematically assessed and used in the current and future geological, metallogenic and environmental research, mapping and land use planning. An optional utilization of the abandoned mines and workings should be explored including their recent and future environmental impacts. Conservation of/or access to some mineral deposits, which are valuable from the historical or geological point of view or which could be mined in the distant future, will be surely appreciated by the next generations.

Translated by J. Aichler

References

- Arapov, J.A.* et al. (1984): Československá ložiska uranu. – ČSUP, Příbram.
- Bernard, J.H.* – *Pouba, Z.* et al. (1986): Rudní ložiska a metalogeneze československé části Českého masívu. – Ústř. úst. geol. Praha.
- Havelka, J.* – *Palas, M.* – *Scharm, B.* (1963): Nová koncepce metalogeneze neželezných rud v jesenické provincii a její dopady na geologický průzkum. – Geol. Průzk., 8, 225–227. Praha.
- Hladíková, J.* – *Šmejkal, V.* – *Fojt, B.* – *Pertold, Z.* – *Aichler, J.* (1990): Izotopické složení síry, uhlíku a kyslíku vybraných lokalit Jeseníků. – Sbor. geol. Věd, ložisk. Geol. Mineral., 29, 141–165. Praha.
- Ilavský J.* – *Satran V.* et al. (1966): Metalogenetická mapa ČSSR, 1:1 000 000. – Ústř. úst. geol. Praha.
- (1981): Metalogenetická mapa ČSSR, 1:500 000. – Ústř. úst. geol. Praha.
- Orel, P.* et al. (1986): Prognózně ložiskové zhodnocení struktury Šternberk – Chabíčov. – MS Čes. geol. úst. Praha.
- Pouba, Z.* (1970): Pre-Cambrian banded magnetite ores of the Desná Dome. – Sbor. geol. Věd, ložisk. Geol. Mineral., 12, 7–64. Praha.
- Skácel, J.* (1987): The Silesicum and adjacent parts of the Lugaicum ore deposits and metallogeny. – Excursion guide, Inaugural Meeting of IGCP 254 in Jeseník, 15–23. Praha.
- Svoboda, J.* et al. (1966): Regional geology of Czechoslovakia. Part I. The Bohemian Massif. – Ústř. úst. geol. Praha.

Stav těžby, prospekce a výzkumu rudních ložisek paleozoika Moravy a Slezska (s důrazem na oblast Jeseníků)

Na území Moravy a Slezska se v minulosti těžila významná ložiska železa, zlata, stříbra a barevných kovů. V současné době jsou zde činné pouze tři doly, těžící uranové (Rožná-1 a 2) a Au-Zn rudy (Zlaté Hory – západ). Prospekční, průzkumné a výzkumné práce na rudních ložiscích, jejichž těžba byla většinou možná jen za předpokladu státních dotací, byly zastaveny nebo silně omezeny. Vedle možnosti nalezení většího neznámého skrytého rudního ložiska lze v oblasti Jeseníků očekávat existenci menších žilných a žilnkových rudních těles polymetalických a zlatých rud s vyššími kovnatostmi.

I přes současný útlum těžby rud je nezbytné zachovat a systematicky zhodnotit rozsáhlé množství geologických informací, získané v uplynulých desetiletích při rudní prospekci, průzkumu a těžbě, a využít je pro geologické studie a mapování, stejně jako pro potřeby ochrany životního prostředí a územního plánování. Současně je třeba zvážit možnosti alternativního využití opuštěných dolů, jejich konzervaci, ev. zpřístupnění, a minimalizovat jejich negativní vlivy na životní prostředí.