FRAME
FORECASTING AND ASSESSING EUROPE'S STRATEGIC RAW MATERIALS NEEDS

Newsletter
OCTOBER 2019

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Welcome to FRAME Newsletter #4!

It has been a busy time for FRAME in particular for WP8 (Link to the Information Platform). This work package requi deliver the final data package to the Information Platform as well as testing of internal means in terms of data storag treatment and delivery.

Because data and data delivery is such an integral part of this work package, a workshop focusing on this was pro in mid-September. A “Data Collection and Harmonisation workshop were the work package leaders representing 7 EU countries (Portugal, Germany, Sweden, Belgium, No Finland and France) as well as members of Mintell4EU and several IT experts from various countries. Discussion fruitful and useful to streamline and flow for the supply of prospectivity maps for critical and strategic minerals in Europ This workshop once again highlighted the connectivity and interaction between the Raw Materials projects as we other current H2020-funded projects dealing with Raw Materials.

Daniel de Oliveira, FRAME Project Coordinator

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GeoERA RAW MATERIALS

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Petr Rambousek (CGS), Henrike Sievers (BGR), Stanislaw Mikulski (PGI-NRI)

Europe is largely dependent on global raw materials markets and supply from international sources, but ha a long mining history. FRAME WP7 investigat whether historic mine sites have the potential to feed into Europe's future d only the main commodities, but also CRM might still be contained in the remaining resources of those deposi as well as in mining and processing wastes.

WP7 partners CGI, PGI-NRI and BGR together visited the historic mining are the Czech Republic to collect more information on mine wastes and their potential for CRM.

Kutná Hora

The polymetallic Kutná Hora ore district (Ag, Pb, Z located about 70 km E from Prague, represents characteristic Variscian vein type polymetalli mineralization in the Bohemian Massif. The vertical development of the mineralization shows similaritie with ore deposits in the Freiberg area in Saxony. T mining activity can be traced back to the 10th centu and continues until the in Kutná Hora are known to contain Bi, Cd, In and Sl Nowadays the mines are closed and flooded (sin 1991) and the tailings pond from modern mining ha been rehabilitated. Accessible dumps from olde mining activities exist in the area. From 1290 until 180 Kutná Hora produced 2,500 t of silver. During the las mining campange in the 20th century over 2.3 Mt or with 2% of Zn and 0.4% Pb were excavated from t Turkank mine in the northern part of ore district. Thi ore contained also up to 350 g/t Ag and In in sphalerite (0.02 to 0.11wt.%). It was calculated that the remainir reserves and prospective resources contain 60 t of Ir

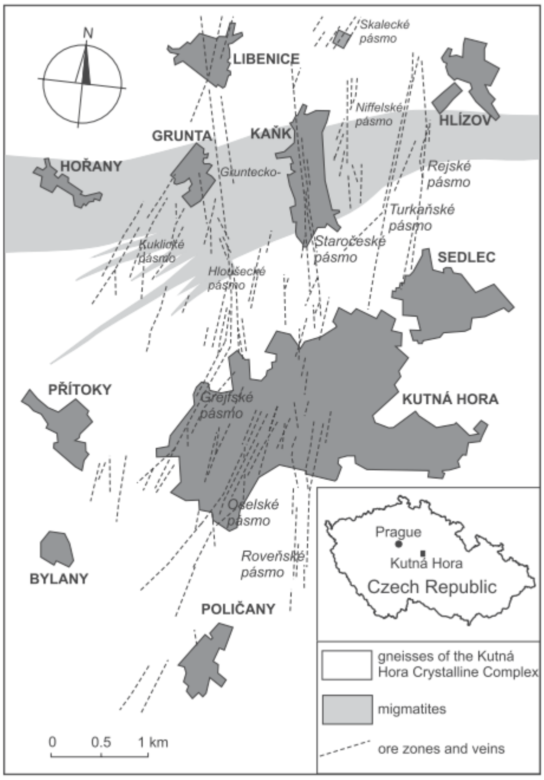

Figure 1: Schematic map of the Kutná Hora ore district
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Today the Turkaňk rehabilitated by the state company DIAMO. Mine water with higl content of As and other heavy metals is pumped t the surface for treatment before its release to a nearby stream.

Ancient mining activities are still influencing the are today. The collapse of a large mining chamber caus an about 100 m long sinkhole, which is located east the village Kaňk.

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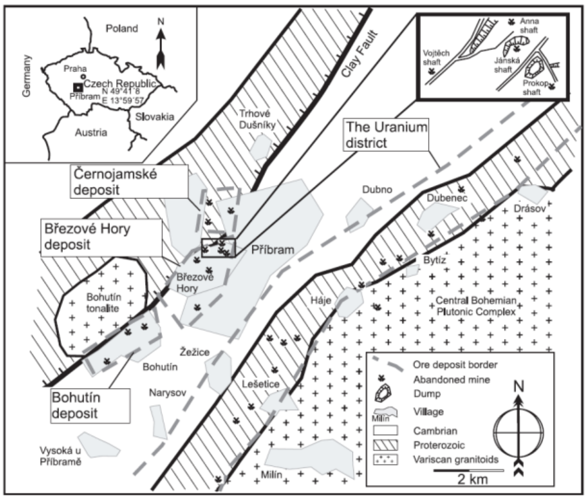

*Figure 3: Schemat*ƛ Ŏ Ƴ ŀ LJ ƻ Ŧ ű Ʀ Ŝ ƚ ŋ
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The medieval adit St. J is part of the mining-historical exhibition of the Czech Museum of Silver and can be visited in the historic center of Kutná Hora. This adit was discovered in 19 during a hydrogeological survey.

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Příbram is located abou world known polymetallic and uranium hydrothermal deposit. The district contains perigranitic veins ar polymetallic deposits in two NE-SW trending zones, which are about 25 km long and 1-2 km wide. The northern zone contains the polymetallic mineralization with Ag, Pb and Zn, the souther mostly uranium, but with occurrences of polymetallic minerals.

Polymetallic base metal ores with Ag, were mine from 11th century on, while uranium mining startec after the 2nd World War. Potential CRM contained i polymetallic ores were out of interest during the mining of U ores and were left on large dumps. Afte the end of the mining activity in 1991, the rehabilitation of this area began.

Mining areas with polymetallic ores we rehabilitated, but the U mining left many hu dumps with an expected rest of base metals potentially CRM. The state company DIAMO sta a project for rehabilitation of these areas.

The dumps with a total volume of over 25 Mm3 mining waste will be removed to one central dum for sorting the materials for base metals ores w CRM, U ores and building stones. In general, entire area is well documented from the geolog point of view, but there is only little informatic about the content of minerals in the dumps.

During their visit, the FRAME partners had opportunity to see the radiometric sorting faciliti of the company Ecoinvest and a test facility of company DIAMO, where sorting is based on X-ray analysis of the rock.

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C ƛ ∃dzNJŜ ғBrod. Mining County with huge dumps

During the period between 1945 and 1991 the whol ore district produced more than 65,000 t of Pb (P ore grade 1.34 %), 509 t of Ag (Ag ore grade 146 g 37,600 t of Zn (Zn ore grade 0.85 %), 11,000 t of Sb (Sb ore grade 0.25 %) and 48,432 t of U (max. gra up to 100 kg U/m2). In total 23 km of shafts an 2,188 km mine tunnels were built. As the first min in the world the depth of 1,000 m was reached i 1,875. The deepest shaft in the district was uranium shaft No. 16 (1,850 m)

Figure 5Y { ƻNJű ƛ ƴ∃ Ŧ ŀ Ŏ ƛ ƒ ƛ ű ƛ Ŝ ă (company Ecoinvest)

Presently the only mining activity is from the dump by the company Ecoinvest. Annual production is ov 400,000 t of sorted and crushed building stones ar additionally 400 t of U ore (uraninite and antraxolite is extracted from the dumps and sent to the processing facility in Dolní R Moravia for U extraction.

Today DIAMO uses former buildings of shaft No. 15 a central archive. The Mining Museum P-ř known mineralogical collection and exposition

Figure 6: Native silver on the quartz-carbonate (Barbara vein, ű K Ŝ . nj Ŝ Î ŀ Ǿ Ş l ƻNJè ŀNJŜ ŀ ú Σ a ƛ .

Acknowledgements

The participants of this field trip thank DIAMO for allowing access to the mining objects and for detaile explanations. Many thanks to the Czech Museum of Silv in Kutná Hora and also t(part of the GeoERA FRAME project this field trip w supported by Czech Geological Survey

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Preliminary prospectivity mapping on energy critical elements (Lithium-cobalt-Graphite) in Europe

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[4]Geological Survey of Finland (GTK)

The FRAME project is part of the H2020 GeoERA platform and consist of 19 partners from different geological surveys in Europe. A working group (WP collected raw data related to energy critical element from partners and non-partners countries across Europe (Gautneb et al., 2019). One main objective WP3 is predictive targeting based on GIS exploration tools and prospectivity assessments at continent scale for the targeted energy critical elements (Coba Lithium-Graphite).

It aims a producing mineral prospectivity maps base on geostatistical tools, of high potential minera provinces overing all EU member states and neighbouring countries. These prospectivit assessments will benefit from the latest developmen in "data driven" minera allow mapping at continental scale, such as the CBA "Cell Based Associations" method CBA is an alternative to GIS supported prospectiv methods. It has been developed to better manag uncertainties related to cartographic data (highly significant at continental scale) (more details o methodology can be found in Tourliere et al., 2015). In addition, others methods will also be used: a classic WofE method and hybrid fuzzy weights-of-evidence (WofE) model for mineral potential mapping tha generates fuzzy predictor patterns based on (knowledge-based fuzzy membership values and (b data-based conditional probabilities applied to a comparison of the results.

Lithium:
Lithium mineralisation can be categorised as: (Greisen); Li (Pegmatite-aplite); Li (rare metal granite); Li (sedimentary-hydrothermal); Li (Brine) and unclassified Li occurrences in Europe. The distribution of lithium in Europe shows a strong clusteri highlighting the Li potential of the Variscan belt south and central Europe.

Graphite:
Graphite occurrences can be categorised into three different types; amorph, flake and unclassified bas on classification carried out by WP5 in the FRA project. Some of graphite occurrences occur Archean or Proterozoic rocks in Fennoscandia Ukraine, as well as Austria and graphite.

Cobalt:
Cobalt can be found as associated elements in sev different type of mineralisation such as IOCG, V laterite, magmatic Fe-Ti-V associations, magmat Ni-Cu-Co associations, sedimentary hosted environ ments, etc. in Europe, most of the Co-bearing deposits show clusters in the Nordic countries. In the cent part of Europe most Co mineralisation are associa with sedimented hosted to lateritic while in norther countries Co mineralisation are associated with magmatic Ni-Cu / Fe-Ti-V and VMS deposits.

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NOBEL prize to Li-ion battery inventors

By Håvard Gautneb

The 2019 Nobel prize in chemistry was awarded to John B. Goodenough, M. Stanley Whittingham and Akira Yoshino "for the development of lithium-ion batteries." This is a very good example research is a long as wise process. Stanley Wittingham started in the 1970 to investigate on technologies that could lead to fos free energy. He discovered an anode made of Li metal with a strong property to release energy. John Goodenough found out that even greater potential and more energy release was achieved by using with lit oxide intercalated with cobalt metal. Akira Yoshino created the first Li-ion battery in 1985, it used petroleum coke intercalated with lithium.

The first Li-ion battery entered the marked in 1991, instead of petroleum coke it used graphite in the ar material. Lithium-ion batteries have deeply affected our lives and laid the foundation for a fossil free fuel, the greatest benefit to our environment

This story and the technology that lie behind the Li-ion batteries, starts with the 3 basic raw materials lithiun cobalt and graphite, commodities that are all found in Europe, but the batteries as well as their raw material are presently for the most part produced outside Europe. The main aim of the FRAME project is to assess occurrences and potential for all raw materials in our fossil free future

Link: https://www.nobelprize.org/prizes/chemistry/2019/summary/

Jong B. Goodenough M.Stanley Wittingham Akira Yoshino
Ill. Niklas Elmehed. © Nobel Media.

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