Smart strategies for the transition in coal intensive regions

Project No: 836819

Factsheet:
Urban of silver mining in Freiberg, Germany

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Description

In recent decades, as the resources of mineral substances are exhausted, the transformation of mines and quarries into heritage objectives with different functions is an increasingly convenient option. On the one hand, the elements of the so-called technological archelogy are preserved, and on the other hand, the mining structures can represent points of attraction for tourists, as well as a study object for specialists and students.

In order to set up mines closed for this purpose, several steps are required, including:

- establishing the future destination of the mining structures;
- ensuring the security conditions for future activities;
- promotion in interested areas.

Figure 1: Reiche Zeche, former mine in Freiberg, Saxony

(source: https://de.wikipedia.org/wiki/Himmelfahrt_Fundgrube)

1. **Location:** Freiberg/Germany
2. **Type of action:** Conversion of industrial site
3. **Actors:** Bergakademie Freiberg
4. **Financing conditions: -**
5. **Fund(s):** Federal, Saxony Land

In 1916 the mines Alte Elisabeth and Reiche Zeche had been transferred from the Saxon Ministry of Finance in the assets of the Bergakademie Freiberg and had been opened on 1 May 1919 as a teaching and research mine. With the mine, the university has a unique selling point in Germany. The underground facility has 129 kilometres of route network. 33 underground laboratories carry out research along the raw material and resource chain;

there are international and national large-scale research projects and 48 external research partners from 26 countries[1].

For many decades, the knowledge of the Bergakademie was used, among other things, directly in Saxon mining. Immediately after the decommissioning of the Freiberger mining industry in 1913, the Bergakademie intensified its efforts to take over parts of the mines for teaching and research. The goal of the management and the staff of the teaching mine is to integrate mine operations more efficiently in teaching and to offer the institutes new possibilities of use. Graduates with a continuous internship in the teaching mine appreciate these experiences[2].

The teaching mine is unique in Germany in its kind, it is the only mine, which is operated for the purpose of teaching, research and education by a university. The focus of teaching is on student education in geoscientific and geotechnical degree programs. In addition, the maintenance, care and development of historical tools (surface and underground) are among the tasks. In addition to the two cable car shafts "Reiche Zeche" and "Alte Elisabeth", the mine also has 14 km of secured extensions in a depth of up to 230 m[3].

Achievements

RESEARCH AND EDUCATION MINE “REICHE ZECHE”

In the teaching mine lectures and practical exercises are developed on the topics of mining methods, safety underground, mine ventilation, dimensioning, drilling, blasting, conveying, mine development, sampling and radioactivity. The Institute of Mine Surveying and Geodesy conducts the underground surveying and surveying work placements underground. At the Institute of Geotechnical Engineering practical trainings will be carried out on the topic of underground mapping of tunnel projects. The Institute of Mineralogy and the Institute of Geology sometimes use the facilities of the mine for teaching content. Furthermore, the University Sports Centre uses these as part of its offer. Likewise, a tour is an offer in the student advertisement of the TUBAF; here are the great majority of the 42 sponsored secondary schools that regularly use this offer[4][5].

Today multiple research institutions and partners from industry use the mine as a fundament for the development of new technologies, production methods and new materials or to gain reference materials for their databases. In addition, multiple Universities make use of the mine in order to train their students practically in mining and surveying operations. The intention is to develop the mine to a European platform for enhancing mining techniques and education. For this, a new access (ramp) is planned and new fields, rooms and drifts[6] will be developed.

The use of high-resolution geophysical exploration systems, developed by the German Research Centre for Geosciences, for underground applications at tunnelling and within boreholes requires a high demand due to safety and operational reliability. The GFZ-Underground-Lab in the research and education mine “Reiche Zeche” in Freiberg offers the possibility to run series of experiments to develop underground applications. Market-ready systems can be realized[7] considering the geological background.

Currently, the Freiberg silver mines are arranged also for other activities, as well as for tourism, organizing exhibitions, school underground etc[8].

TRAIL

[1] https://www.freiepresse.de/mittelsachsen/rochlitz/reiche-zeche-gibt-es-seit-100-jahren-artikel10536408
[2] https://tu-freiberg.de/lfbw
[3] https://de.wikipedia.org/wiki/Himmelfahrt_Fundgrube
[4] Mischo, H. – Der Ausbau des Forschungs- und Lehrbergwerks der Bergakademie Freiberg zum zentralenForschungsstandort unter Tage. 15. Geokinematischer Tag, May 2014, Freiberg.
[5] https://www.researchgate.net/publication/271072634_Der_Ausbau_des_Forschungs-und_Lehrbergwerks_der_Bergakademie_Freiberg_zum_zentralen_Forschungsstandort_unter_Tage
[6] http://bsuin.eu/underground-labs/reiche-zeche-germany/
[7] https://www.gfz-potsdam.de/en/section/geomechanics-and-rheology/infrastructure/gfz-underground-lab-freiberg/
[8] https://www.silberbergwerk-freiberg.de/touren

It is a basic route, which lasts 45 minutes and facilitates the knowledge of the history of mining in Freiberg, the geology of the deposit and the aspects of mining technology. The round trip involves descending to a depth of 150 m with the cage and has a total length of about 300 m. The underground science route consists of topics focusing on "Freiberg mining history", "Freiberg deposit geology", and aspects of "Mining technology". A mine guide provides explanations of display cases and panels. At the cutting bench, visitors can try manually cutting the ore and sterile rock.

MINE TOUR

It is a tour that lasts about 1.5 hours and offers the possibility to explore the mining galleries excavated in the second half of the 20th century. The galleries have an average cross section of 2 x 2 m and get up close to the mining of the 19th century with lower heights, which are in places at 1.60 m.

EXPERIENCE TOUR

It takes 2.5 hours and offers a visit to the mining industry of the 50s and 60s of the last century. It manages 60 m ascent over rides (ladders) with a slope of 45 degrees. Visitors will also discover the adventurous labyrinth and the traces left by the medieval mining industry.

EXPERT TOUR

Physically demanding and exciting to the last step is the expert tour, with duration of 5 hours. The tour includes various sole changes, including up to 200 meters of altitude overcome by rides (ladders) or rocks cut into the rock. This extraordinary and eventful expedition gives an idea of the dimensions of this unique mining district.

STATE EXIBITION 2020

For the state exhibition 2020, the guests will learn in 150 m "Teufe" how mining works yesterday and today and how issues of raw material extraction are solved in a promising way. In addition, the underground nature trail is planned to be transformed into a playful, multimedia and interactive explorer tour - a first approach to "mining". Starting in 2020, a researcher's tour along selected test stands will showcase the natural and geoscientific research of the Bergakademie Freiberg and show how diversified the mine is used today.

SCHOOL UNDERGROUND

The concepts offered by the Freiberg Silver Mine in the School Underground project offer students of all ages a varied stay at an exciting out-of-school learning location.

Challenges

After transforming the former silver mine into an educational, research and tourism objective, the main challenges result from the need to maintain and ensure the security of the underground environment.

Due to the strength and competency of the host rock, many of the oldest workings still stand and remain open today, although they may not be accessible. Reiche Zeche also connects to several other, closed mines in the area that are largely unmapped. This allows air to leak into neighbouring mines, reducing the air available to ventilate to the working areas of Reiche Zeche. In order to improve ventilation efficiency, it is necessary to control the ventilation and reduce leakage by constructing seals, stoppings and regulators. A challenge with building traditional seals and stoppings in the Reiche Zeche is that the old workings lack transportation pathways or rails. In addition, the lack of compressed air, water or electricity makes it difficult to operate power tools and drills. This means that construction materials must be hand carried – some over distances of several kilometres[9].

[9] A. Mull, J. Weyer, H. Mischo, J. Brune - MINE STOPPING CONSTRUCTION AND LEAKAGE. SME Annual Meeting Feb. 21 - 24, 2016, Phoenix, AZ

Another challenge is to control the underground drainage, given that mine waters are usually acidic. However, the last researches show that concentrations of metals and ions both within and coming out of the mine have decreased over time. This is perhaps due to an 'armouring' of pyrite surfaces within areas of the mine. As pyrite oxidation is the primary mechanism by which sulphides are released, and since no fresh surfaces have been exposed in nearly 50 years, previously exposed sulphide surfaces have likely been weathered enough that no more oxidation is occurring, leading to decreases in minerals leaching from the ore[10].

Enabling conditions

Today multiple research institutions and partners from industry use the mine as a fundament for the development of new technology, production methods, new materials or to gain reference materials for their databases. In addition, multiple Universities make use of the mine in order to train their students practically in mining and surveying operations. It is intended to develop the mine to a European platform for enhancing mining techniques and education. For this, it is planned to create new access (ramp) and to develop new fields, rooms and drifts[11].

References and further links

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[11] http://bsuin.primus.kpk.fi/underground-labs/reiche-zeche-germany/

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