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# GSEU

**GEOLOGICAL SERVICE | FOR EUROPE**

## **GSEU WP2 TRAIN-THE-TRAINER COURSE**

### **Module Case Studies**

### **Level 2**

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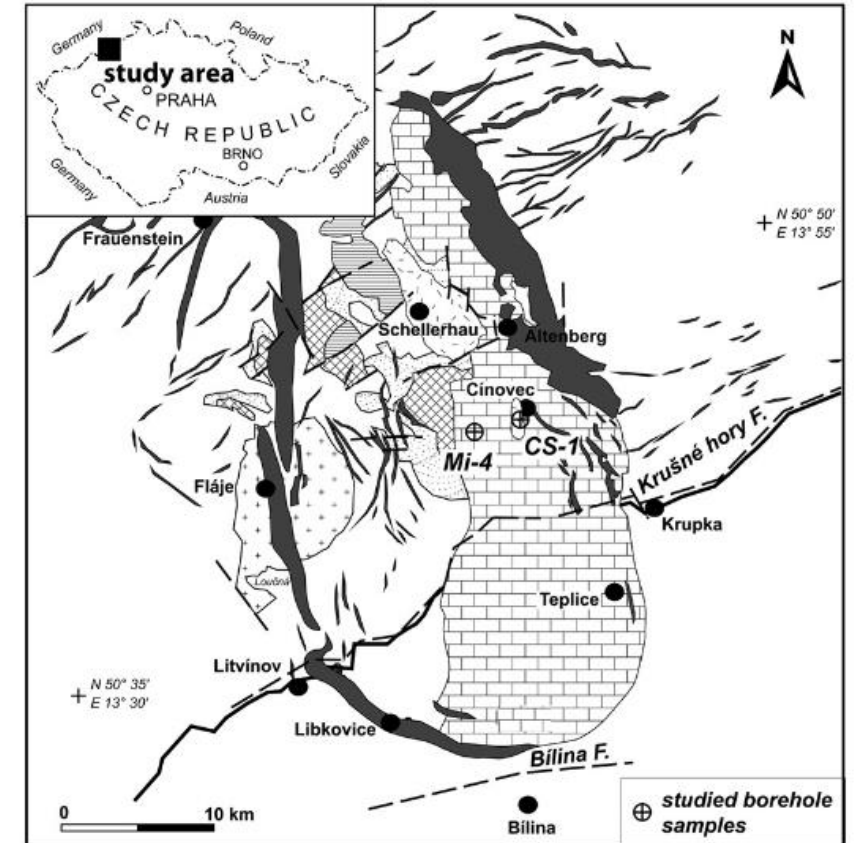
[www.geologicalservice.eu](http://www.geologicalservice.eu)





# Case Study Topics

- Cross boarder deposits
  - different owners, two legal frameworks;
- Various reporting standards;
  - CRIRSCO (PERC, NI43-101) Bridging of Resources and Reserves to UNFC.
- Multiple commodity targets;
- Multiple owners at various stages
  - bankruptcy included;
- Historical mining site - reactivated
- Political support
  - e.g. by Saxon Raw Materials Strategy





# Introduction



# Geology

The Eastern Erzgebirge/Krušné (Saxothuringian Zone of the Variscan orogeny) is characterised by late- to post-collisional Variscan uplift and exhumation processes accompanied intense felsic magmatism.

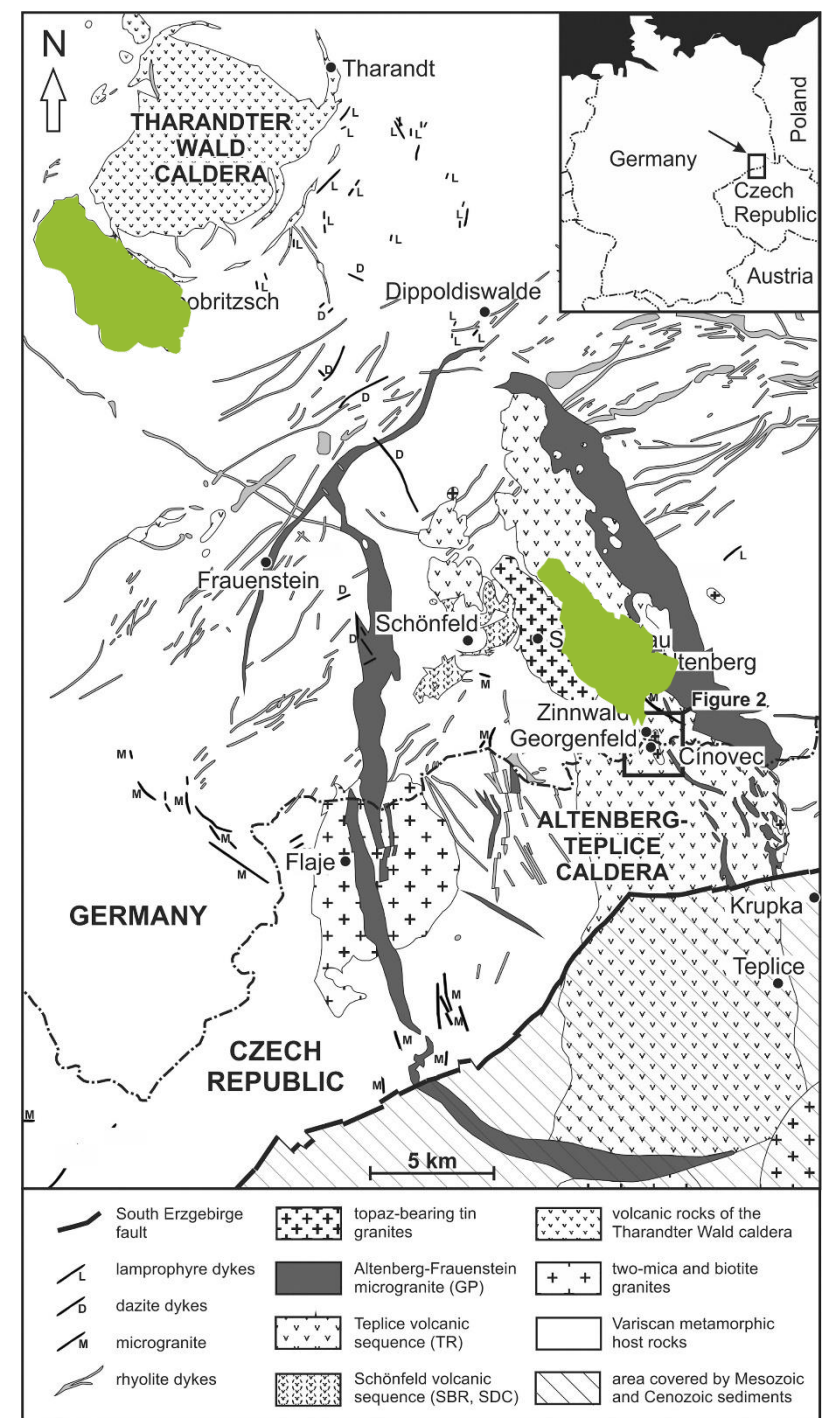
The Krušné Hory/Erzgebirge Crystalline Complex (pre-Variscan basement) comprises various tectonic units of different metamorphic grades with a last metamorphic and deformation imprint during Lower Carboniferous times.

The Eastern Erzgebirge volcano-plutonic complex developed during Variscan post-collisional collapse beginning with the intrusion of the Niederbobritzsch granites at 328–314 Ma and ending with intrusions of topaz-bearing rare metal granites and related Sn-W mineralization at 326–308 Ma.

The youngest stage is represented by intrusions of topaz-bearing rare-metal granites comprising the Schellerhau granite complex and other small intrusions (Zinnwald/Cínovec, Altenberg, Sadisdorf, Schenkenshöhe, Hegelshöhe, Loupežný, Preisselberg, Knötl).

All these intrusions belong to the high-F, low-P Li-mica A-type granites of the Krušné Hory/Erzgebirge. The granite is slightly peraluminous and enriched in F, Li, Rb, Cs, Nb, Ta, Sn, W, Sc and U; and poor in P, Mg, Ti, Sr and Ba

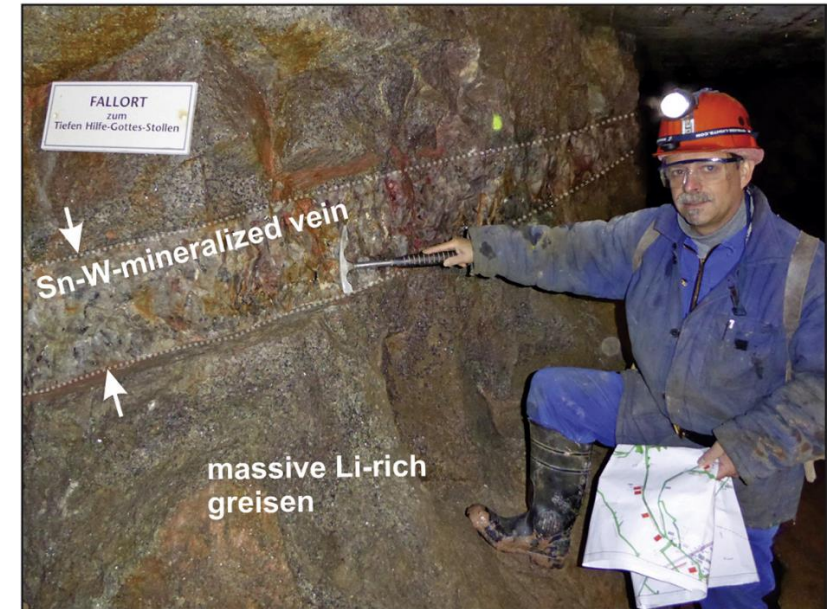
These shallow granites are also enriched in Sn, W, Rb, Cs, Sc, Nb, and Ta. Ar-Ar ages of Li-mica of Zinnwald/Cínovec intrusion between  $312.6 \pm 2.1$  to  $314.9 \pm 2.3$  Ma that are interpreted as near-formation ages of Li-mica .





# Project History I

- 15th century the first underground mining for tin started
- 1686 the Tiefe-Bünau-Stollen was driven, became the most important gallery (and finely the visitors mine);
- 1846 discovery of larger W-deposits and reorganised 1889 as W-mining site due to global market situation (high price);
- 1845 discovery of Li-F-mica called Zinnwaldite (siderophyllite-polyolithionite series with up to 1,9 wt.% Li) first mined in 1869;
- 1912/13 lack of capital led to the foundation of the trade union **Zinnwalder Bergbau**; mining rights by Saxon Tin and Wolfram Mining Co. Ltd., London; bankruptcy in 1924 caused by water retention costs and floodings of the Bohemian mining field;
- 1924-1934 owned by Metallurgische Gesellschaft AG, Frankfurt am Main owned the site, did not mine but extracted Li-mica from heaps for its subsidiary Hans Heinrich Hütte, Langelsheim, Harz Mountains. When mining operations were not economically viable, the mine was temporarily used as a visitor mine.



Source: Müller et al 2018,  
<https://doi.org/10.1016/j.gexplo.2018.04.009>



## Project History II

- 1945/46 due to reparation demands by the Soviet occupying power, the underground and above-ground facilities on the Saxon side were dismantled.
- 1954/56 geological prospection for Li-ore in saxonian part;
- 1987/89 prospection for Sn-ore supported by the State;
- 1992 opening of the visitors mine;
- Since 2012 exploratory drilling and bulk sampling have been carried out on the Saxon part of the deposit for the possible extraction of remaining lithium deposits – exploration by Deutsche Lithium GmbH (now known as Zinnwald Lithium GmbH) was initiated by SolarWorld;
- 2017 bankruptcy of SolarWorld AG, Canadian Bancona Minerals became 50% shareholder of Deutsche Lithium;
- 2019 feasibility study (PERC, NI 43-101) published, 2020 Erris Resource Plc 50% share on Deutsche Lithium;
- 2022 Zinnwald Lithium Plc, London became wholly-owned shareholder of Deutsche Lithium, several NI 43-101 reports since.



Source: Zinnwald Lithium, <https://zinnwaldlithium.com/project/the-resource/> accessed 26.02.2024



# Case study - Project Background

## Commodities

- Sn, W, Li mined in the past
- Lithium current target commodity, with potential to mine Sn, W and to produce  $K_2SO_4$ .

## Location - 50°4'11" N, 13°45'55" E

- Municipality of Zinnwald-Georgenfeld / Erzgebirge;
- Free State of Saxony / Federal Republic of Germany.

## Geology

- late Variscan greisen deposit

## Project status

- non-active historical mining site
- Potentially-Viable Project (active exploration project - feasibility-study);

## Current holder / ownership

- Deutsche Lithium GmbH subsidiary of Zinnwald Lithium Plc, London
- Licence concession Bergrechtliche Bewilligung ( § 8 BBergG) valid for 12.10.2017 - 31.12.2047 to explore and to mine Li-Sn-W greisen ores and its further beneficiation.

## Project history

- Mined for more than 500 years for Sn and W, Li-mica first mined in 1869;
- closed late 1980es; visitor mine since 1992;
- several periods of intensive exploration campaigns;
- Various project owners through time (some went through bankruptcy), interest indicated by international investors.





# Production / Challenges

## Historic Production

Production Periode			Concentrate [t]			Source
			Sn ore	W	Li mica	
1880	-	1890	4.5	390		After Eisentraut, 1944 according to SolarWorld: PERC Report 2014
1891	-	1899	9	370		After Eisentraut, 1944 according to SolarWorld: PERC Report 2014
1900	-	1924 (1933)	1,400	1,200	5,000	After Eisentraut, 1944 according to SolarWorld: PERC Report 2014
1943	-	1945			7,700	according to SolarWorld: PERC Report 2014

## Current Production

- Non / under development

## Envisaged Production

- Lithium (LiF); and  $K_2SO_4$  and PCC as by-product of the Lithium beneficiation process
- Zinnwald's 2022 Preliminary Economic Assessment (PEA) identifies a 12,000 t/a production and a greater than 35-year mine life.
  - 12,011 t /a of battery-grade  $LiOH \cdot H_2O$  at least;
  - 5,112 t LiF production with a forecast selling price of €22,000 per tonne LiF;
  - 56,887 t/a of  $K_2SO_4$ ;
  - 16,000 t/a PCC (precipitated calcium carbonate) by-products.



## Permit issues

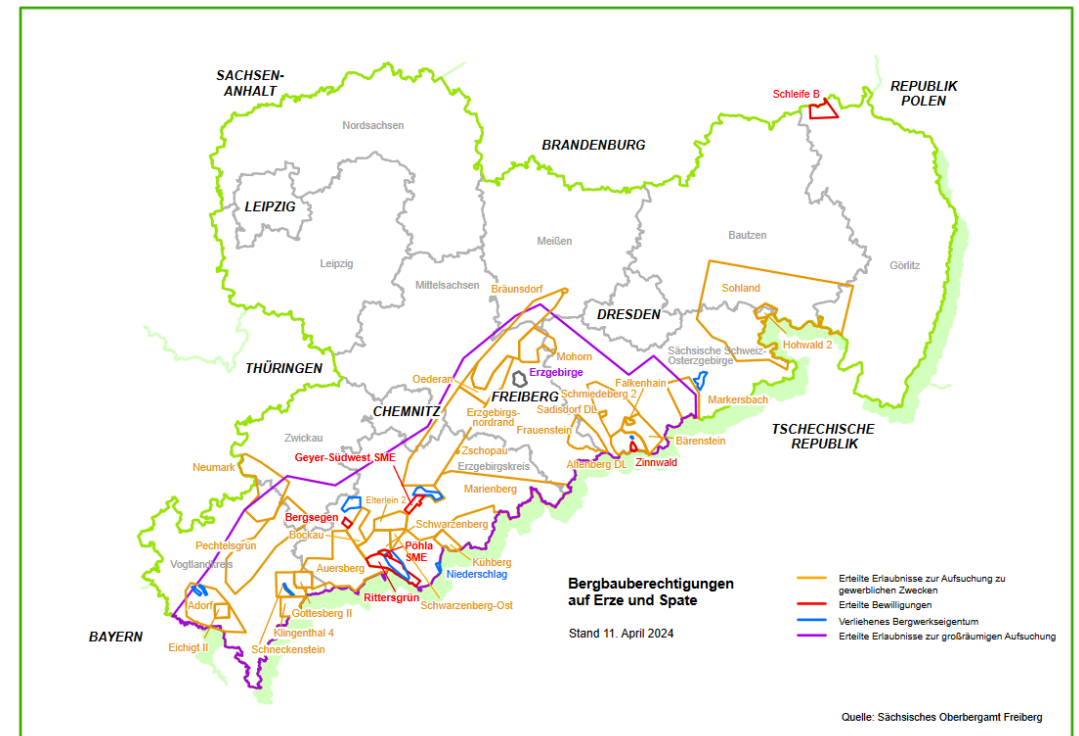


# Free State Saxony

Raw materials create the future  
New Saxon Raw Materials Strategy

**FUTURE.**

STAATSMINISTERIUM  
FÜR WIRTSCHAFT  
ARBEIT UND VERKEHR





# Permits

**Mining Act** - including the mine, associated mining infrastructure and the mechanical separation plant.

This includes the Mandatory Framework Operation Plan after BBergG §52 Subsection 2a which is led by the Saxon Mining Authority.

**Environmental Impact Assessment** - Mining related EIA / UVP processes are regulated in the special legal text of §57a in the BBergG as well as the “UVP-V Bergbau” (Special legal act regulating EIA processes for mining projects). EIA is required for underground mining projects with a surface footprint exceeding 10 ha of area for all associated installations (mining, mineral processing, tailings, maintenance and administration buildings).

**Bundesimmissionsschutzgesetz (BImSchG)** (Federal Emission Protection Act) - Part of Germany’s environmental law and can be led by either regional authorities or the mining authority and evaluates compliance of facilities with existing technical standards as well as other requirements set by law.

**Water Permits** - All aspects relevant to water use, potential for water pollution etc are reviewed and permitted by the water authority, in this case the lower water authority.

**BImSchG** aspects to be considered, incl. but not limited to:

- All technical details of the planned operation. pollutants, meteorology, impact on climate etc)
- State Development Plan and Regional Planning
- Environmental Impact Assessment (EIA / UVP, separate from the MFOP EIA)
- Estimated Noise emissions of operation
- Estimated Air emissions of operation (type and quantity of
- Operational Safety Margins
- Compliance of installation with relevant technical standards such as EN / DIN / ISO
- Fire Safety Standards / Concepts for installation
- Logistical / Transportation Concept
- Waste and Waste Management



## Permits | Mining act

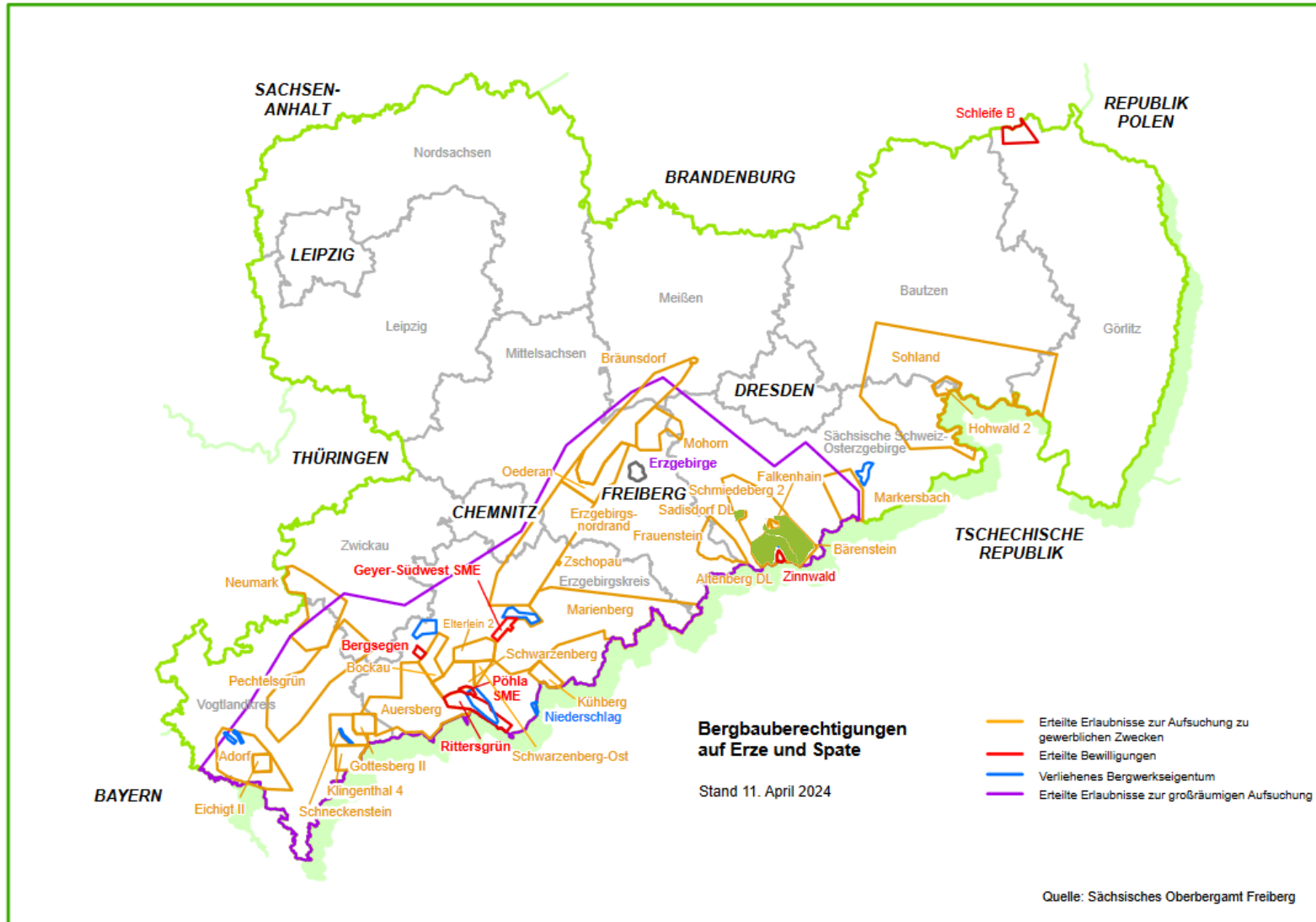
Mandatory Framework Operation Plan (MFOP) provides clarity on a first outline of the planned operation, at a time when not all details of technical nature are yet defined.

- **Mandatory** are overview of the **technical process of mining and processing**, considerations for **environmental aspects, urban planning** and **expected impact on residents**.
  - Note: The actual construction and operation of the intended assets must however be separately permitted within a Main Operation Plan Permit (Hauptbetriebsplan), clearly defining the activities of the operation for the next up to 24 months.

The process of MFOP is led by the Saxon Mining Authority, however as stipulated in BBergG §54 Section 2, the Saxon Mining Authority must involve and consider positions of other authorities.

Further permits to be gained, incl. but not limited to:

- Water Use Permits
- Compatibility with EU Water Framework Directive
- BImSchG of Mineral Processing Plant & Lithium Activation and Lithium Fabrication

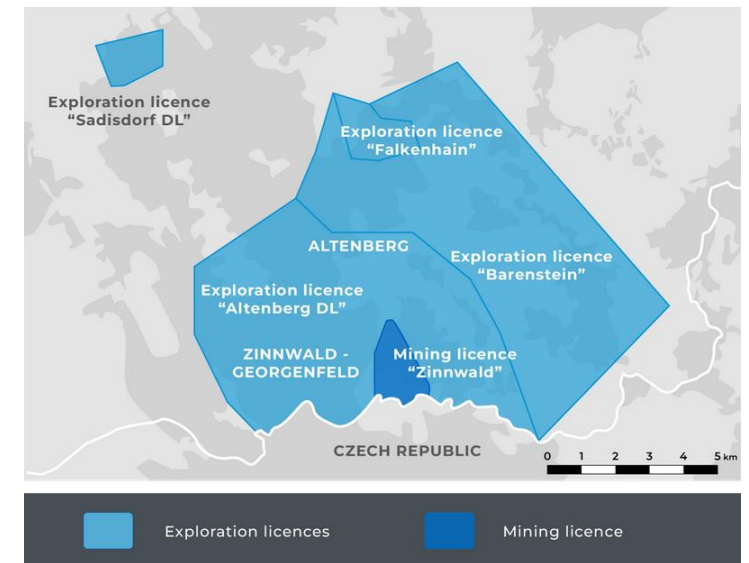
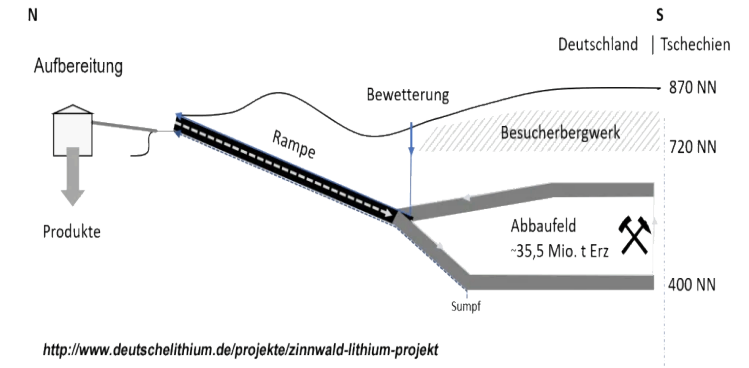




# Permit no 2960 Zinnwald - by Oberbergamt Sachsen

12.10.2017 - 31.12.2047 - Bergrechtliche Bewilligung ( § 8 BBergG) representing an advancing and chemical development project for mining of Li-Sn-W greisen ores and its further beneficiation and extraction of battery-grade lithium compounds covering 2,564, 800m<sup>2</sup> at below 740 m.a.s.l.

- 2022/2023 drill programme with S 84 holes of ~300m  $\cong$  27km of core samples for analysis; supplemented in 2023 by further exploration licences to Zinnwald Lithium GmbH aiming to produce LiF.
- Li, Ag, Al, Au, Bi, Cs, Fe, Ga, Ge, In, La- Lu, Mn, Mo, Nb, Rb, Sc, Sn, Ta, W, Y, Zn
- Project under development. The permit allows to use existing infrastructure former mining site while a visitors mine - cultural heritage site – keeps active.
- Envisaged mining life time ~ 35+ years
- Owner: Zinnwald Lithium GmbH, <https://zinnwaldlithium.com/>;
- to establish complete value chain in Europe cooperation with Advanced Metallurgical Group (AGM) that develops a LiOH-refinery in Bitterfeld, Sachsen-Anhalt, Germany.





## Quiz – Political support I

The Zinnwald/Cínovec with a remarkable ore deposit that has been mined for centuries has received political support many times. Due to the strategic importance for the GRD (1949-1990) Zinnwald was in production even not considered to be economic viable without subsidies.

### **How does this is expressed in UNFC?**

*(Assumption: the stated reserve and resource data are up-to-date and the mine is in operation)*

- a) E1 F1.1 G1or G2– as it considered an Viable Project on production and an QE should not interfere with political statements.
- b) E1.2 F1.1 G1or G2– as it a Project on production and made Viable through government subsidies and/or other considerations whilst when based on current [global] conditions and realistic assumptions of [global] future conditions - operation are not environmentally-socially-economically Viable.
- c) E2 or even E3.3 F1.1 G1or G2 – as without subsidies it is Non-Viable Project under unbiased and fair competing conditions – a QE should indicate those risks.





## Quiz – Political support II

The Zinnwald/Cínovec with a remarkable ore deposit that has been mined for centuries has received political support many times. Today Zinnwald (Germany) is aiming for reactivation fully in line with the Saxon Raw Materials Strategy aiming to ensure sustainability and access to resources of the country.

### **How does this might effect UNFC?**

*(Assumption: the stated reserve and resource data are up-to-date)*

- a) It will have no effect on the UNFC.
- b) It will effect positively on the E-aches of UNFC as the political support ensures that all legal issues are tackled.
- c) It will effect negatively on the E-aches of UNFC as people don't trust politicians and redraw their SLO.



## Quiz – Reactivated historical mining site

The Zinnwald/Cínovec with a remarkable ore deposit that has been mined for centuries. Many times the new findings, expansion and improvement of technologies has expanded mine life. Today Zinnwald (Germany) is aiming for reactivation.

### **How does those changes effect UNFC?**

*(Assumption: the stated reserve and resource data are up-to-date)*

- a) It will have no effect on the UNFC.
- b) It will effect positively all aches of UNFC as the improvements lower the risks associated to the related aches.
- c) It will effect negatively on the E-aches of UNFC as the resources and reserves get lesser with any mining period.



## Quiz - Multiple owners at various stages

The Zinnwald/Cínovec with a remarkable ore deposit that has been mined and developed further for centuries whilst owners have changed.

### **How does those changes effect UNFC?**

*(Assumption: the stated reserve and resource data are up-to-date, multiple answers possible)*

- a) A change of ownership does not have an effect the resource and reserve estimations and hence not the UNFC.
- b) A change of ownership may lead to new risk assessments and hence effects the UNFC depending on the details.
- c) A change of ownership might be caused by bankruptcy and hence the UNFC E-ache is directly effected.
- d) A change of ownership calls for a new resource and reserve estimation by a CP trusted by the new owner –hence the UNFC might change significantly mainly as the assets / capital / access to loans / technical equipment etc. might have changed.



## Quiz - Multiple commodity targets

The Zinnwald/Cínovec with a remarkable ore deposit that has been mined and developed further for centuries for several commodities including Sn, W, Li but are known for its potential for Rb, Cs, Nb, Ta, Sc and U as well.

### **Which approach shall be taken to address these information by UNFC?**

*(Assumption: the stated reserve and resource data are up-to-date)*

- a) All commodities can be provided as one UNFC since they are in one deposit
- b) All commodities that are produced can be provided as one UNFC whilst those that are potentials shall kept in one UNFC separately -> so two figures will be given
- c) All commodities need to be provided separately as they might be treated differently and or their economical figures are different
- d) Only figures for the target commodity shall be given.
- e) All target commodities need to be provided separately whilst the potential can be kept in one.



## Quiz - Various reporting standards

The Zinnwald/Cínovec with a remarkable ore deposit that has been mined and developed further for centuries. Several reporting standards has been used to estimate the resource and reserves targets.

**Which approach shall be taken to address the resource and reserves information by UNFC?**

*(Assumption: the stated reserve and resource data are up-to-date, multiple answers possible)*

- A) Do whatever you like – you are the QE!
- B) One has to follow the respective bridging document (e.g. PERC, NI 43-101)
- C) Use the Guidance for Europe as it refers to the INSPIRE Code list acknowledging the obligatory INSPIRE Directive
- D) Use the Guidance for Europe only when there is nothing else
- E) Use the UNFC 2019 update and follow the instruction therein



## Quiz - Cross border issue

The Zinnwald/Cínovec with a remarkable ore deposit stretches across political borders.

**How should UNFC be applied here to assess Europe's strategic and/or critical mineral potential?**

- A) It's a single deposit under different regulations. Yet, the EU CRMA is common law calling for harmonising data. Hence, the EU potential must be expressed as one single entry. Therefore all known clusters must be assessed individually whilst the resources and reserves reported needs to be accumulated as one figure each. Data provider in effected countries must join forces and agree on one figure.
- B) It's is a single deposit and therefore the EU potential must be expressed by cumulating all resource and reserve estimates. To this end, the most progressive solution of the UNFC is indicated in order to stimulate investment.
- C) It's is a single deposit and therefore the EU potential must be expressed by cumulating all resource and reserve estimates. To this end, the most conservative solution of the UNFC is given to avoid overestimates.
- D) It's is a single deposit but it falls under different regulations and therefore the EU potential must be expressed separately. To this end, all known clusters must be assessed individually and the resources and reserves reported according to this respective classification.



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**Thank you for your attention**

