



DOPAS Training Workshop 2015 Siting in the Czech Republic

Lukáš Vondrovic

16 September 2015

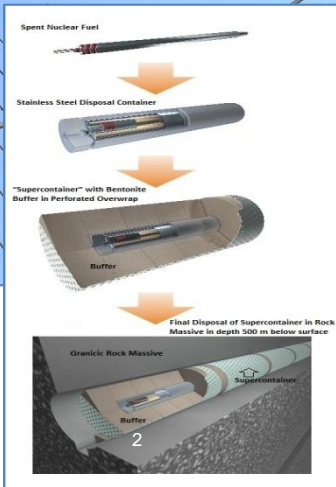
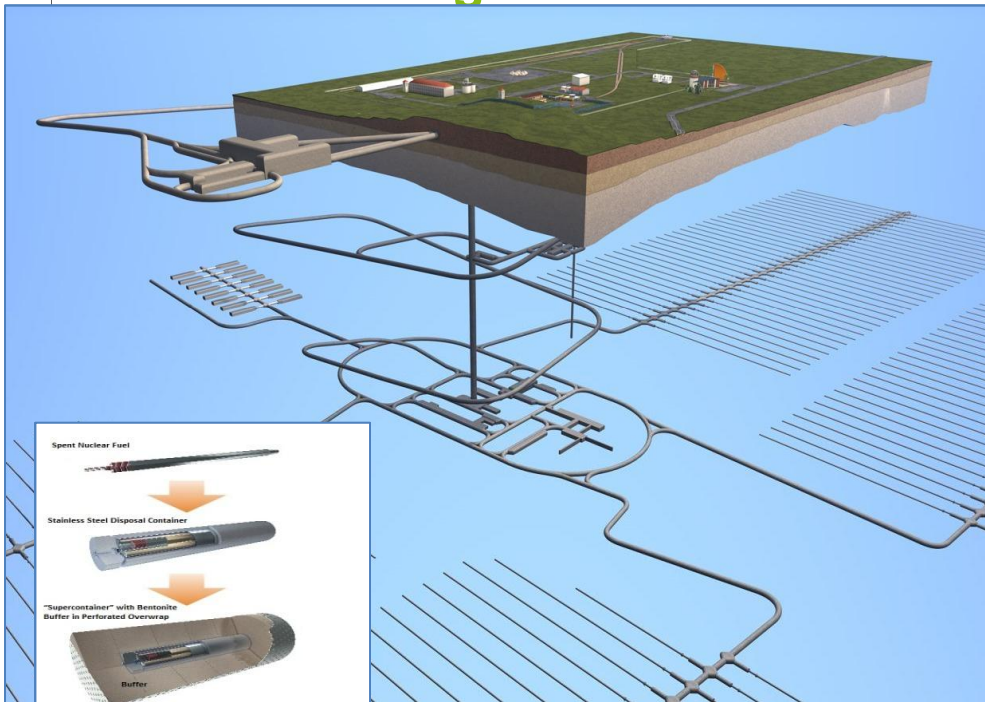
D3 7.1

The research leading to these results has received funding from the European Union's European Atomic Energy Community's (Euratom) Seventh Framework Programme FP7/2007-2013, under Grant Agreement No. 323273 for the DOPAS project.



Geological Disposal of Spent Nuclear Fuel in the Czech Republic

Reference Design of CZ DGR 2011



Source: SÚRAO

DOPAS Training Workshop 16.9. 2015 Prague

- The basic fuel back end concept consists of the **direct disposal of spent fuel in steel based canisters in a crystalline host rock**
- Depth: 500 - 600 m
- Operation period **2065 – 2140**

Site Selection Programme for Final DGR Site 2015 - 2025

- Ü Near surface geological survey of preselected sites **(7) – now**
- Ü Evaluation of primary data from sites and selection of the most suitable sites on the basis of preliminary safety
- Ü Evaluation and other socioeconomic, political and environmental criteria **(2016)**
- Ü Geological survey of selected sites with deep boreholes **(2018 – 2019)**
- Ü Evaluation of sites and selection of **2 candidate sites** for **Government decision (2019/2020)**
- Ü Detailed characterisation at 2 candidate sites **(2020 – 2024)**
- Ü Evaluation of the candidate sites and selection of the **final site (2025)**

Geological Disposal of Spent Nuclear Fuel in the Czech Republic



SÚRAO

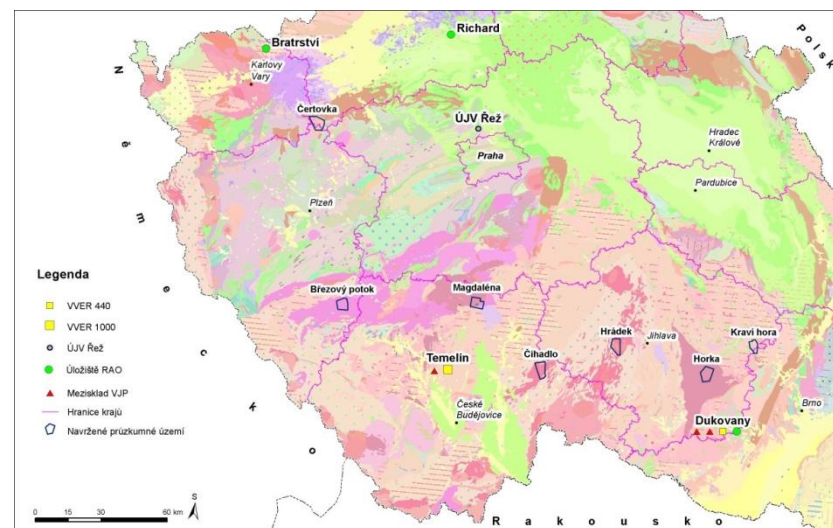
RADIOACTIVE
WASTE REPOSITORY
AUTHORITY

Sites

- 7 sites
- Proposed exploration areas
- Located in the crystalline rocks 515 - 320 Ma
- Crystalline = granites and metamorphic rock

Advantages:

strength, homogeneous composition,
low permeability, stable environment



Source: SÚRAO

Geological Disposal of Spent Nuclear Fuel in the Czech Republic



SÚRAO

RADIOACTIVE WASTE REPOSITORY AUTHORITY

Rocks

Granite

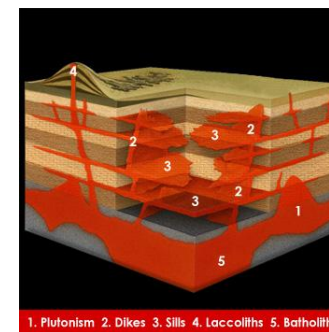
Plutonic rock origin from depth 5-10 km

Main minerals: quartz, felds, mica, amphibole

More precisely: granite, granodiorite, syenite, durbachite



Source: trugeo



Source: www.gfology.com

Granulite / migmatites

Metamorphic rocks HT-MP condition 20 km depth

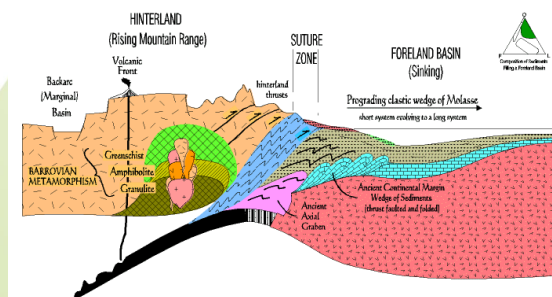
Granulites: feldspar, garnet, quartz

Migmatites: quartz, felds, micas



Source: trugeo

DETAILED FEATURES OF A CONTINENT-CONTINENT COLLISION OROGENY



Source: www.geology.com

Geological Disposal of Spent Nuclear Fuel in the Czech Republic

Sites

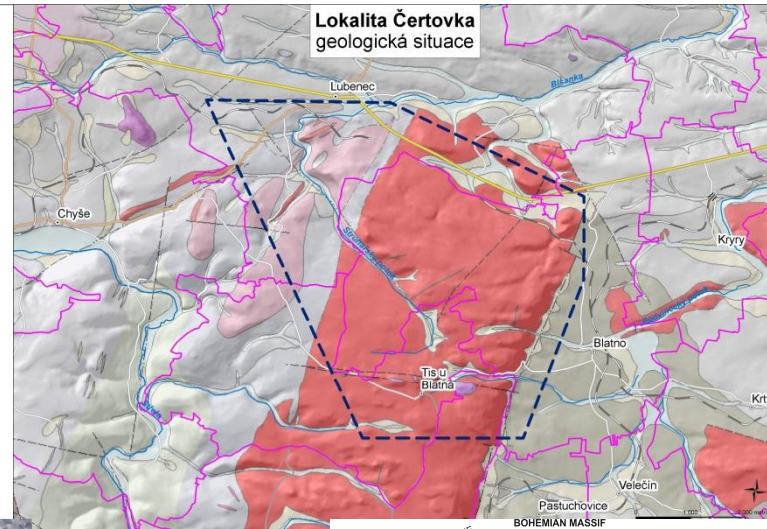
Čertovka

Granite, 515 Ma Tis pluton, reflected the Cambro-ordovician extension

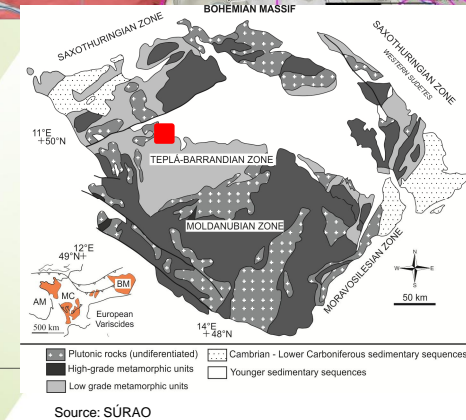
Teplá-Barrandian Unit (west)

East part sediments of the Žihle basin (sandstones, arkose)

Proposed exploration area: 29 km²



Source: SÚRAO



Geological Disposal of Spent Nuclear Fuel in the Czech Republic

Sites

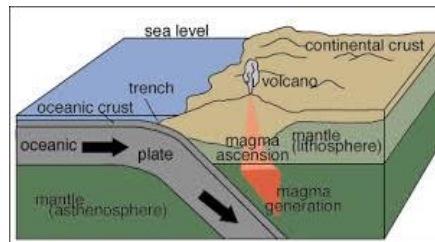
Březový potok

Granodiorite, 350 Ma, reflecting subduction processes

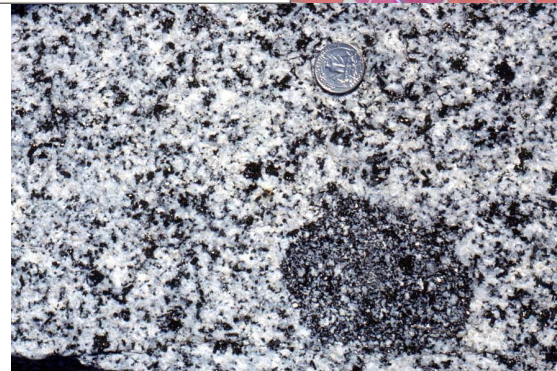
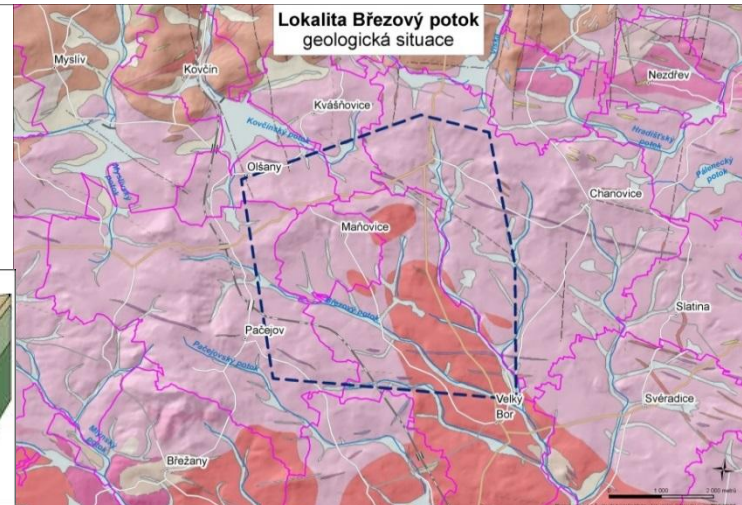
Central Bohemian plutonic complex

Moldanubian Unit

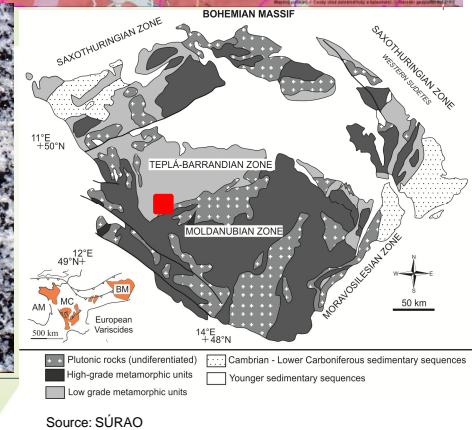
Proposed exploration area: 23 km²



Source: trugeo



Source: SÚRAO



Source: SÚRAO

Geological Disposal of Spent Nuclear Fuel in the Czech Republic

Sites

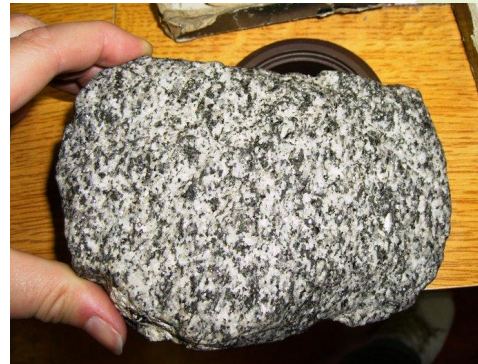
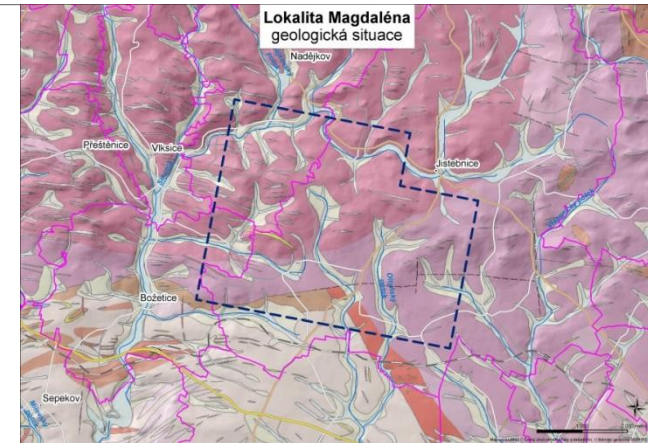
Magdaléna

Syenite, 340 Ma, mixing of the earth crust and mantle material

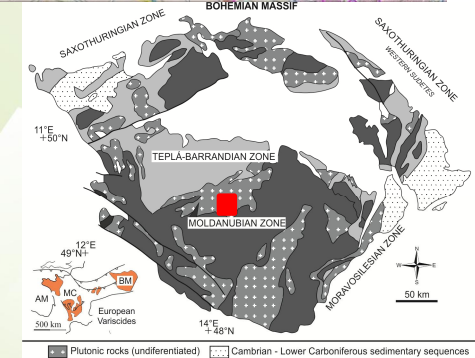
Central Bohemian plutonic complex

Moldanubian Unit

Proposed exploration area: 23,5 km²

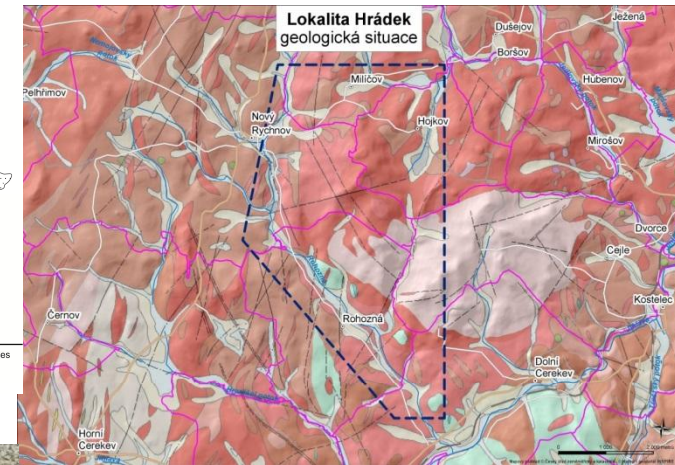
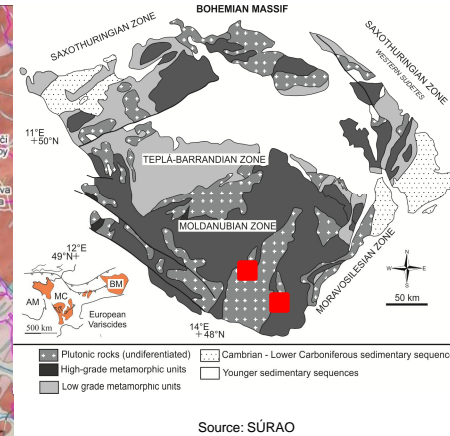
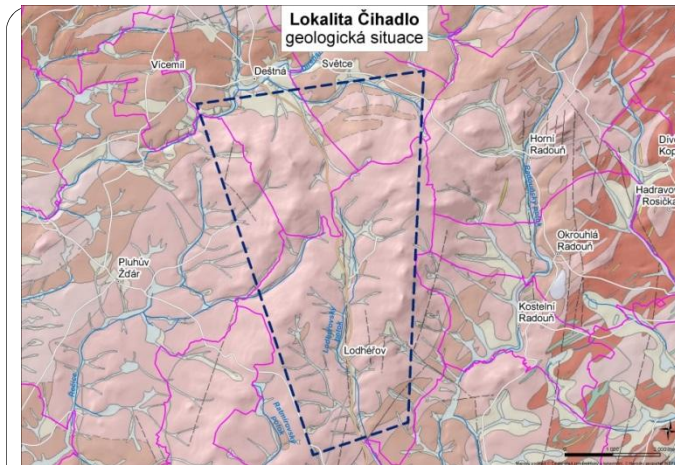


Source: SÚRAO



Source: SÚRAO

Geological Disposal of Spent Nuclear Fuel in the Czech Republic



Čihadlo

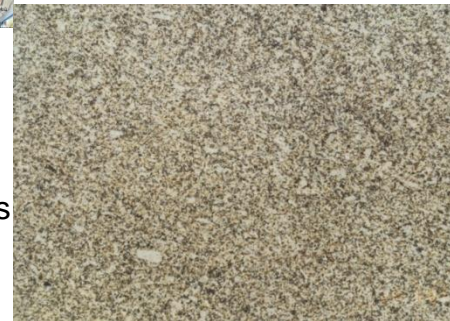
Granite, 328 Ma Klenov pluton

Decompressional melting of deep seated rocks

Central Moldanubian Plutonic Complex

Moldanubian unit

Proposed exploration area: 24 km²



Source: SÚRAO

Hrádek

Granite, 330 Ma

decompressional melting of deep seated rocks

Central Moldanubian Plutonic Complex

Proposed exploration area: 25 km²

Geological Disposal of Spent Nuclear Fuel in the Czech Republic

Sites

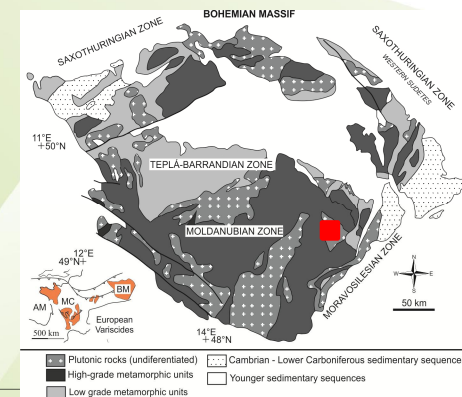
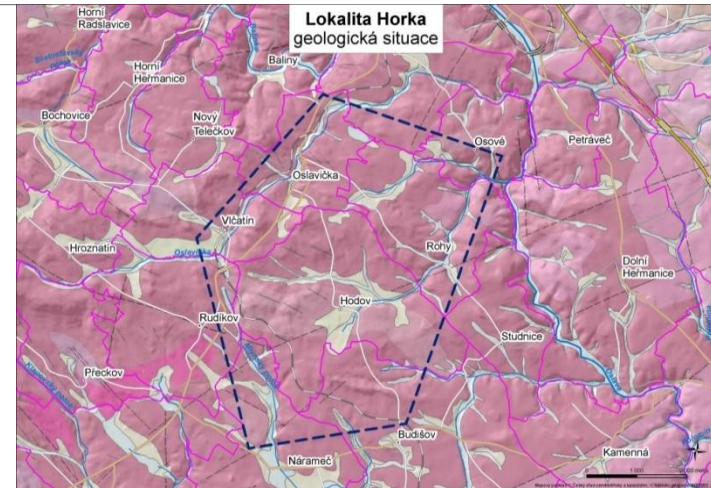
Horka

Durbachite, 340 Ma Třebíč pluton,

Mixing of the earth crust and mantle material

Moldanubian Unit

Proposed exploration area: 28 km²



Geological Disposal of Spent Nuclear Fuel in the Czech Republic

Sites

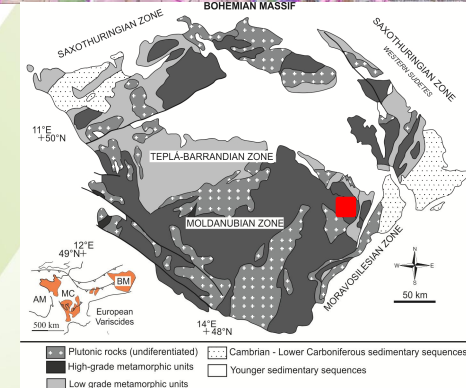
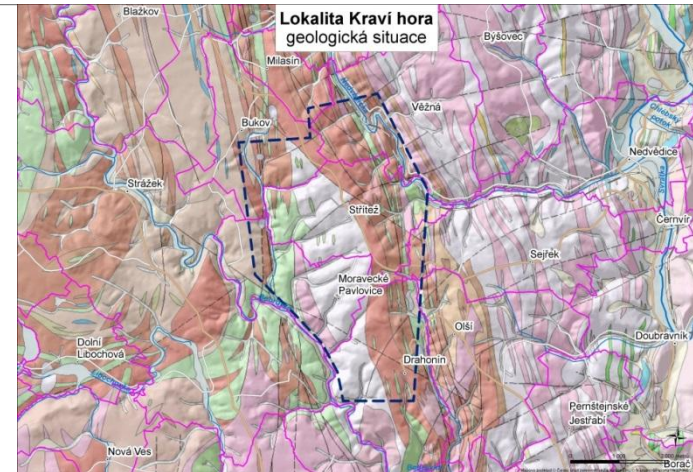
Kraví Hora

Granulite/migmatite 340 Ma

High-grade rock, continental collision

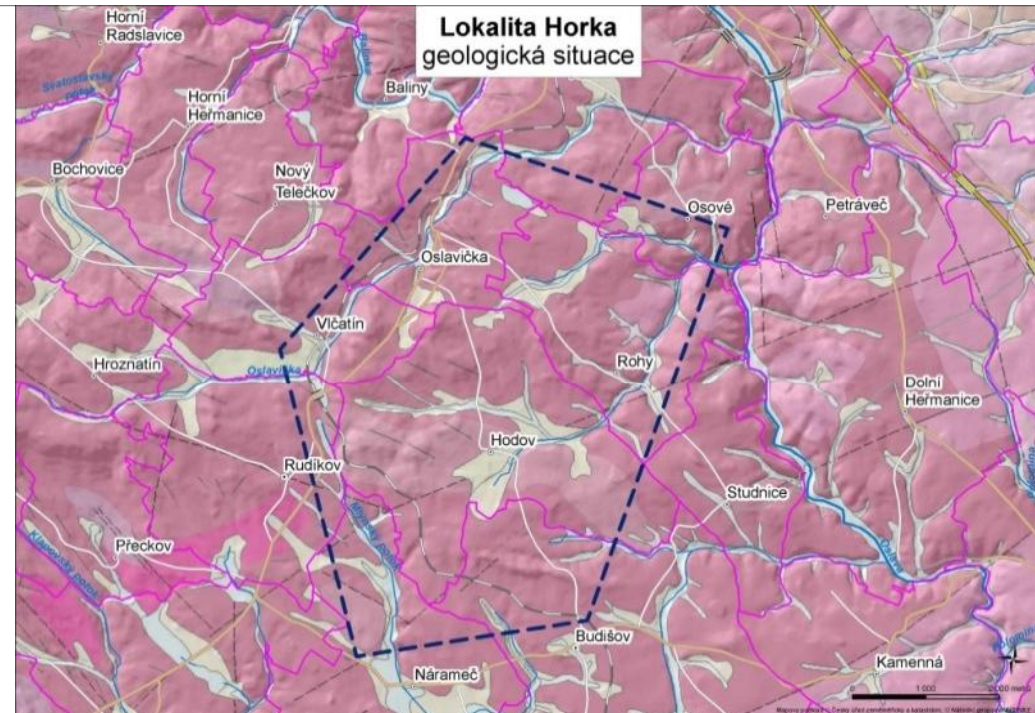
Moldanubian Unit

Proposed exploration area: 18 km²



Exploration programme stage I

- Near surface geology
- Narrowing the numbers of potential localities
- **Aims:**
- Geological map (3D model)
- Verification of faults and brittle structures
- Hydrogeological model
- Define possible block in level of repository



Exploration programme stage I

Geological mapping

Synthesis of all exploration methods

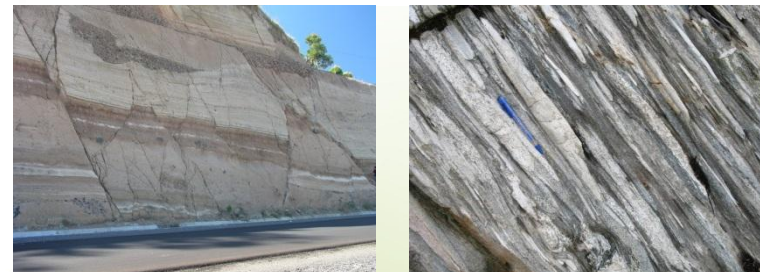
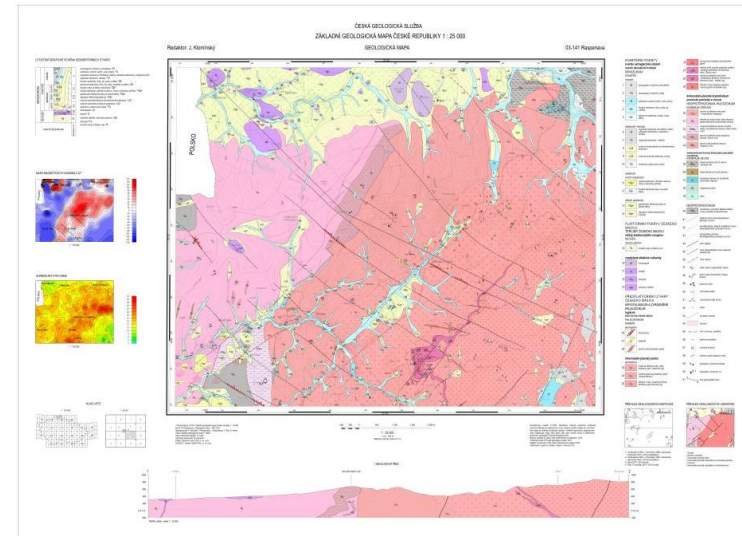
3D visualization of geological pattern

Visualization:

Rock types

Ductile and brittle structures

Geological pattern in the depth



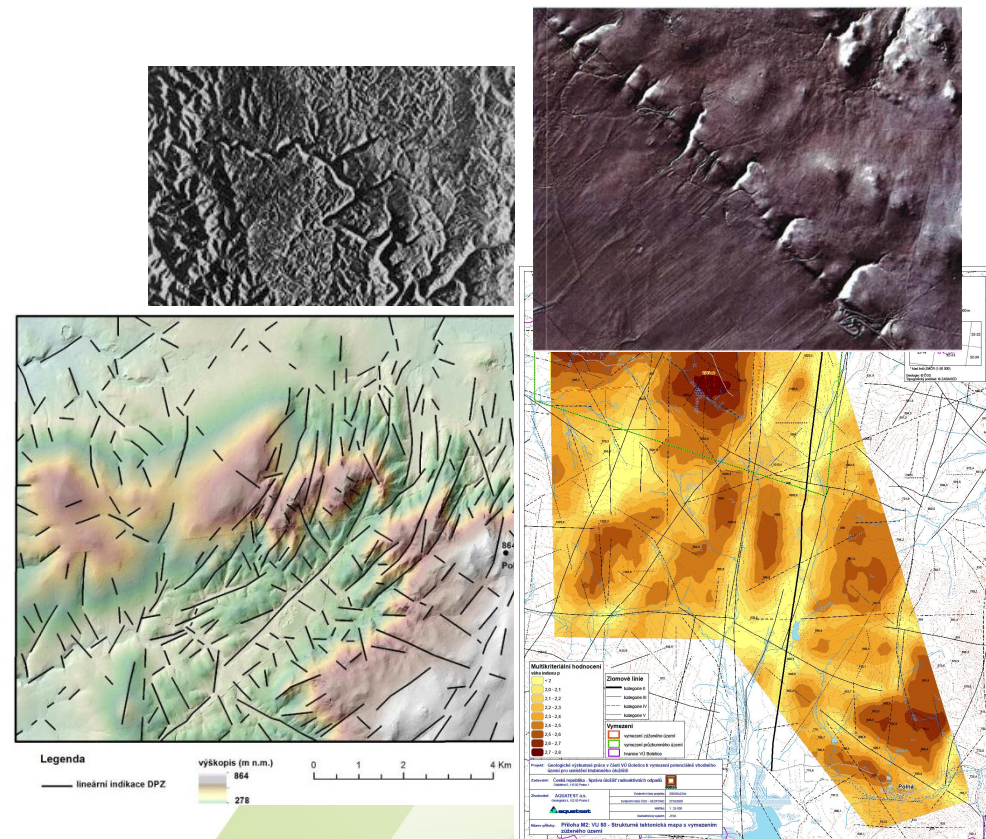
Exploration programme stage I

Remote sensing

Satellite and radar image

3D topographical model

Defining the brittle fractures



Exploration programme stage I

Geophysics

Study of „fields“

Definition of: faults, rock types, geological boundaries

Fields:

Gravity

Regional structures, depth evolution

Electric

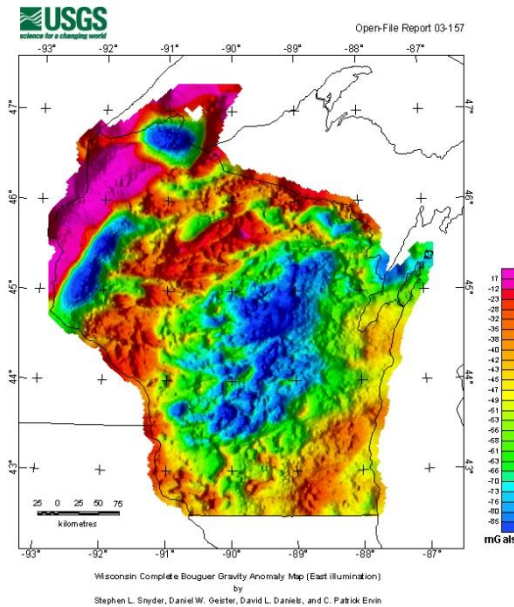
Local faults

Magnetic

Faults, rock types

Seismic

Geological boundaries, faults



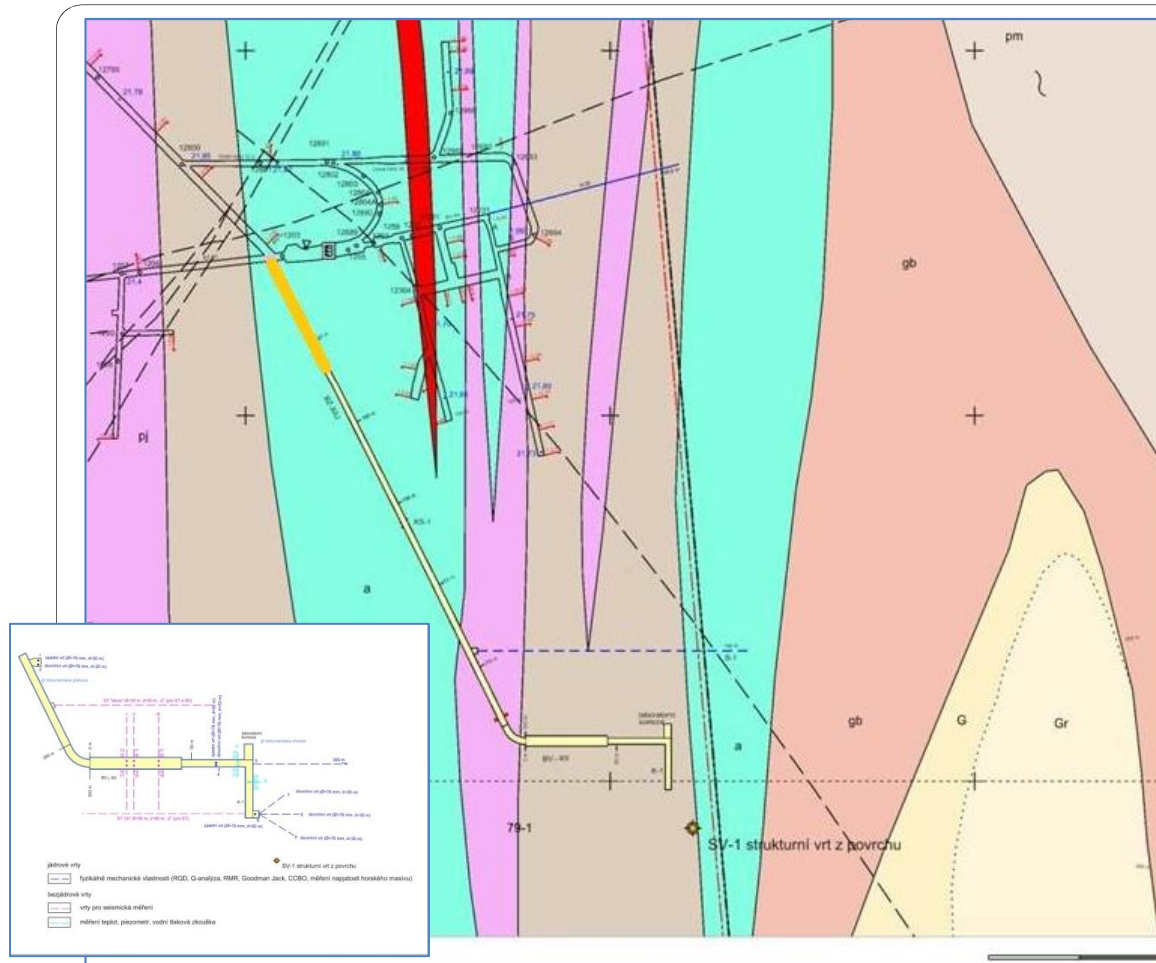
Exploration programme stage I

Site selection




Criteria:

- Project
- Safety (geology)
- Environmental
- Socio-economic

Generic research for DGR



URF Bukov

- Crystalline rocks – gneisses, migmatites with sequences of fractures
- Depth – 600 m below surface
- Construction - 2013 – 2016
 - 1st research project parallel with construction – Pilot Rock Characterisation / Site Descriptive Model
- Operation until 2025 ...??)
- Research projects
 -  Long-term properties of canister materials in reducing conditions
 -  Rock matrix diffusion properties in crystalline rocks
 -  T-H-M-C properties of the rock

Generic research for DGR

Bedřichov Water Supply Tunnel

Construction period:

§ 1981-83

Tunnel profile:

§ Circular 3,6m diameter

Building technology:

§ drill and blast 1705 m,

§ TBM 890 m

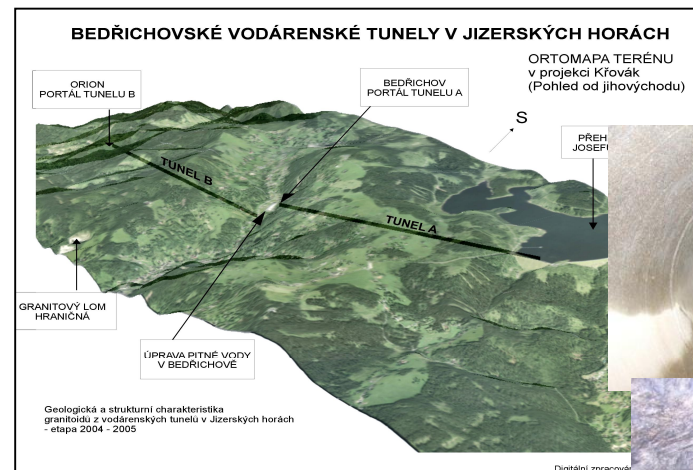
Tunnel depth:

§ max. 140 m

Uncovered granite:

§ total 1397 m

§ TBM section 787 m



Demonstration research for DGR



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WASTE REPOSITORY
AUTHORITY



Josef Gallery

- Operated by CTU
- Demonstrations projects
- Training activities
- Supported by ministries and SÚRAO

UEF Josef geology - situation



Thank you for your attention



Fig. 7. Example of how the surface facility for access to the geological repository might also look

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www.sura0.cz

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DOPAS



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