

Initial research on geological conditions in the Underground Research Facility Bukov, Bohemian Massif, Czech Republic



CZECH
GEOLOGICAL
SURVEY

Zita Bukovská, Kryštof Verner, David Buriánek, Igor Soejono, Ondřej Švagera, Petr Dobeš, Lenka Rukavičková, Radmila Nahodilová, Jan Franěk, Lukáš Vondrovic, Zoltán Pécskay, et al.

Czech Geological Survey, Prague, Czech Republic (zita.bukovska@geology.cz)
Radioactive Waste Repository Authority (RAWRA), Prague, Czech Republic
Institute for Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary



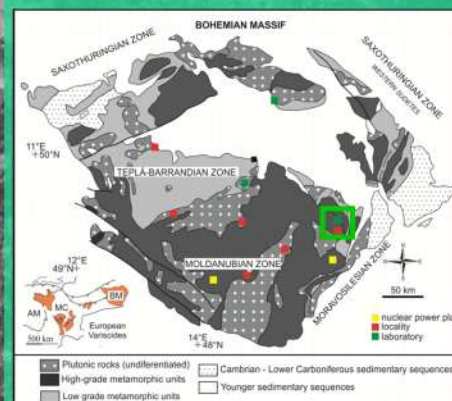
OVERVIEW

In the realm of Bohemian Massif in high grade metamorphic rocks of northeastern Moldanubian zone is built unique underground research laboratory Bukov (URF). The laboratory is situated on level 12 of the uranium mine Rožná. The URF is projected for series of major research experiments focused on long term safety and technical feasibility of a future deep geological repository of radioactive waste.

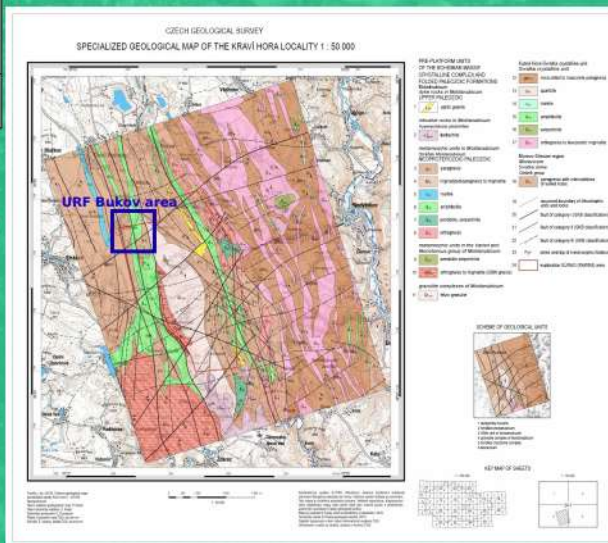
Initial documentation and research was focused on detail description of petrology, structural geology, geochemistry, mineralization events, anisotropy of magnetic susceptibility, hydrogeology, hydrogeochemistry in order to obtain relevant data and to build representative 3D model.



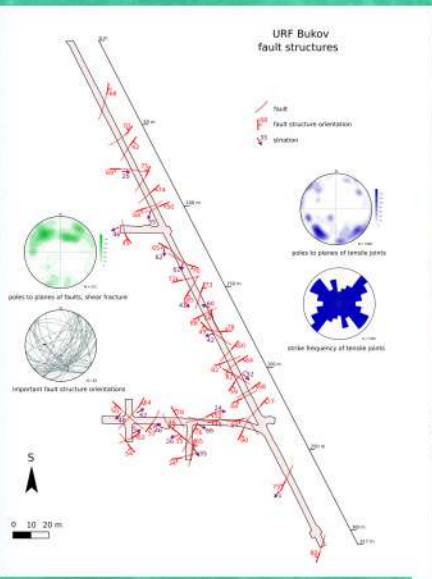
GEOLOGICAL SETTING + URF LOCATION



The URF location is shown within the realm of Bohemian Massif (above) and in the simplified geological map of Kraví hora potential repository locality (to the right) and on the 3D view of Rožná mine (upper right).



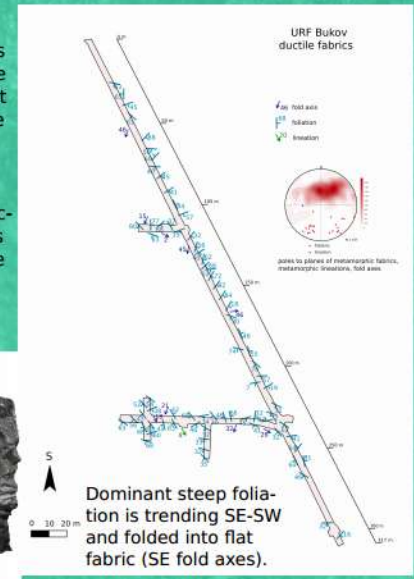
BRITTLE STRUCTURES



Presence of brittle deformation features is of high importance in the URF. Main fault structures are on the schematic map with the orientations of other documented faults, joints and fractures. Dominant sets of brittle failure have SW-NE and NW-SE orientation.



DUCTILE FABRICS

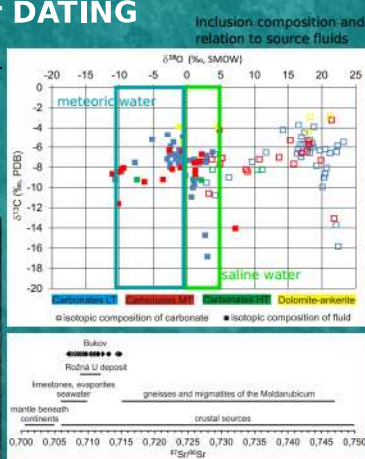
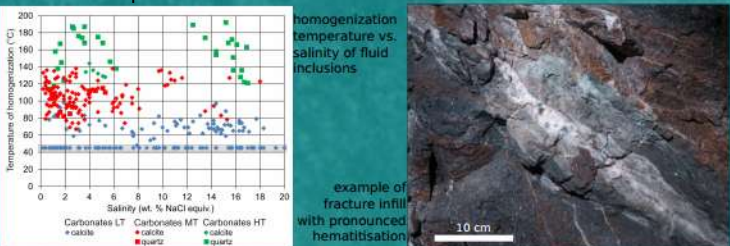


Dominant steep foliation is trending SE-SW and folded into flat fabric (SE fold axes).



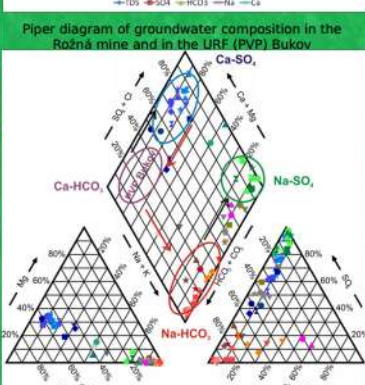
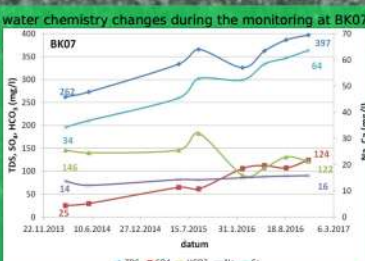
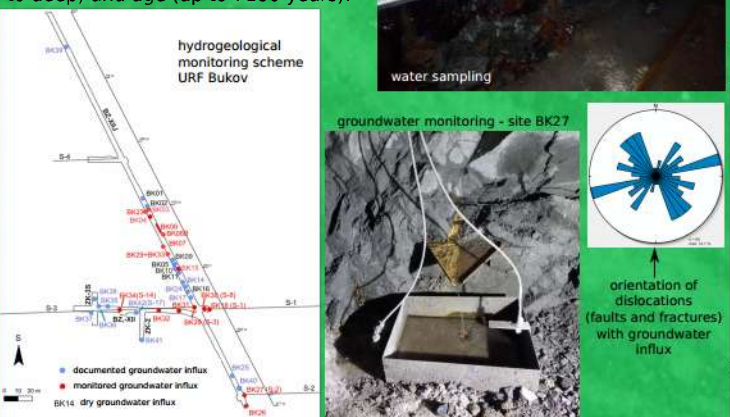
FRACTURE INFILL - MINERALIZATION + K-Ar DATING

Detailed study of fracture infill revealed dominantly calcite and dolomite-ankerite mineralisation. The fluids came from mixed sources of evaporites, lime-stones and partially from metamorphic rocks according to Sr isotopes. The inclusion study estimated temperature of formation of carbonate and quartz to 200 - 50 °C, where the high T carbonates have a source in saline waters from Permian sedimentary basins and lower T carbonates in meteoric water according to $\delta^{13}C$ and $\delta^{18}O$. K-Ar dating of illite yields 288-250 Ma related to uranium and post-uranium mineralization.



HYDROGEOLOGY + HYDROGEOCHEMISTRY

The hydrogeological monitoring network comprises 3 boreholes and 6 well springs on the surface as well as 36 documented sites of water infiltration in the URF. Study of hydrogeochemistry revealed composition of fluids (lower right) as well as their origin (shallow to deep) and age (up to 7100 years).



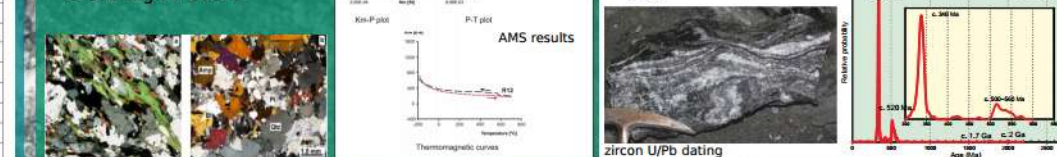
PETROLOGY + GEOCHEMISTRY + AMS + U/Pb DATING

In the URF the high-grade rocks are represented by presence of migmatite, migmatitised paragneiss and amphibolite, occasionally also by calc-silicate rocks and granite, pegmatite or aplite. Very often hydrothermal alterations are present (e.g. hematization, chloritization, kaolinization, carbonization).

These rocks represent basic rocks of a volcano-sedimentary complex, that have been affected by intense migmatitisation and undergone re-equilibration under amphibolite facies conditions (670-730 °C).

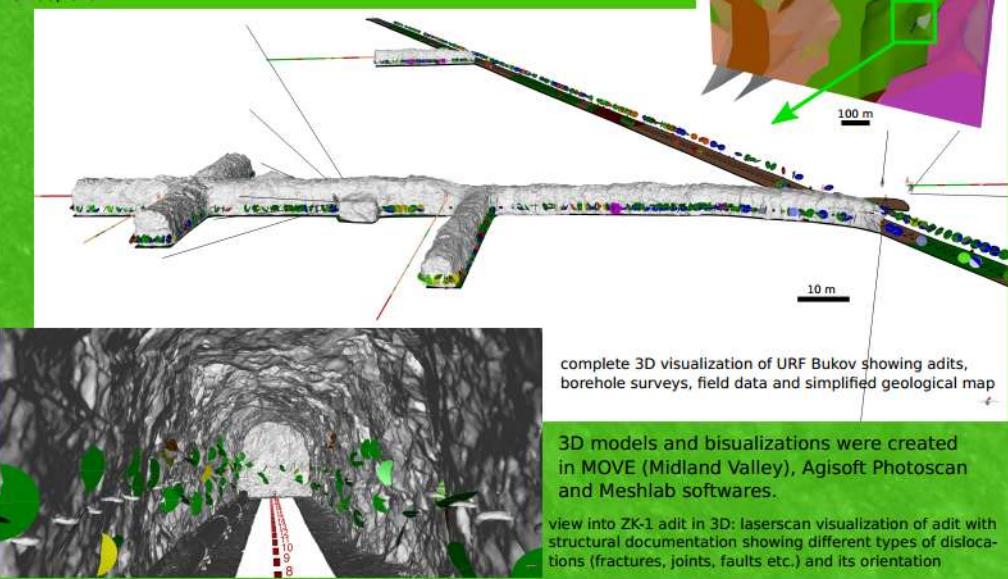
Anisotropy of magnetic susceptibility (AMS) study revealed the principal carriers of AMS: biotite and amphibole. There is significant concordance of magnetic and mesoscopic fabric, the AMS orientation reflects changes in regional strain.

Zircon U/Pb dating revealed many similarities with published data from Moldanubian domain and Teplá-Barrandian domain, which reveals primary identical nature and Carboniferous age of all these units as well as the early Carboniferous high-T event.



3D VISUALIZATION + 3D MODEL

The area of URF was visualized in 3D for the purpose of future experimental programme. The visualization comprises of laserscan of all tunnels with depicted lithology, all data collected by structural geologists and also shows location of boreholes, samples, hydrological monitoring sites, etc.



Acknowledgment
This project was financed by Radioactive Waste Authority of the Czech Republic (SÚRAO).