DOPAS

DOPAS
Training Workshop 2015

The Josef Underground Facility

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15 September 2015

D2 6.2a

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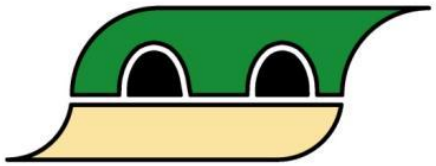
Content

- The Josef: Brief history and site description
- Education & training
- Research & development projects
- Public welcome

The Josef facility

- Operated, managed, financed… by Centre of Experimental Geotechnics (CEG) as integral part of the Faculty of Civil Engineering, CTU in Prague
- Facility is not old but you can hear several names of it…

- *The Josef Underground laboratory, The Josef gallery, The Josef ~~mine~~, URC Josef…*



The Josef facility

Underground Educational Facility
since 2007

&

Underground Research Centre
since 2011

The Josef facility

http://www.mapy.cz

60km south from Prague

The Josef facility: brief history

- Underground exploration works for the mining of gold
- Gold exploitation commenced in the Middle Ages – the peak of production reached in the 14th century
- Interest was renewed in the 1980s
- The excavation of the Josef Gallery commenced in 1981
- Exploration ceased in the mid 1980s

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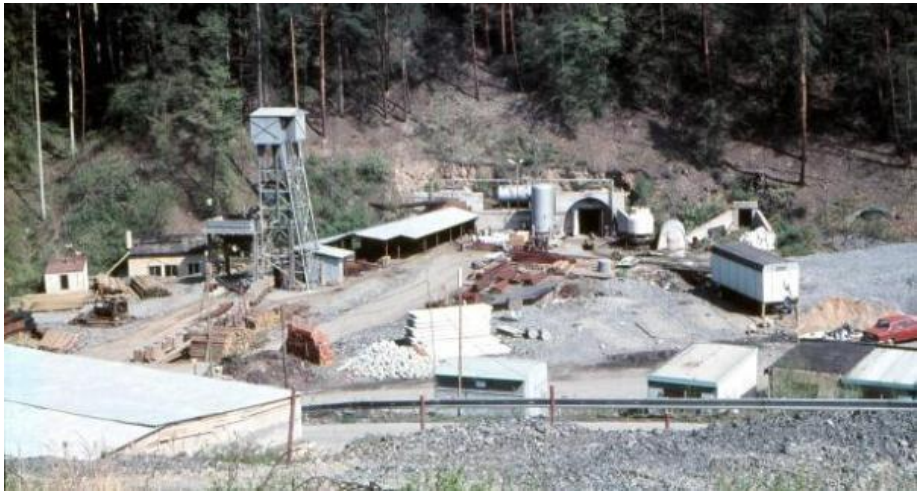
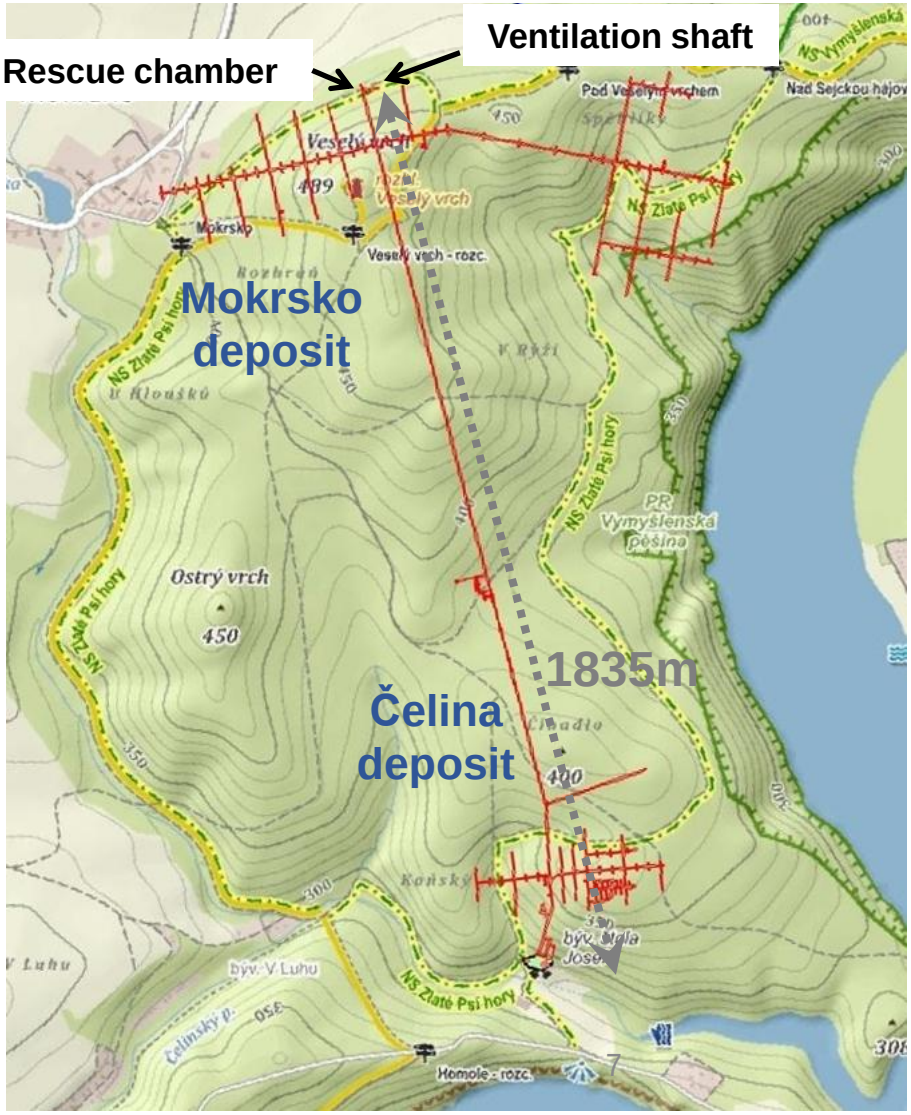


Photo by P. Morávek

Since 1980‘s is there:

- Underground:
  - The main drift 1 835m with profile 14 – 16m^2
  - Total length of the other drifts 6 018m, profile 9m^2
  - Height of the overlying strata 30 – 180m
  - About 20km of core drills
- Adequate surface area with administrative building – newly renovated

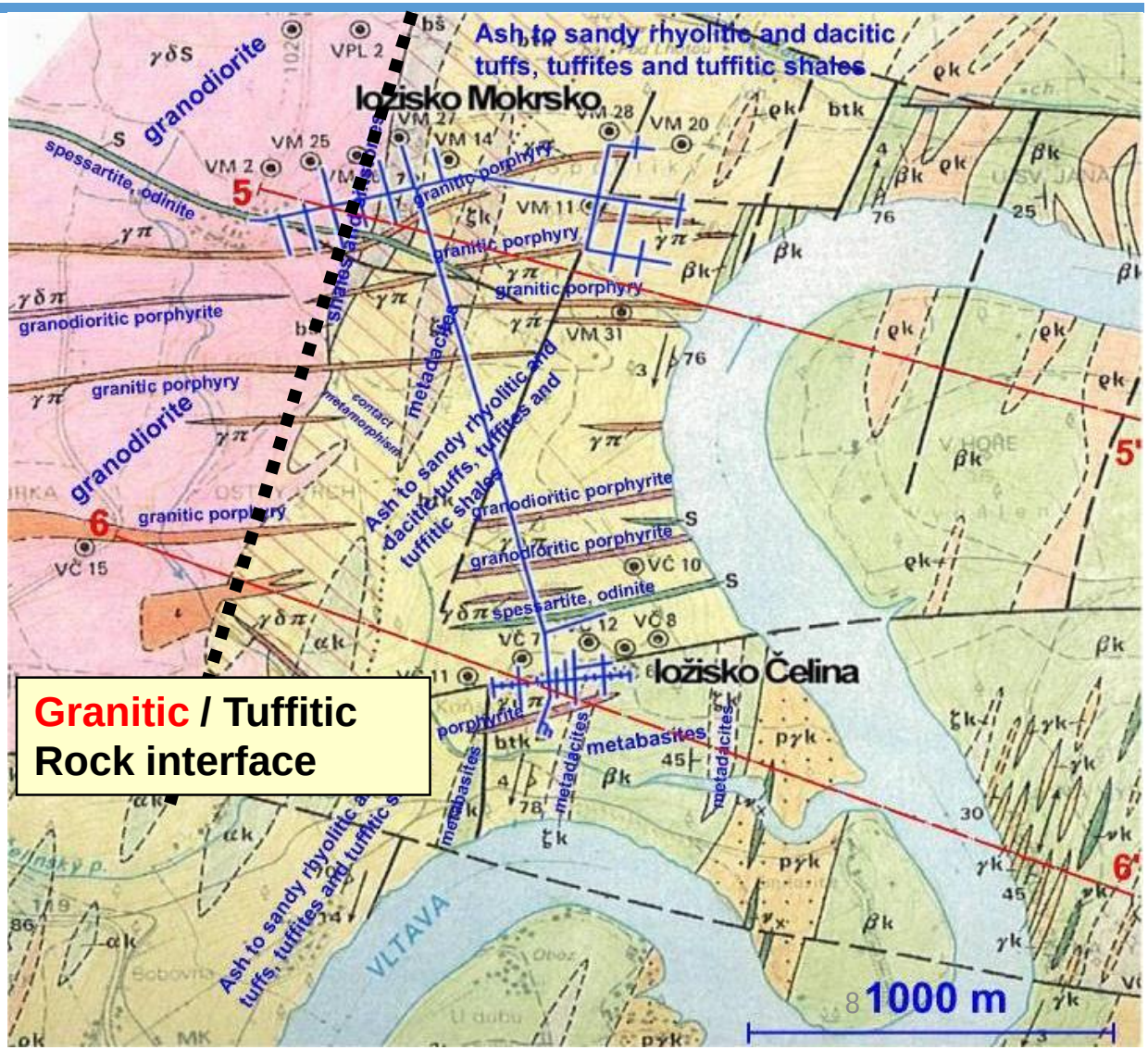


http://www.mapy.cz

The Josef facility: geology – More by Michal Roll 6.2b…

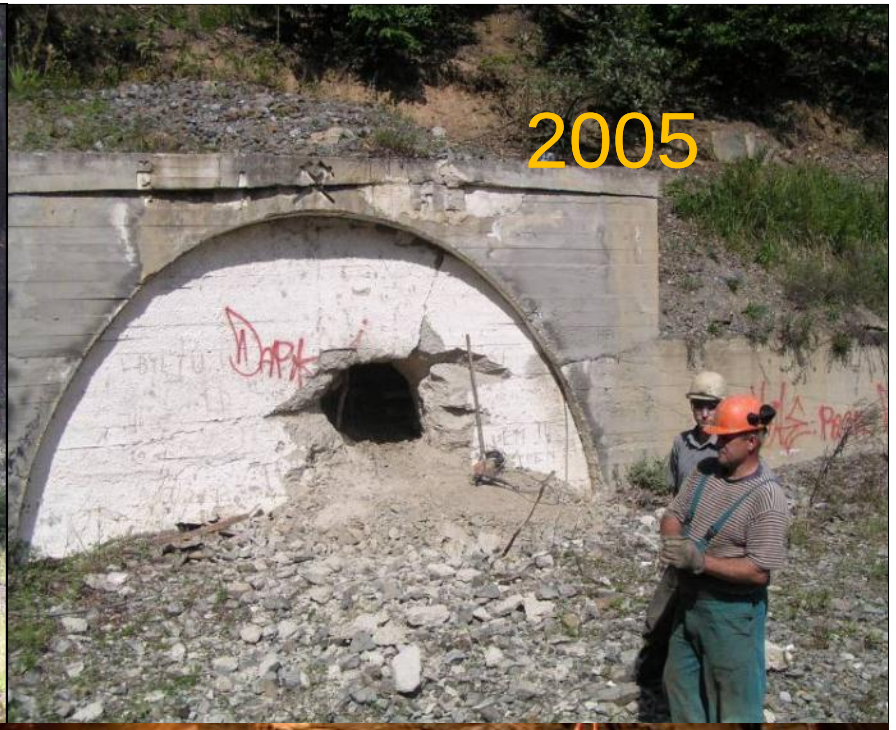
- The locality is characterised by rich veining and a complicated tectonic structure.
- Most of the underground areas are not lined.

Photo by P. Morávek



Geological map: Morávek et. al., 1991


2003


2005


2006


2006


Nov 06


Feb 07

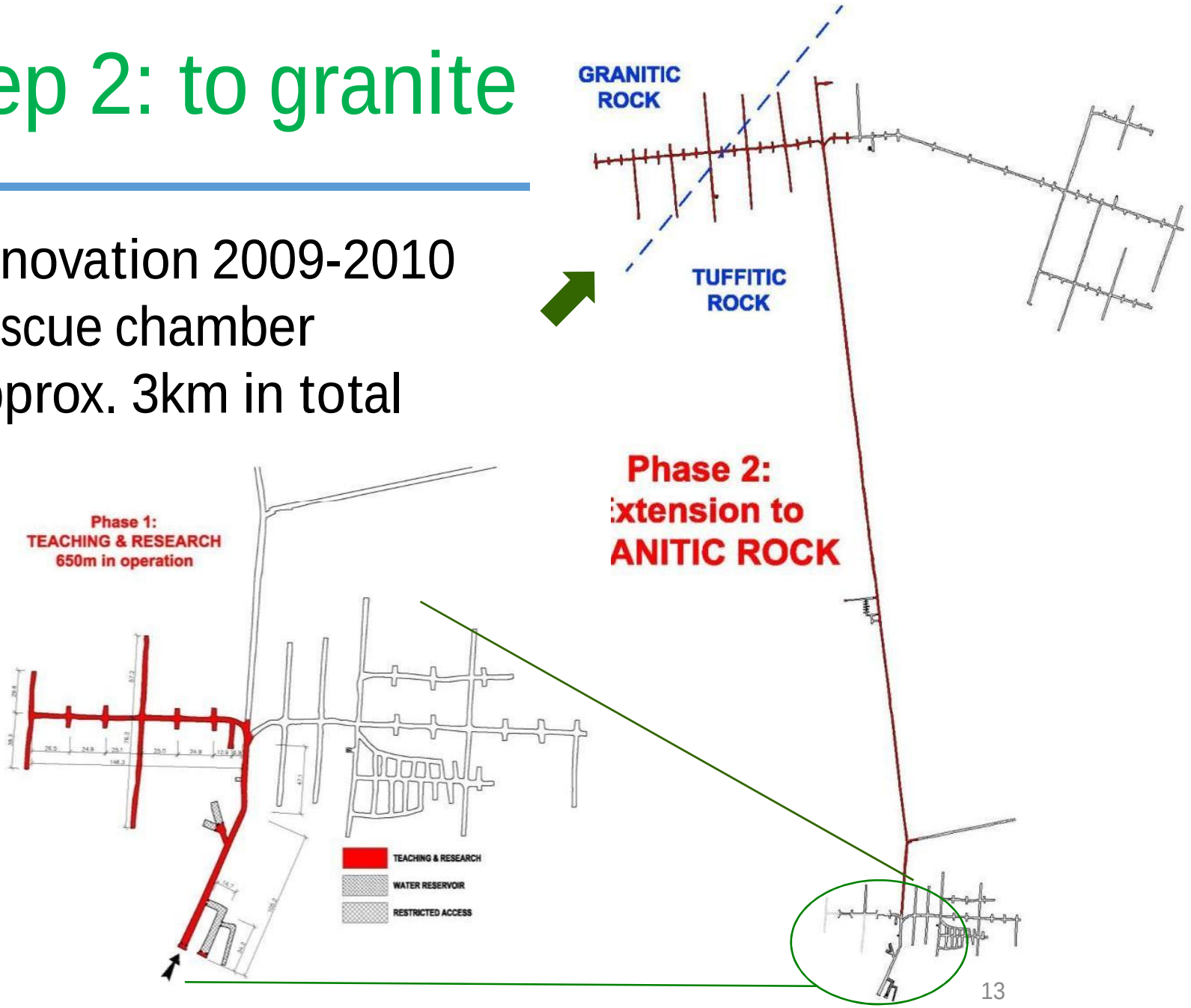
The Josef Underground Educational Facility Opening Ceremony 20th June 2007

Step 1: 650m in tuffs

Regular teaching & research works since Sept 2007

Step 2: to granite

- Renovation 2009-2010
- Rescue chamber
- Approx. 3km in total

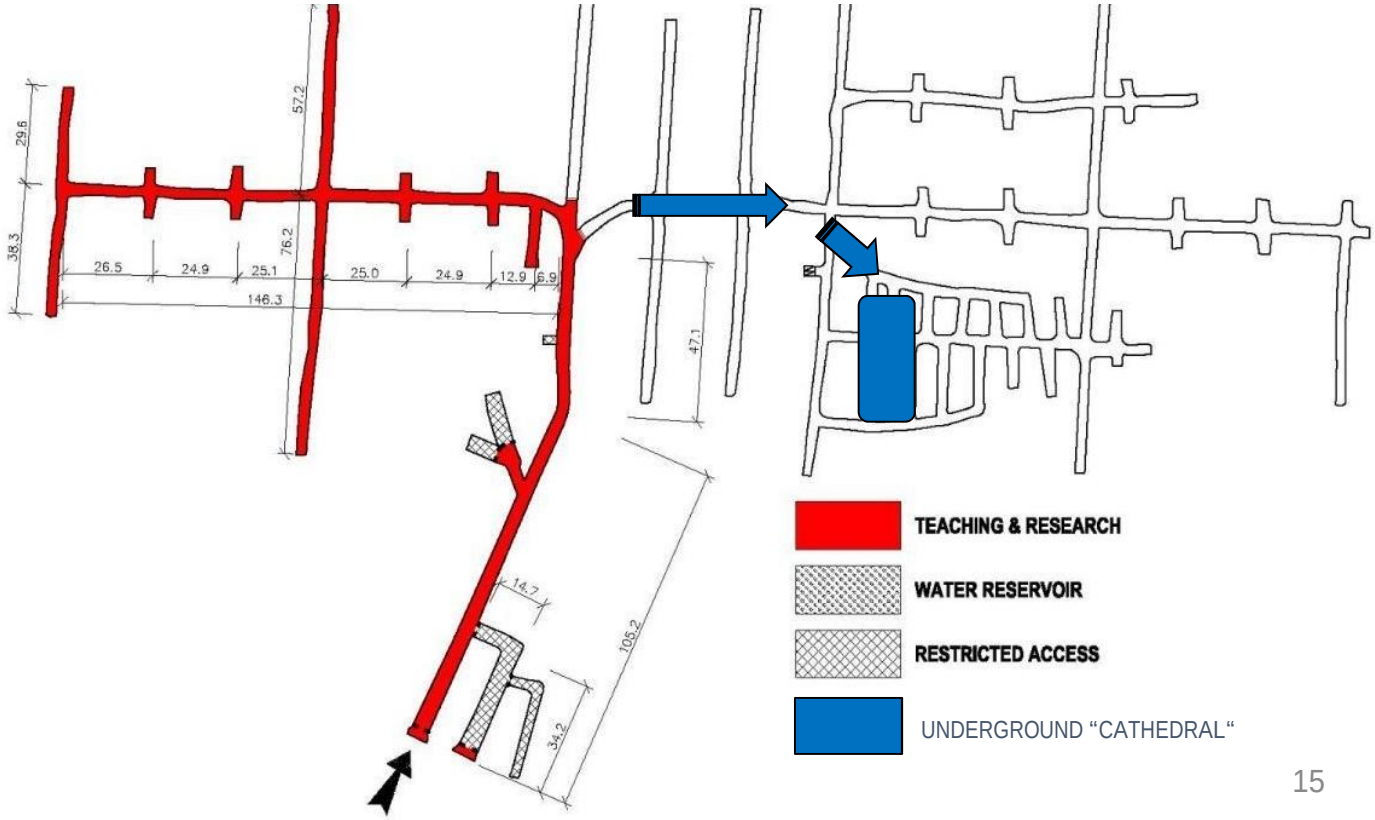


Step 3: Underground Research Centre

- Surface facility
- Research, training and marketing
- After 4 years of preparation
- Opened 2011

Step 4:
2 floors + large room at Čelina–east

- Renovation of galleries at 2 levels above „zero“ (20 and 40m) and adaptation of large cavern - underground „cathedral“
- Public visits since Aug 2014 - THURSDAY



Education & Training: CTU

- Faculty of Civil Engineering
- Starting in 2007 with 3 departments
  - Centre of Experimental Geotechnics
  - Dept. of Geotechnics
  - Dept. of Special Geodesy
- geology, rock mechanics, underground structures, field testing, environmental engineering, mining, geodesy, the „disposal“ aspects
- Practical exercises in 20 courses, 300 students / year




Education & Training: national

- Since 2010 - ’’Inter University Laboratory“
- Related to the construction and operation of:
  - Underground gas storage tanks,
  - spent nuclear fuel disposal in deep repository
  - the potential underground storage of CO_2
- Supported by Ministry of Youth, Education and Sport
- FCE CTU and 4 other Czech universities

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

EURATOM

Education & Training: national

Inter University Laboratory

- CTU: CEG and Faculty of Nuclear Sciences and Physical Eng.
  geotechnics, radiochemistry
- University of Chemistry and Technology Prague
  analytical chemistry, radioanalytics
- Masaryk University - Faculty of Science
  geochemistry, tectonics, hydrogeology, mining mapping
- Technical University Liberec - Faculty of Mechatronics
  numerical modelling, nanotechnology, transport processes

Education & Training: memberships

- European Nuclear Education Network (ENEN ass.; CTU – FNSPE, FCE)
- 2009: Recognized as IAEA training site - Member of the "Underground Research Facilities Network" (URF)
- 2009: ITC School of underground waste management (n/a)
- 2010: Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP)
- 2011: The Competence Maintenance, Education and Training group – the group of IGD-TP

Education & Training: projects

2006 – 2008: ENEN II

- Networking of European nuclear education, training and knowledge management (from national to European level)
- Nuclear engineering, radioprotection and radwaste management, geological disposal

2009 – 2012: PETRUS II - „Towards an European training market and professional qualification in Geological Disposal“

- Geological disposal only, sharing of teaching capacities, knowledge and experience, students
- 18 participants (7 Universities, 6 WMOs…)

2013 – 2016: PETRUS III - „Implementing sustainable E&T programmes in the field of Radioactive Wastes Disposal“

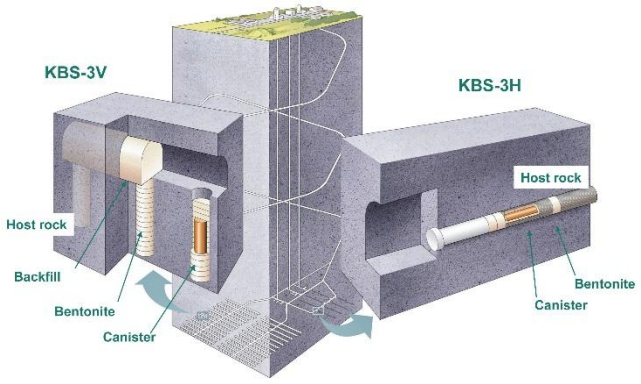
- Master Programme implementation, focus on PhD and professional development
- 20 participants (9 Universities, 6 WMOs…)

Education & Training: practical courses at Josef

- 1 – 3 weeks
- with help of SURAO and other institutions
- geotechnical laboratory, in-situ tests and experiments and more…
- June 2011: 1st course “Fundamentals of Geological Disposal“; by CTU, ITC and IAEA
- September 2013: another IAEA practical course (+ Cardiff Uni)
- September 2011, 2012, 2014: 2-3 weeks practical courses on RADWASTE disposal (CTU + SURAO; FR, ES, CZ, FI)
- Now J

Research & Development: general

- Following Swedish concept KBS3 of the deep repository
  - granitic rock + bentonite buffer and backfill
  - SÚRAO, other national – MIT/ TACR, MYES, GACR...
  - Intl. - EURATOM, Norwegian funds...
- Several issues on buffer & backfill (and plugs)
  - THMC parameters, material selection, long term stability, technologies...



SKB, Illustrator: Jan Rojmar

Research & Development: CEG focus

Geotechnical problems related to the repository being solved at Josef by CEG

- Swelling clays behaviour
  - Laboratory investigations and specifics of laboratory methods
  - Technological aspects (sprayed clays)
  - Long term stability
- Gas permeability of rock massive
- Large scale in-situ tests

  (buffer, backfill, plugs...)

Research & Development: cooperation

Other problems in geological disposal and other fields

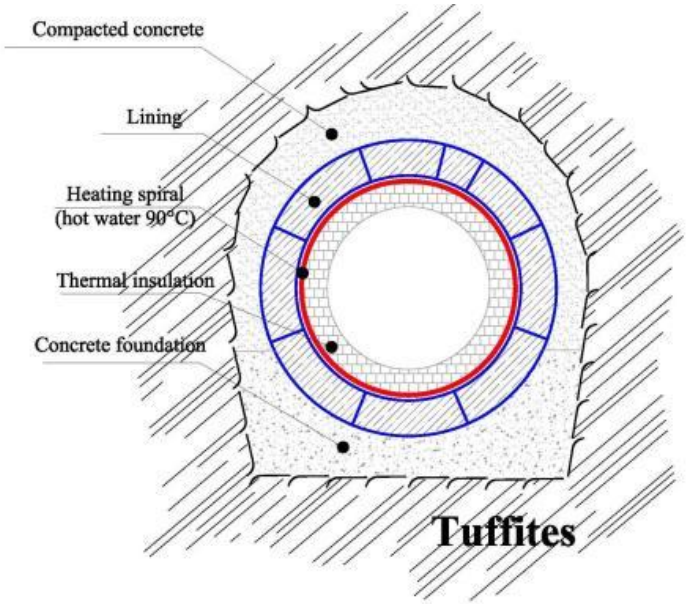
– in cooperation

- Geochemistry and mineralogical stability of bentonite and interaction with the rock environment
- Tracer tests (fluorescent, radioactive – PAMIRE…)
- Dynamic fracturation of rock
- Underground energy storage and geothermal energy
- SÚRAO, ÚJV Řež a. s., VŠCHT, TUL, ČGS, Charles Uni, IsaTech, Geomedia, Arcadis a. s., Progeo…

R&D example: TIMODAZ

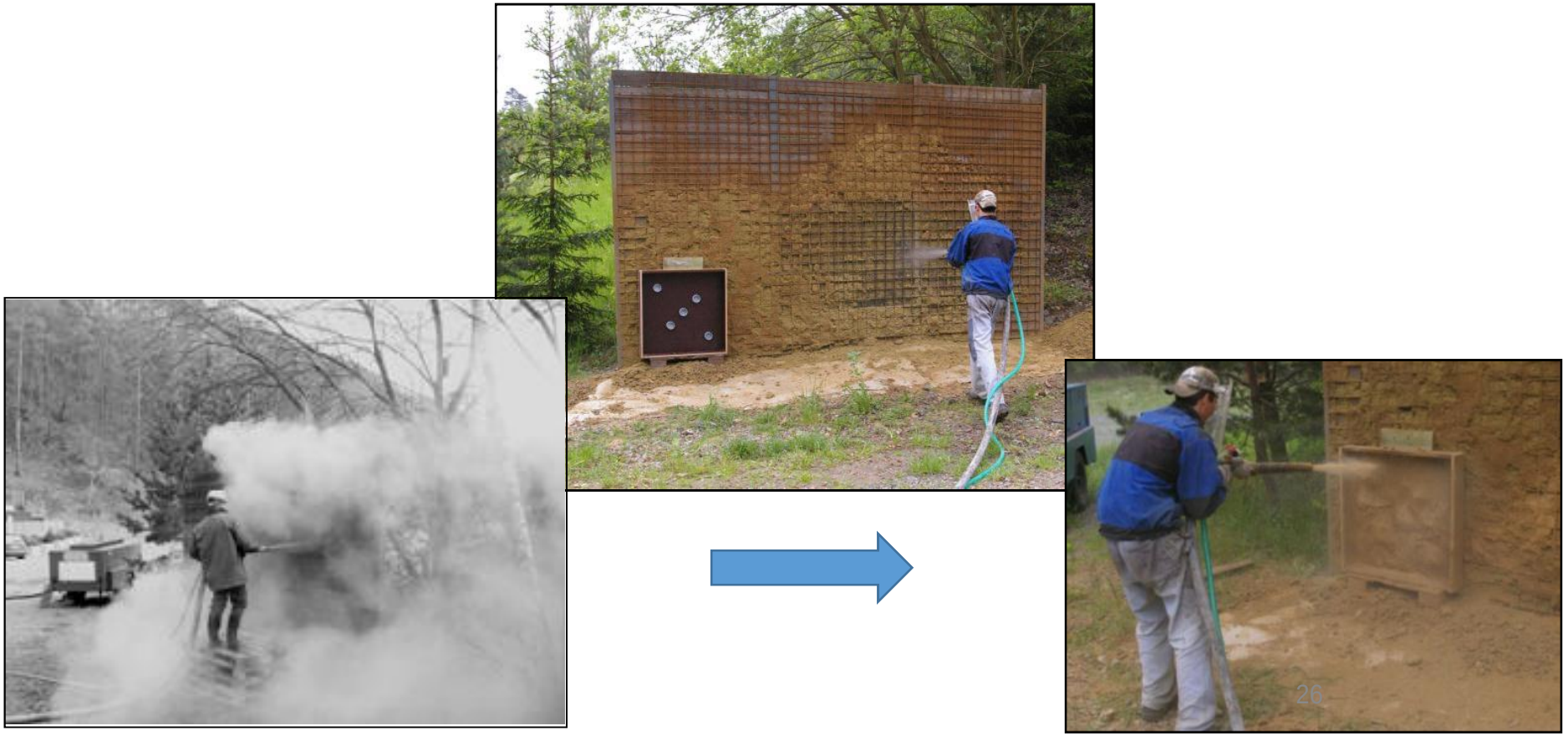
- ''Thermal Impact on the Damaged Zone Around a Radioactive Waste Disposal in Clay Host Rocks“
- 6.FP EU, 2007-2010
- WP4.3 Lining stability under thermal load

SIXTH FRAMEWORK PROGRAMME



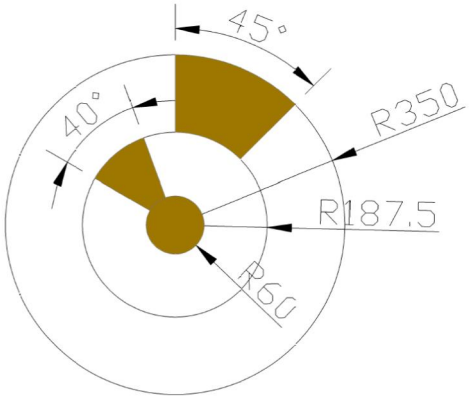
R&D example: Shotclay

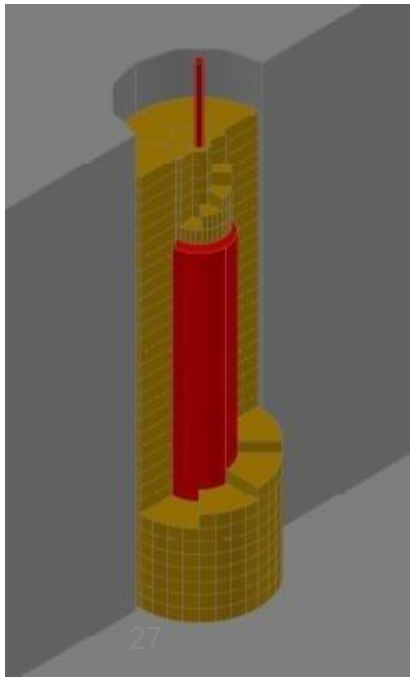
- The Development of Sprayed Backfill Technology
- SURAO, 2008 - 2009



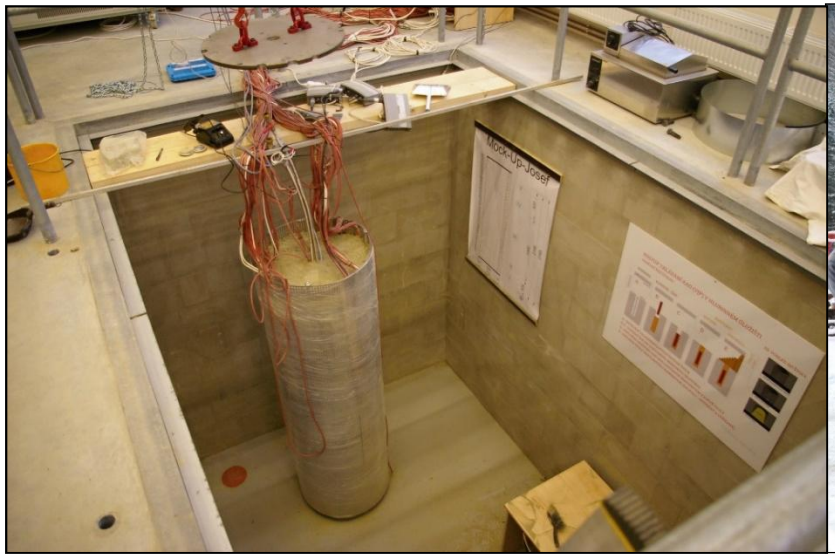
R&D example: Mock-Up-Josef

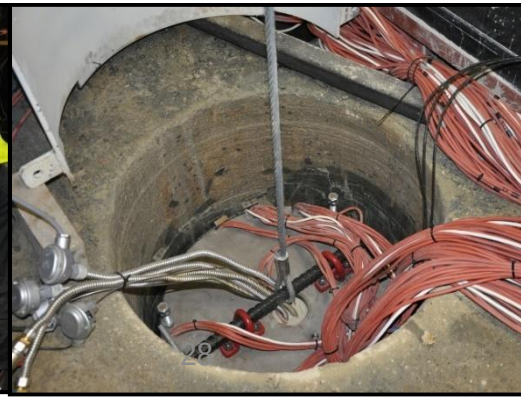
- SURAO, 2011 - 2015
- Real (1:2) model of disposal cell according to SKB – KBS3V
- 0.75m diameter, 2.25m depth in granite (2.8m total)
- Czech Ca-Mg bentonite, Blocks ρ_d=1.65g/cm^3
- Saturation from granitic massif
- Heater up to 200°C (real 95°C)





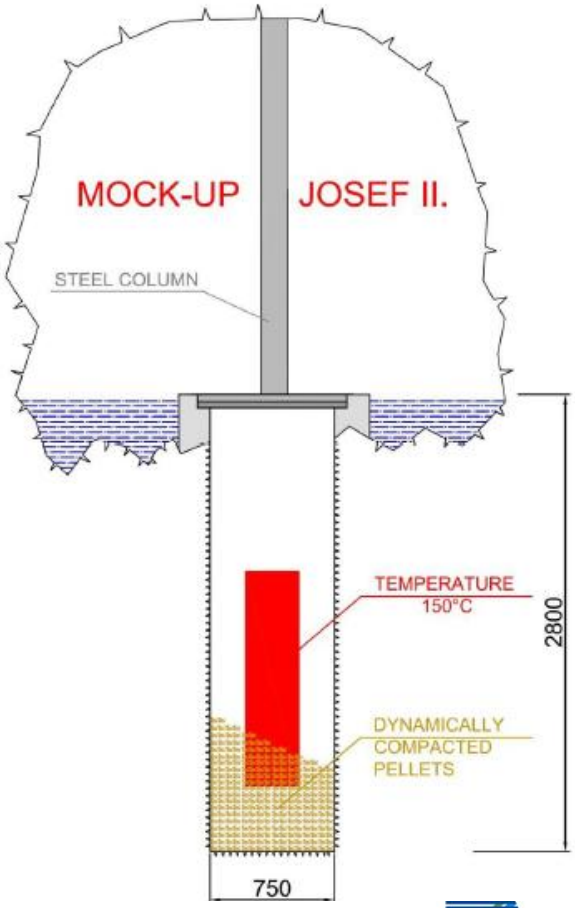
R&D example: Mock-Up-Josef





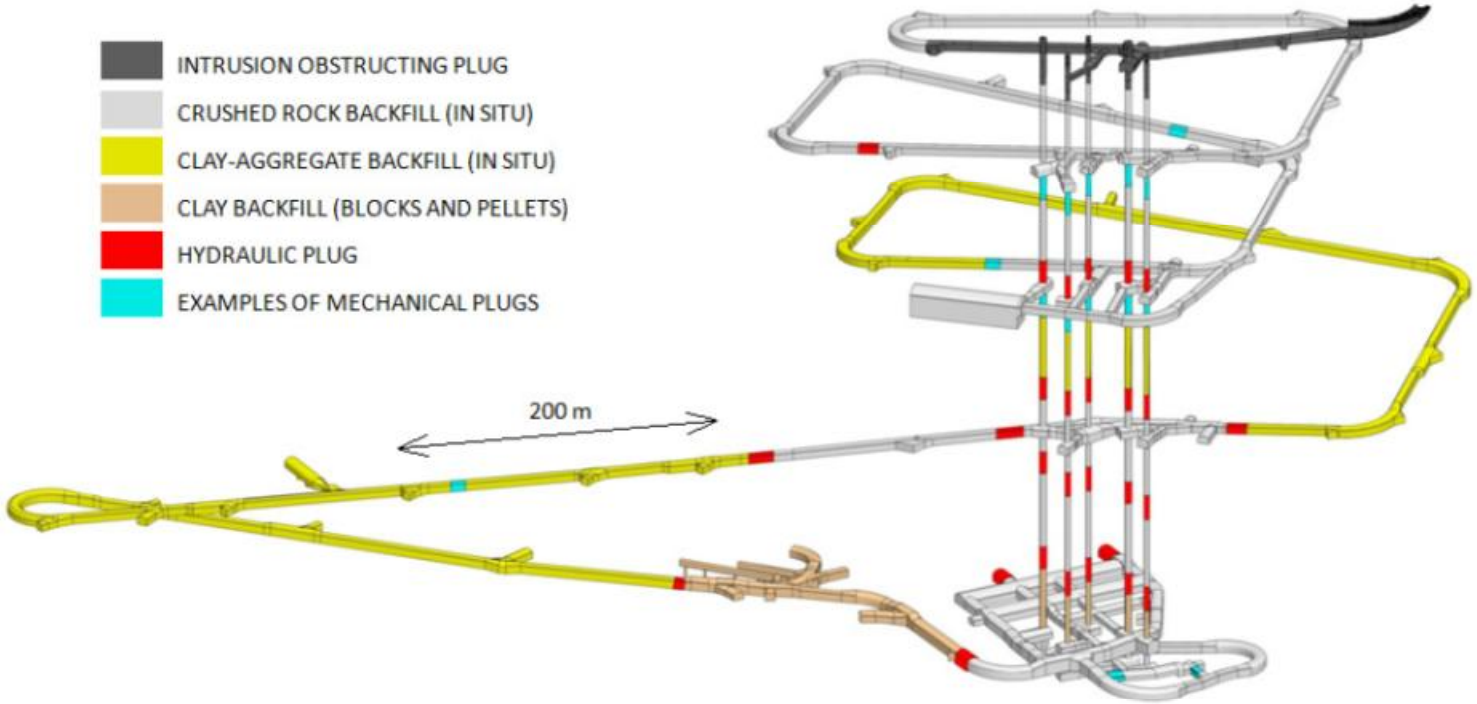
R&D example: Mock-Up-Josef II

- Under preparation 2 similar experiments
- Buffer – compacted pellets
- Bentonit 75 - as in EPSP/ MX80
- Temperature above 100°C (150°C?)
- Artificial saturation allowed



R&D example: DOPAS – this workshop J EPSP - More by Jiri

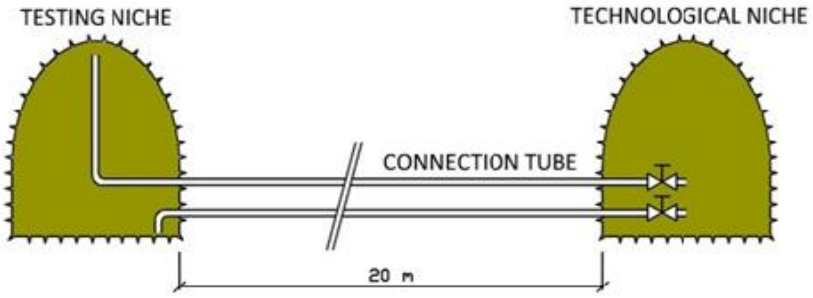
Repository sealing plugs – FP7

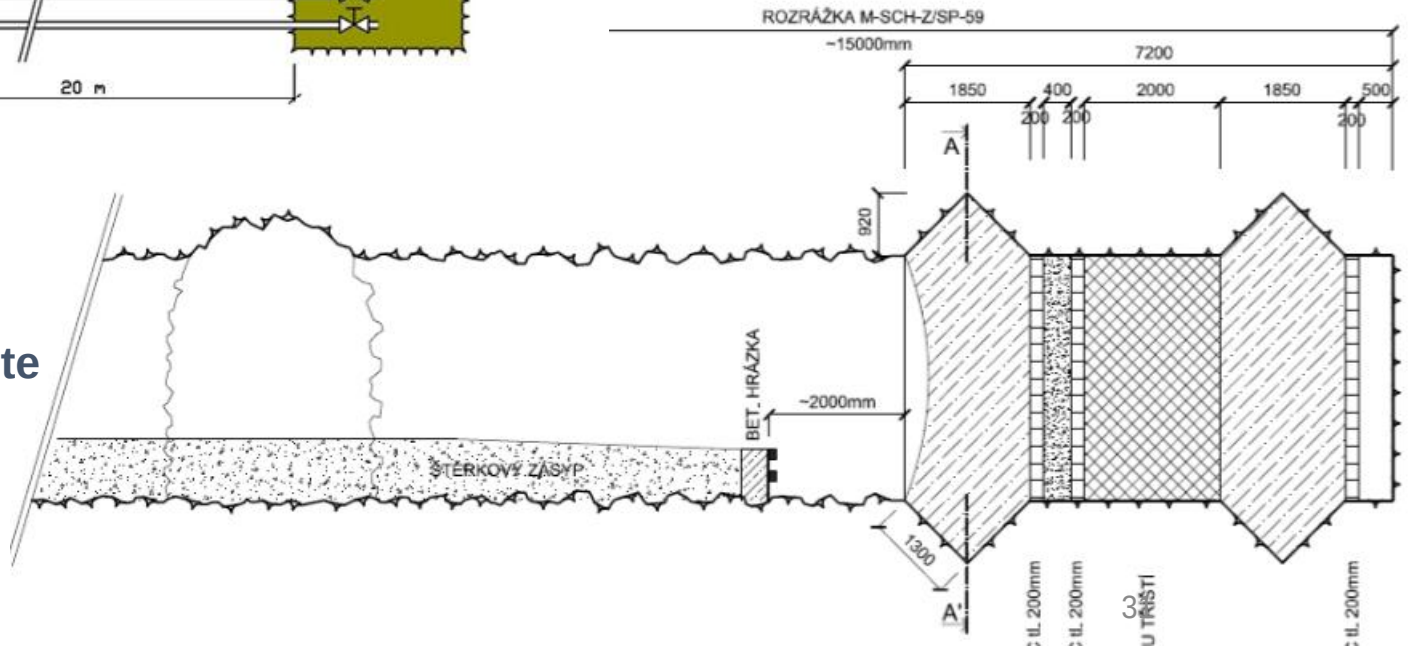


Sievänen et. al., 2012 © Posiva Oy

R&D example: DOPAS - EPSP

- **Experimental Pressure and Sealing and Plug**
- CTU together with SÚRAO and ÚJV Řež a. s.

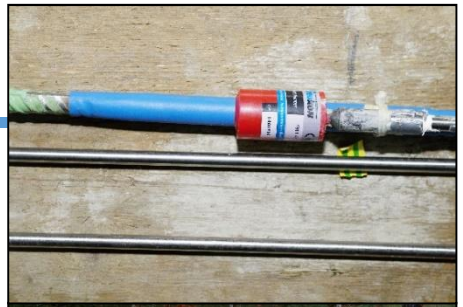




- **7m long plug**
- **grouting**
- **low pH concrete**
- **swelling clay**
- **rock**

R&D example: DOPAS - EPSP









Space for… marketing

- Minova/ Orica drilling and bolting tool – all in one

Space for … fire experiment - Sept 2008






Space for… testing of vehicles

- Škoda auto a. s. & Faculty of transportation, CTU

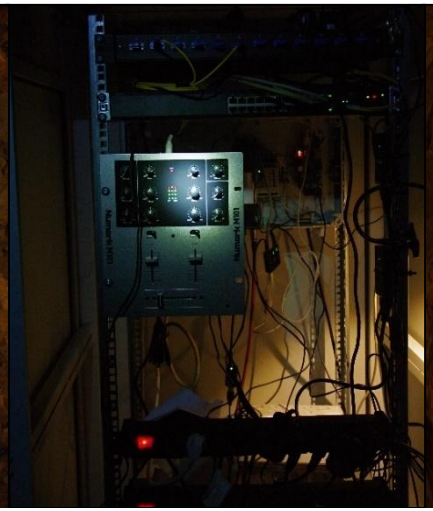
Public welcome

- Regular visiting days, Open days
- Group visits on request (public, high schools)
- SURAO guests (public) from potential DGR localities
- Three circuits for visitors in the underground
- Intl. road bike competition (next 8 May 2016)
- and…

Public welcome

New attraction: Underground „cathedral“ - THURSDAY

- chamber 10*26*40m, 3D on youtube
- Vertical quartz veins, up to 40cm thick
- Viewpoints and balconies at 3 levels (0, +20m, +40m)
- Darkness, music, lightshow and more...



Conclusion

The Josef site is:

- not far from Prague, situated in lovely area,
- A good example of the place where radwaste waste cannot be disposed (gold deposit, shallow, fractured rock, water regime,...)
- With more than 18 finished, 14 ongoing and 6 submitted projects very good „playground“ for universities and research institutions in geological disposal and other fields
- A nice place for education & training (continuing activities of 4 Czech universities, PETRUS, IAEA URF net...)
- Open to public...

List of references

- Morávek P., Röhlich P., Váňa T., Odkrytá geologická mapa jílovského pásma, list č. 2, 1:25 000, Český úřad geodetický a kartografický, 1991
- Sievänen, U., Karvonen, T. H., Dixon, D., Hansen, J. & Jalonen T. Closure Production Line 2012 – Design, production and initial state of underground disposal facility closure. POSIVA 2012-19. Posiva Oy, Eurajoki. ISBN 978-951-652-200-8.
- *SKB, Illustrator: Jan Rojmar, available online [10.9.2015]:* http://www.posiva.fi/en/final_disposal/basics_of_the_final_disposal

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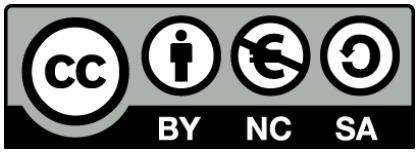

Thank you...