

# REPP-CO<sub>2</sub> – Czech-Norwegian research project to prepare a CO<sub>2</sub> storage pilot in the Czech Republic

- Coordinator: Czech Geological Survey (CGS)
- Partners: IRIS, VŠB – Technical University of Ostrava, ÚJV Řež, a.s., Research Centre Řež, Miligal, s.r.o., Institute of Physics of the Earth, Masaryk University (UFZ)
- Funding: Norway Grants
- Budget: 77 mil. CZK  $\cong$  2.85 mil. €
- Grant provider: Ministry of Finance
- Project partner: Ministry of Environment
- Project duration: 23/1/2015 – 30/11/2016

# Project objectives

- (i) **Assess the selected geological structure** (a depleted oilfield) as a possible geological storage site for a research CO<sub>2</sub> storage pilot project, utilising the methodology according to the Czech national law No 85/2012 Coll. on the storage of carbon dioxide in natural geological structures;
- (ii) Strengthen the **Czech-Norwegian cooperation** in the area of CO<sub>2</sub> geological storage and related research and development;

# Project objectives

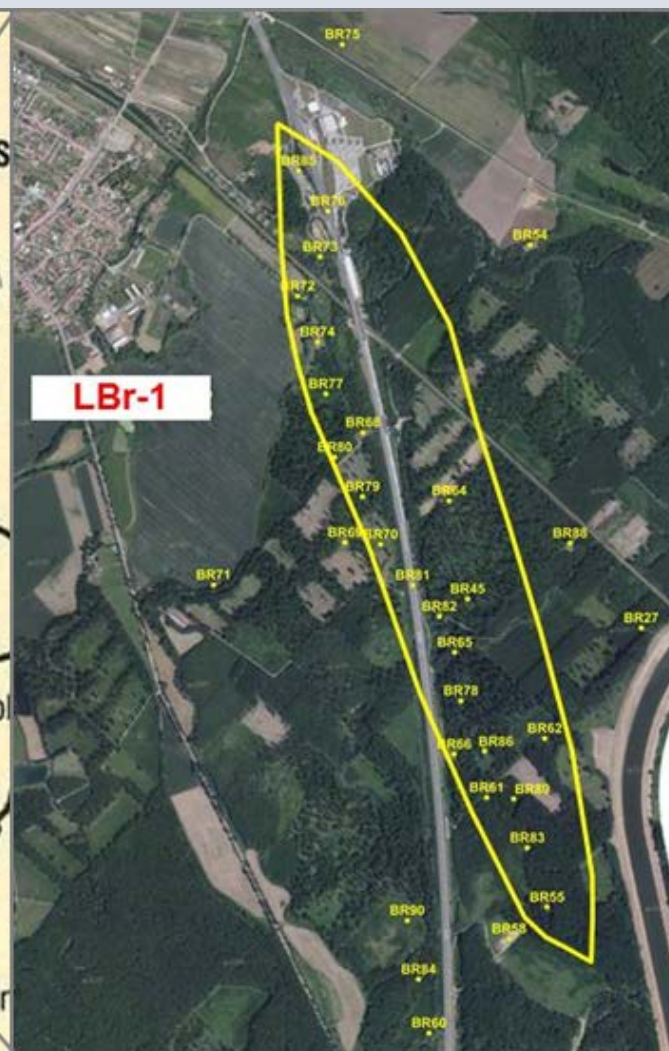
- (iii) **Test the methodology**, procedures and criteria for description and assessment of a planned CO2 storage complex as specified by the **law No 85/2012 Coll.** on the storage of carbon dioxide in natural geological structures under real conditions of a concrete storage site preparation;
- (iv) Perform **geological modelling** of the storage site and subsequent **numerical simulation of CO2 injection**;

# Project objectives

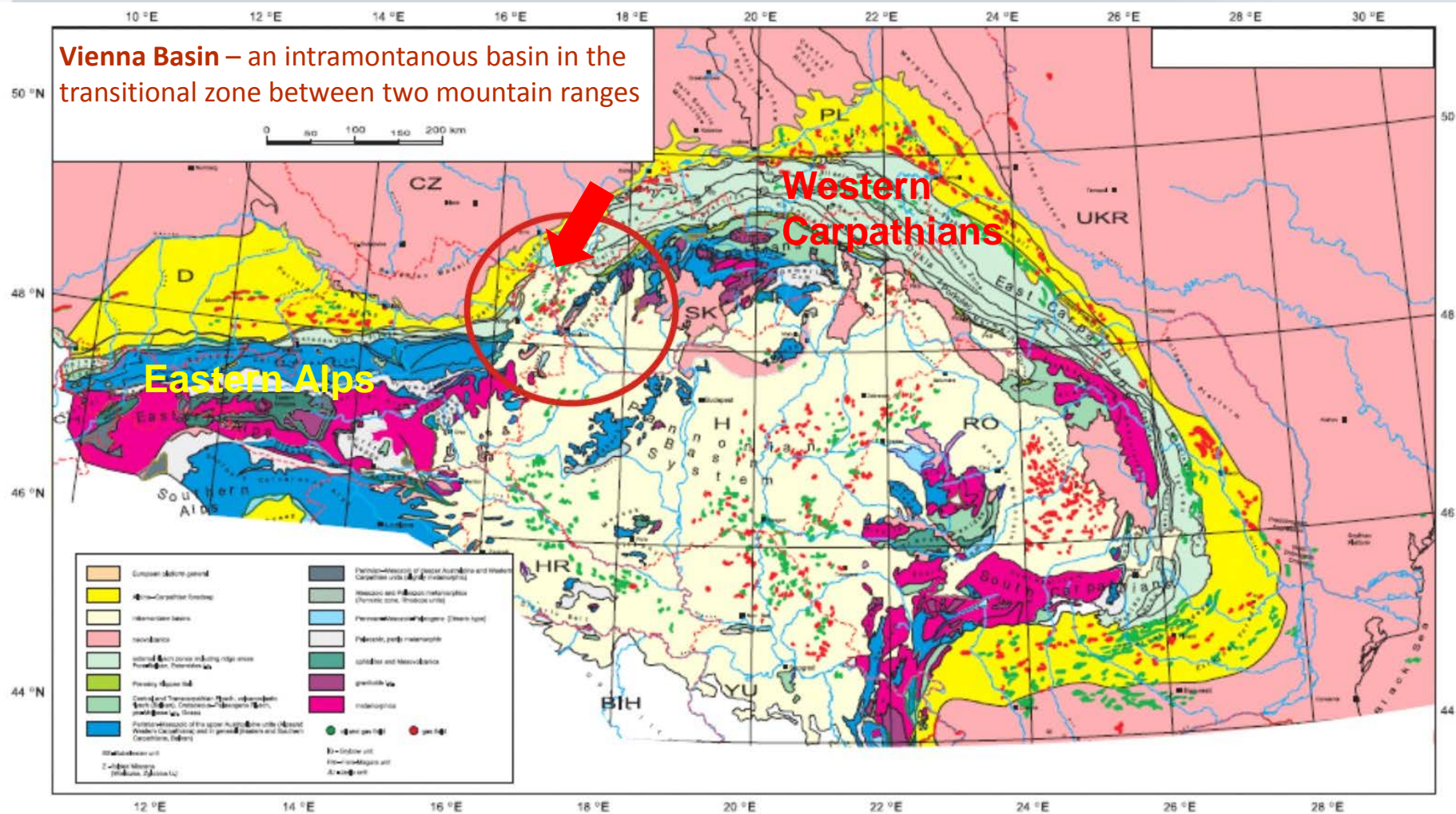
- (v) Perform a **risk analysis of the storage site**, including assessment of conflicts of interest, proposal of risk mitigation measures and compilation of **storage site monitoring plan**;
- (vi) Newly **assess the potential of the Carpathian** rock formations in the area of the Czech Republic from the CO<sub>2</sub> storage point of view.



# LBr-1 location



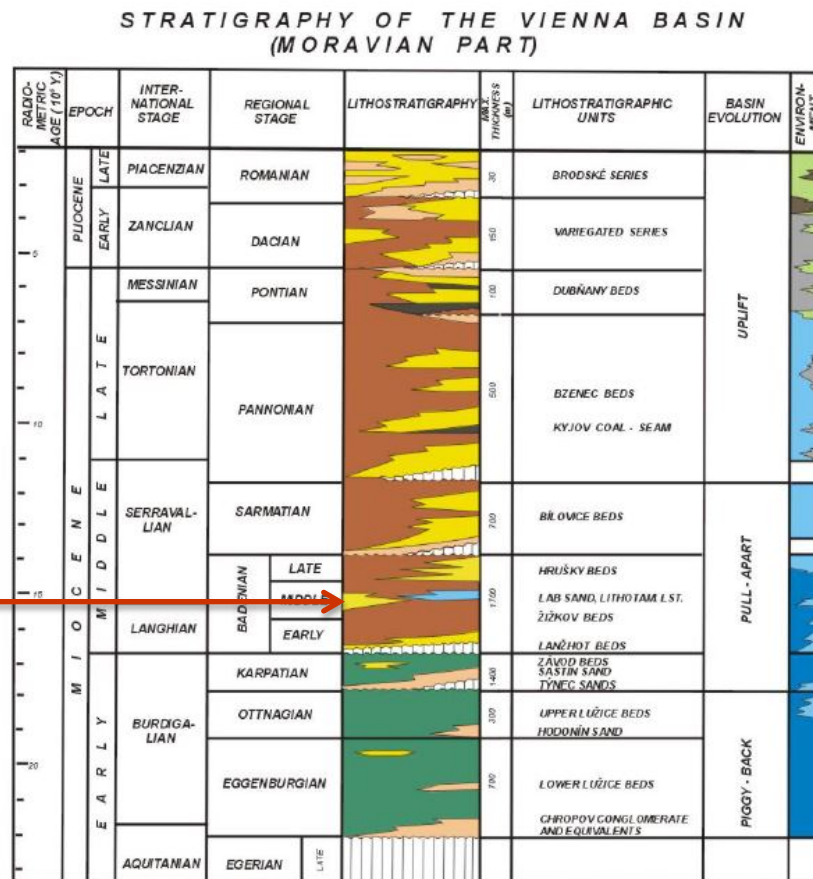




## General overview and distribution of oil and gas fields in the Circum Carpathian Region of Central Europe. (Golonka & Picha, 2006)

# Stratigraphic position

LBr-1 oil field



## LITHOLOGY AND PALEONTOLOGY

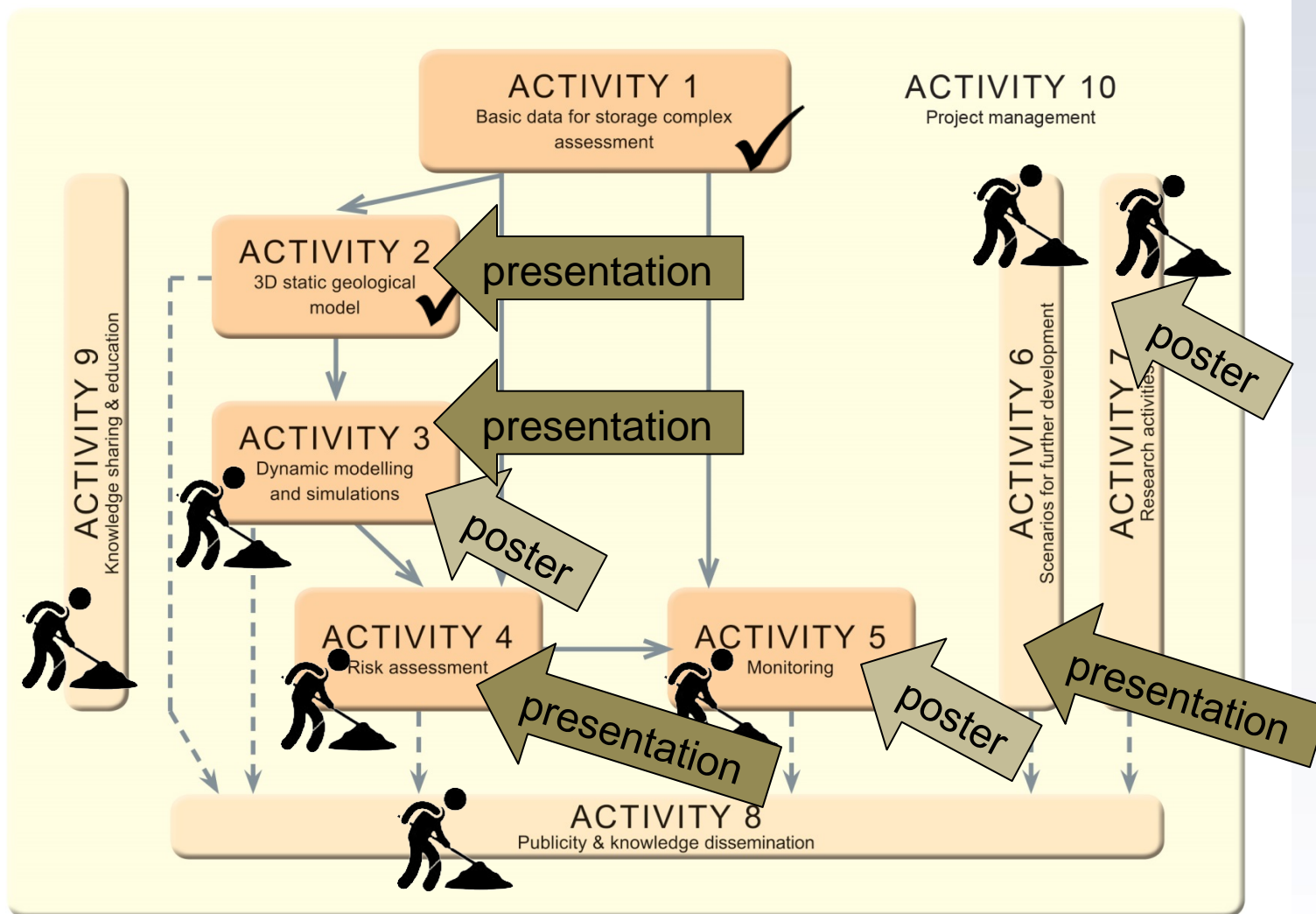


## ENVIRONMENT





# Project structure



# A1 - Archive cores



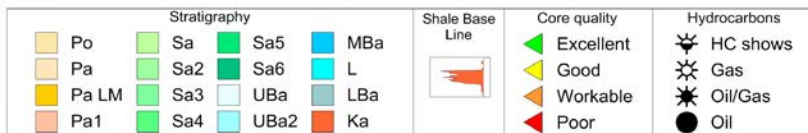
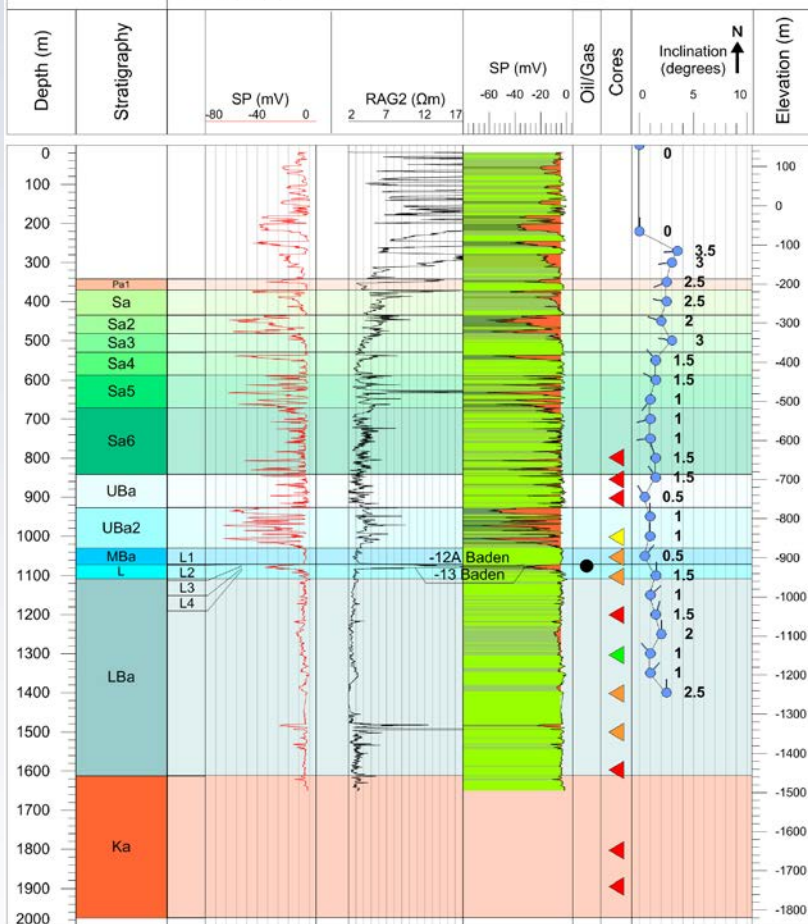


# A1 – Re-assessment of old data

**LBr North  
BR45**

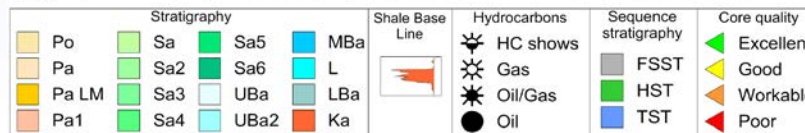
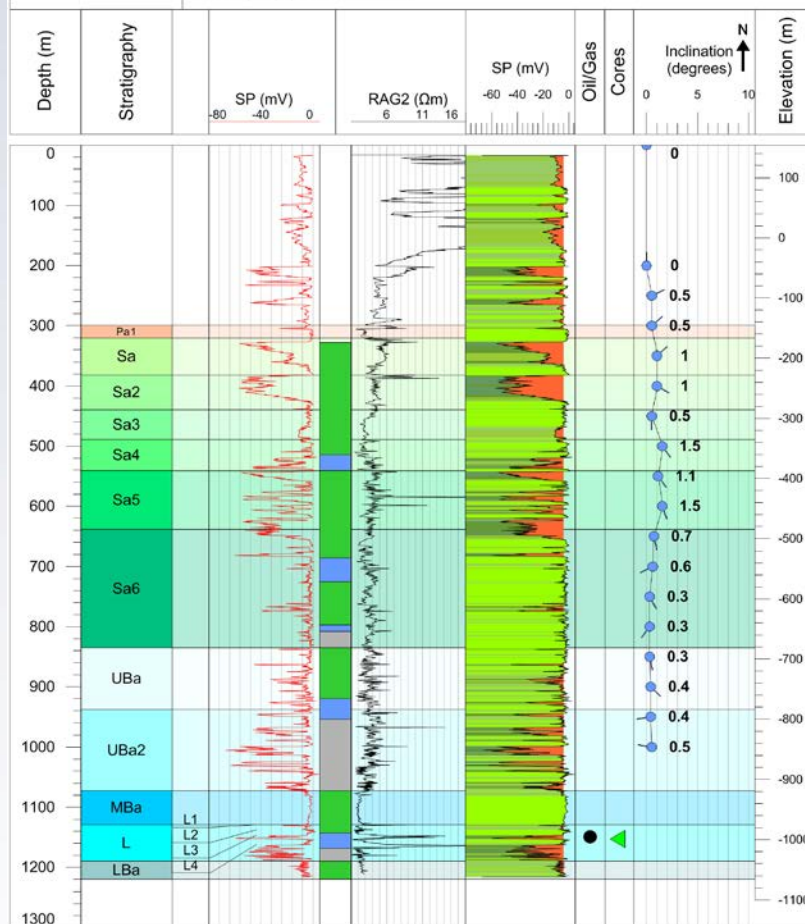
Easting: 646497  
Northing: 5399684.4  
Elevation (m): 154.83  
Total Depth (m): 1975.5

Date: 15.10.1957



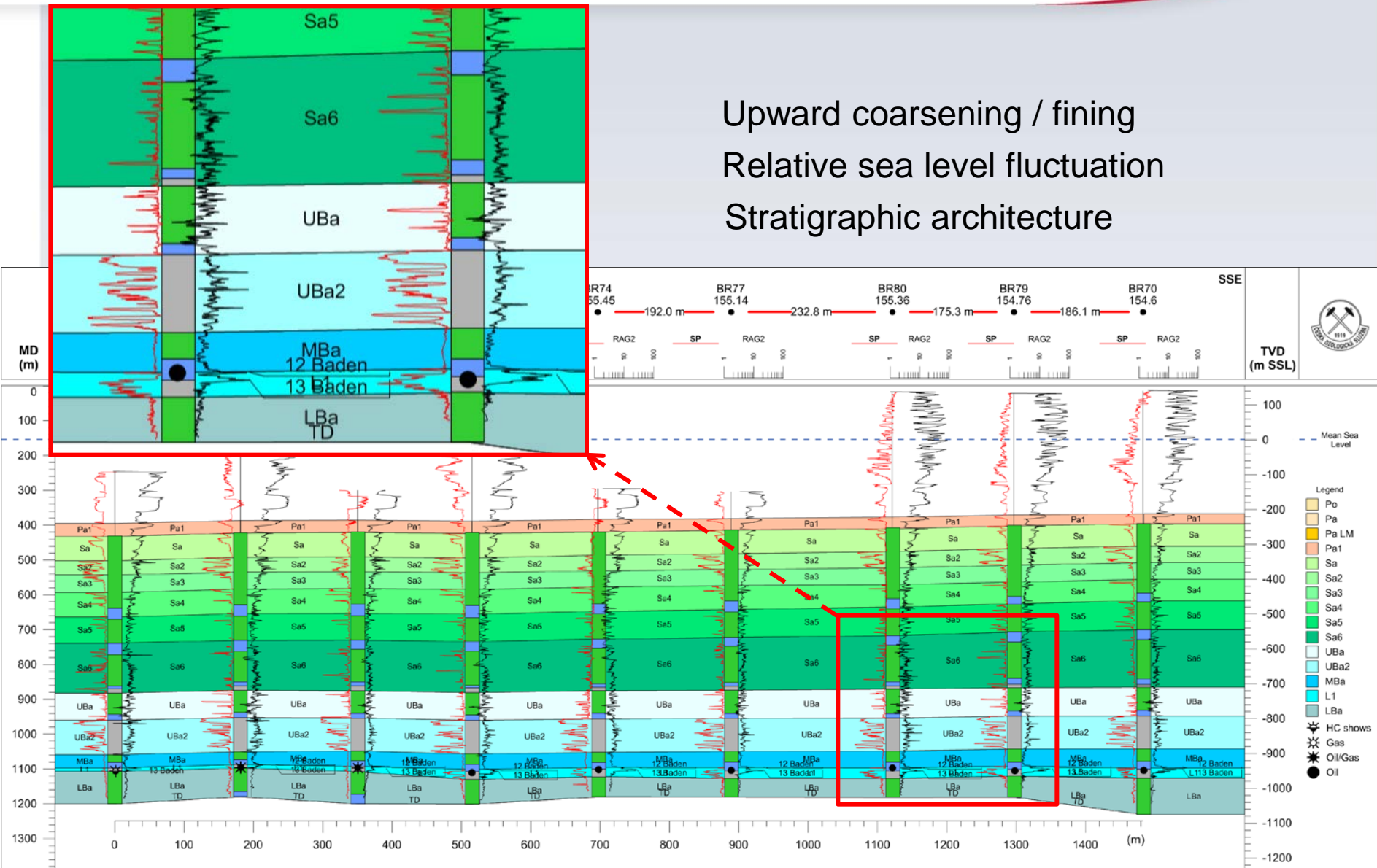
**LBr South  
BR52**

Easting: 646660.2  
Northing: 5397328.6  
Elevation (m): 153.87  
Total Depth (m): 1220



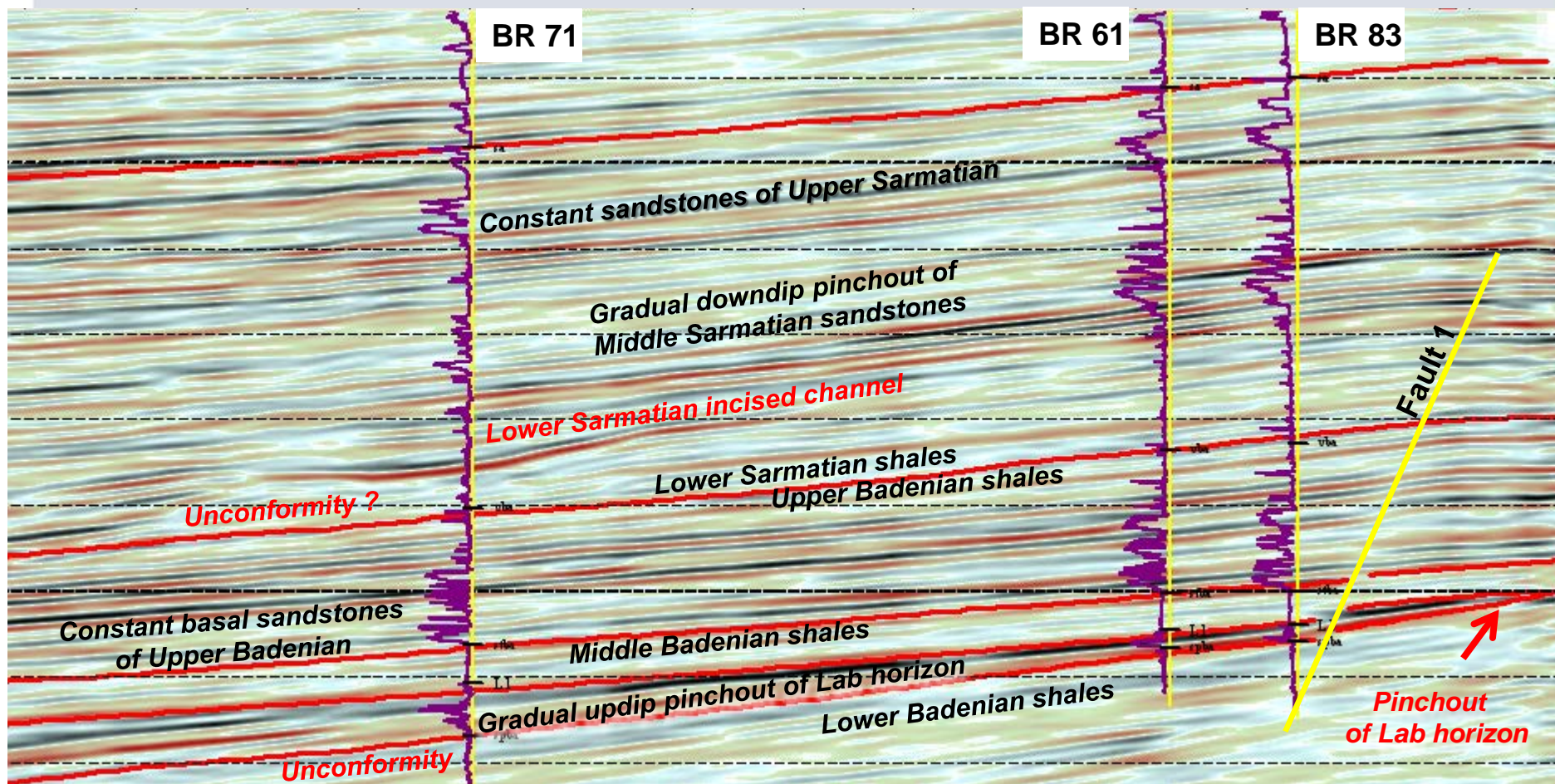
# Sequence stratigraphic interpretation of well log data

Upward coarsening / fining  
Relative sea level fluctuation  
Stratigraphic architecture





# Integration of seismic stratigraphy and well log data



# LBr-1 – status of wells

## Top of Lab Horizon



Fault



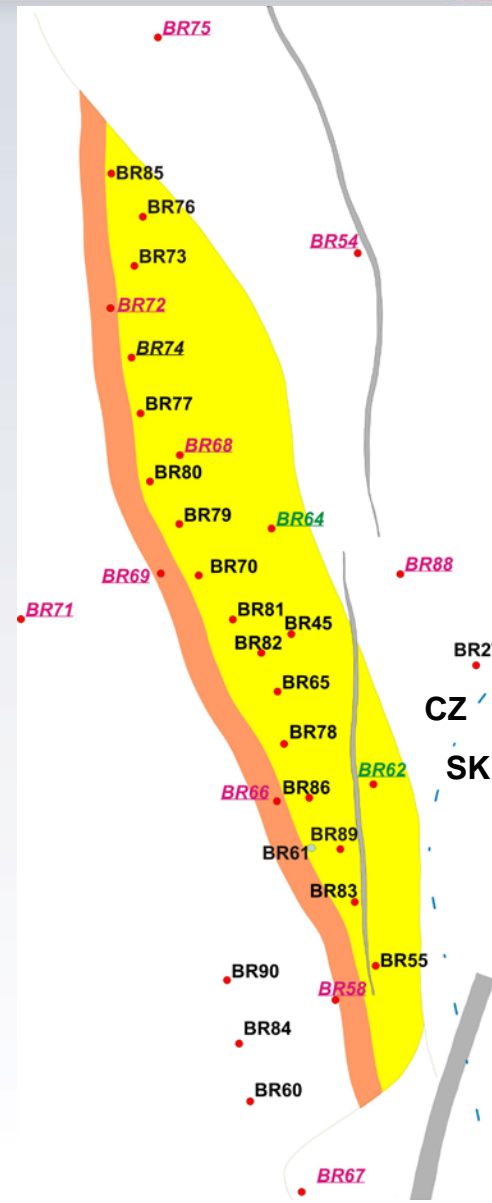
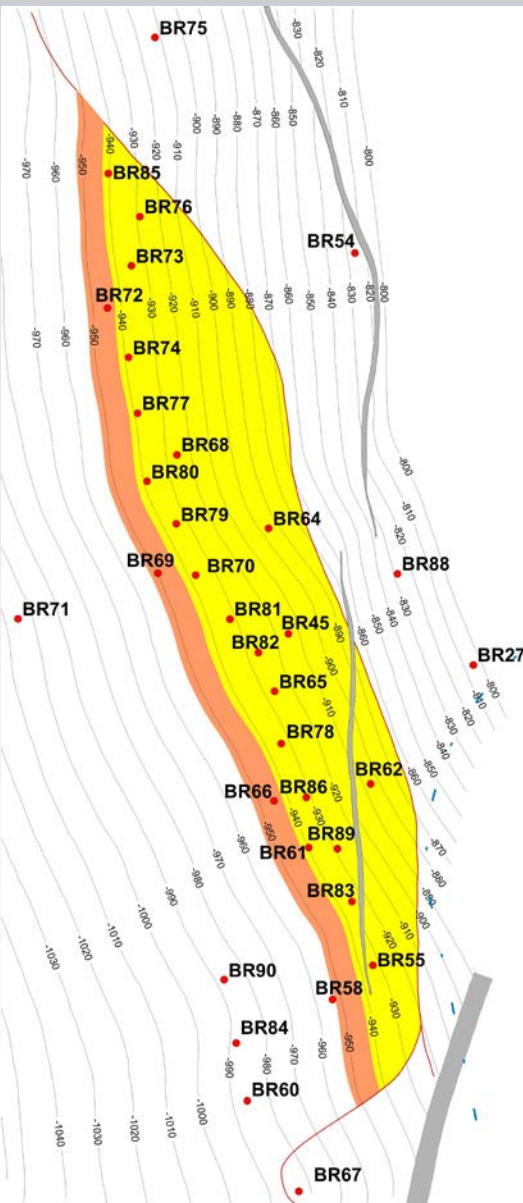
Pinch-out boundary



Gas zone



Oil zone



Abandoned well

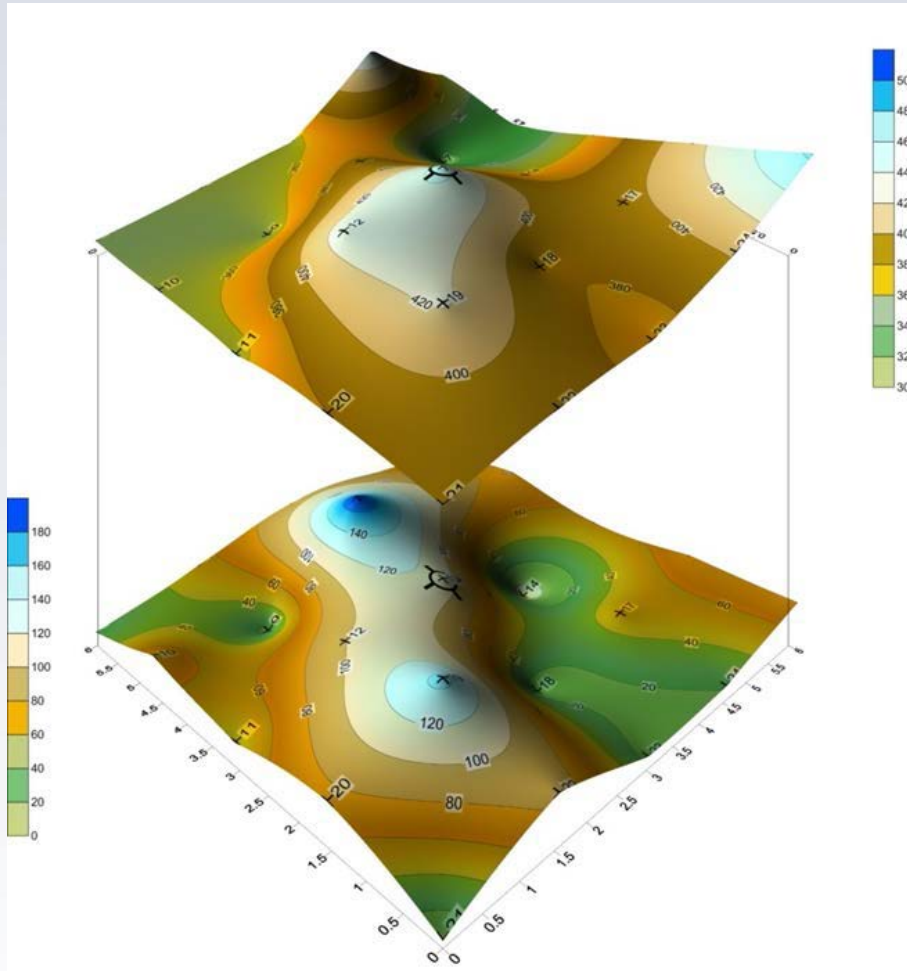


Re-abandoned well



Targeted well

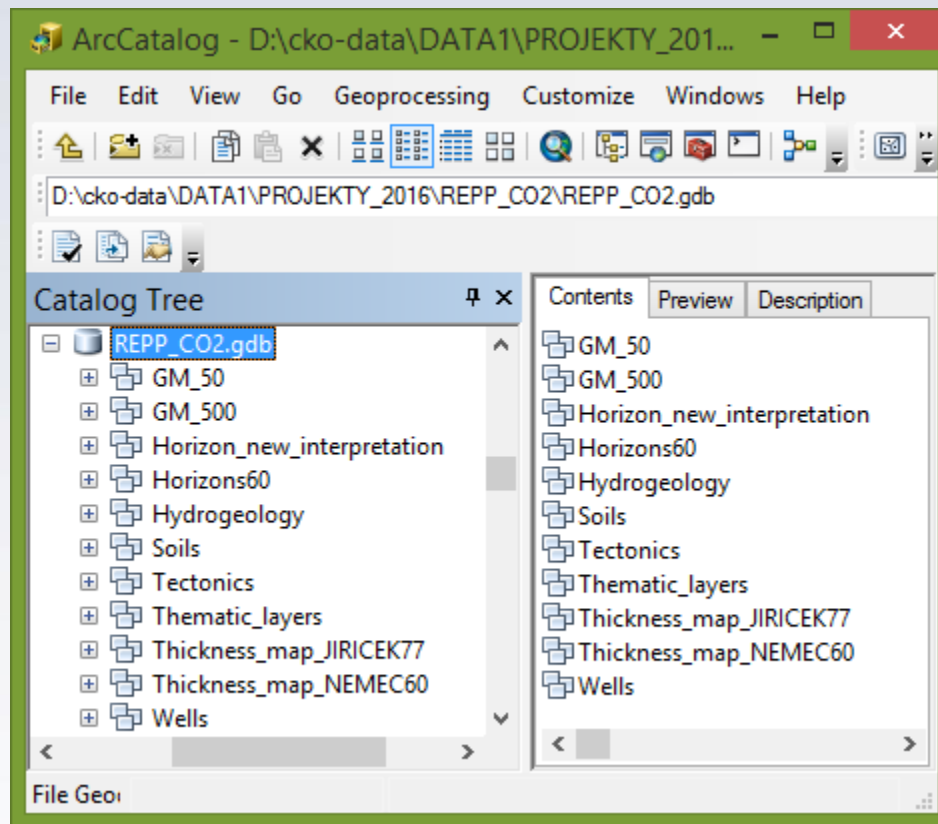
CZ  
SK



Atmogeochemical monitoring:  
Concentrations of CO<sub>2</sub> and CH<sub>4</sub>  
in soil gas in the vicinity of  
well Br-22



\\nts46\661130\_REPP-CO2\10 Data\01\_GEODATABASE



- Geology50
- Geology500
- Horizons\_new\_interpretation
- Horizons60
- Hydrogeology
- Soils
- Tectonics
- Thematic layers
- Thickness maps\_JIRICEK77
- Thickness maps\_NEMEC60
- Wells

Related Tables (Petrology, Pressure, Saturation, Seismic profiles description)



Team work, cooperation and keeping deadlines are essential:

- 10 Activities
- 54 Tasks
- 106 deliverables
- >130 researchers and technicians from  
7 institutions

- $M_{CO_2} = \rho_{CO_2} * R_f (1 - F_{IG}) * OGIP * ((P_s * Z_r * T_r) / (P_r * Z_s * T_s)) \cong \text{produced gas volume} * Bg \text{ factor} * \rho_{CO_2}$

*for gas*

- $M_{CO_2} = \rho_{CO_2} * (R_f \times OOIP / B_f - V_{iw} + V_{pw})$   
 $\cong \text{produced oil volume} * \rho_{CO_2}$

*for oil*

Recovery factor, fraction of injected gas, pressure, temperature, gas compressibility factor, formation volume factor, injected and produced water.

(Bachu et al. 2008, CSLF)

Fundamental assumption:

- The volume previously occupied by the produced hydrocarbons becomes, by and large, available for CO<sub>2</sub> storage.
- ... but not for reservoir in hydrodynamic contact with an underlying aquifer

## Estimation for LBr-1

- Production history: 72.4 th. m<sup>3</sup> oil, 75.4 mill. m<sup>3</sup> gas
- CO<sub>2</sub> density: 630 kg m<sup>-3</sup>
- Bg factor (compress.) = 0.0078169
- **Estimated capacity = 417 kt CO<sub>2</sub>**



- „Digging“ for information from old archive data is time consuming and requires specific „local“ knowledge but results can be excellent
- Supplementary site investigation is necessary, especially to get fresh cores for geomechanical and geochemical experiments and allow in-situ borehole tests (stress field, permeability)
- Local conditions need to be taken into account for choice of monitoring methods (high seismic noise level, periodical flooding, etc.)
- A promising CO<sub>2</sub> source revealed (95.5 % purity) – 240 th. t/yr released into the atmosphere

- Finalisation of dynamic modelling and simulations of CO<sub>2</sub> injection into the reservoir
- Finalisation of risk analysis – quantification of risks, tool for evaluation of abandoned wells
- Drafting of final monitoring plan
- Scenarios for further development of the pilot project
- Lessons learned & plan of „to be done“
- Final project conference and seminar in Lausanne
- Continuation of work – ENOS project

# To learn more

Final project conference – Praha

CO<sub>2</sub> CAPTURE AND STORAGE IN THE CONDITIONS OF  
THE CZECH REPUBLIC – COOPERATION OF CZECHIA  
AND NORWAY

**7 – 8 November 2017**

Discussion seminar – Lausanne

COOPERATION BETWEEN FORERUNNER AND  
FOLLOWER COUNTRIES IN CCS RESEARCH:  
THE EXAMPLE OF NORWAY AND THE CZECH REPUBLIC

**14 November 2017**

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[www.geology.cz/repp-co2](http://www.geology.cz/repp-co2)