Preparation for a pilot project of CO2 geological storage in the Czech Republic

Baseline monitoring of CO2 and methane for risk assessment of a future pilot CCS site LBr-1: relationship to the residual oil and gas field saturation

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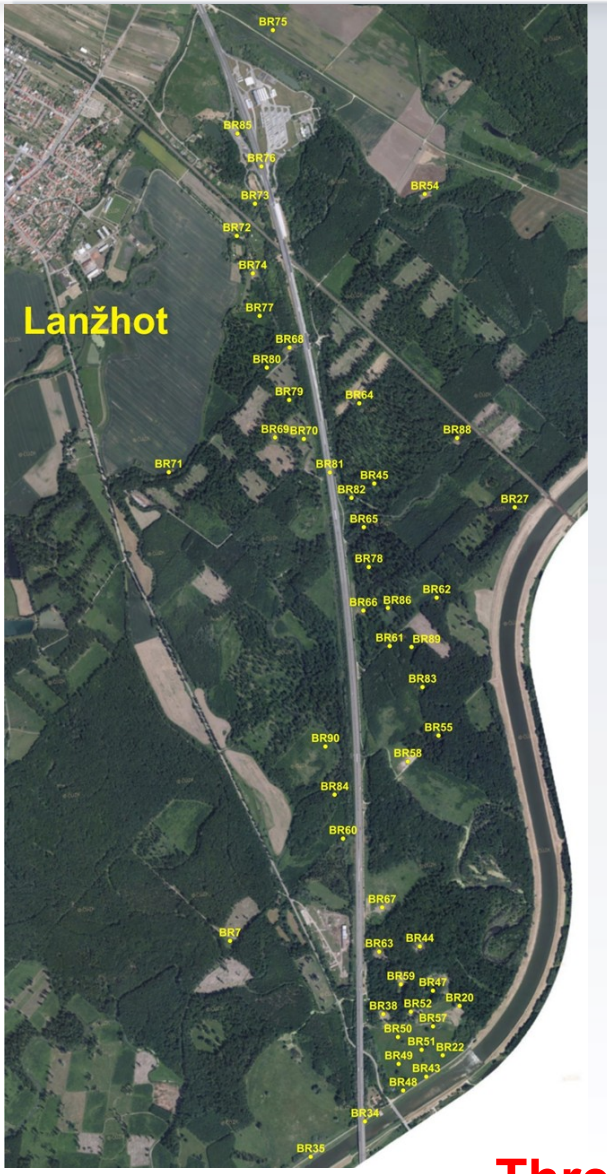
Principle steps in Soil Gas Baseline Monitoring

1. Screening soil gas measurements
2. Finding elevated CO_2 and CH_4
3. Instalation of automatic stations
4. Meteo data
5. Soil and subsoil clay/sand content
6. Old wells and abandoned oil/gas field
7. Ground water level
8. Isotopes
9. Background values and Anomalies

LBr-1 CO_2-Storage Complex
Well locations and 3D seismics



Three state borderlines Czech R. – Slovakia - Austria

Field screening measurements

Sniffing

Portable Instrument

Early Spring flooding

Soil profiles & Gs sampling

Soil probe makes a hole

Soil profile description

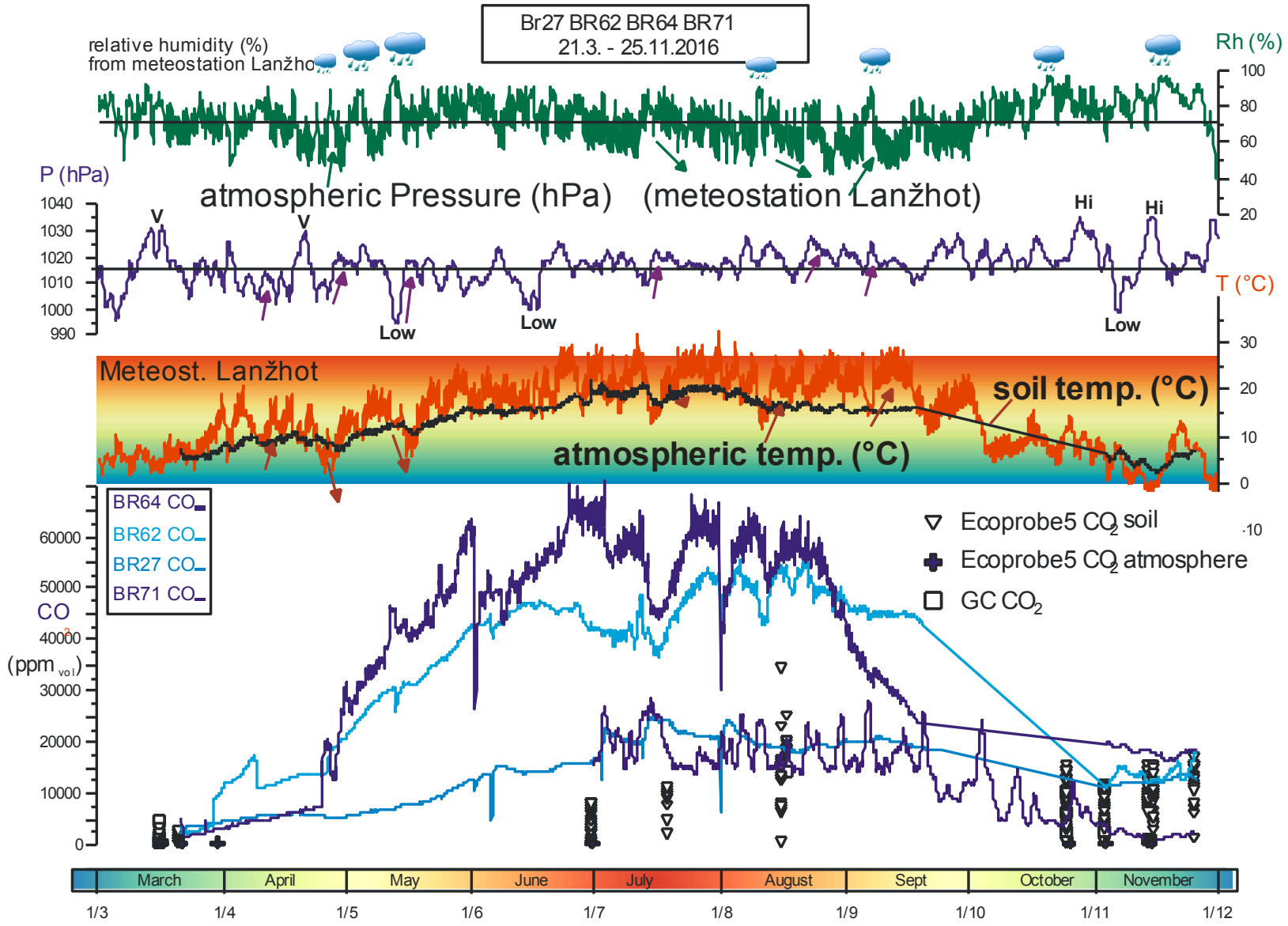
Gas sampling & measurements

Automatic stations
CO_2 & Methane monitoring

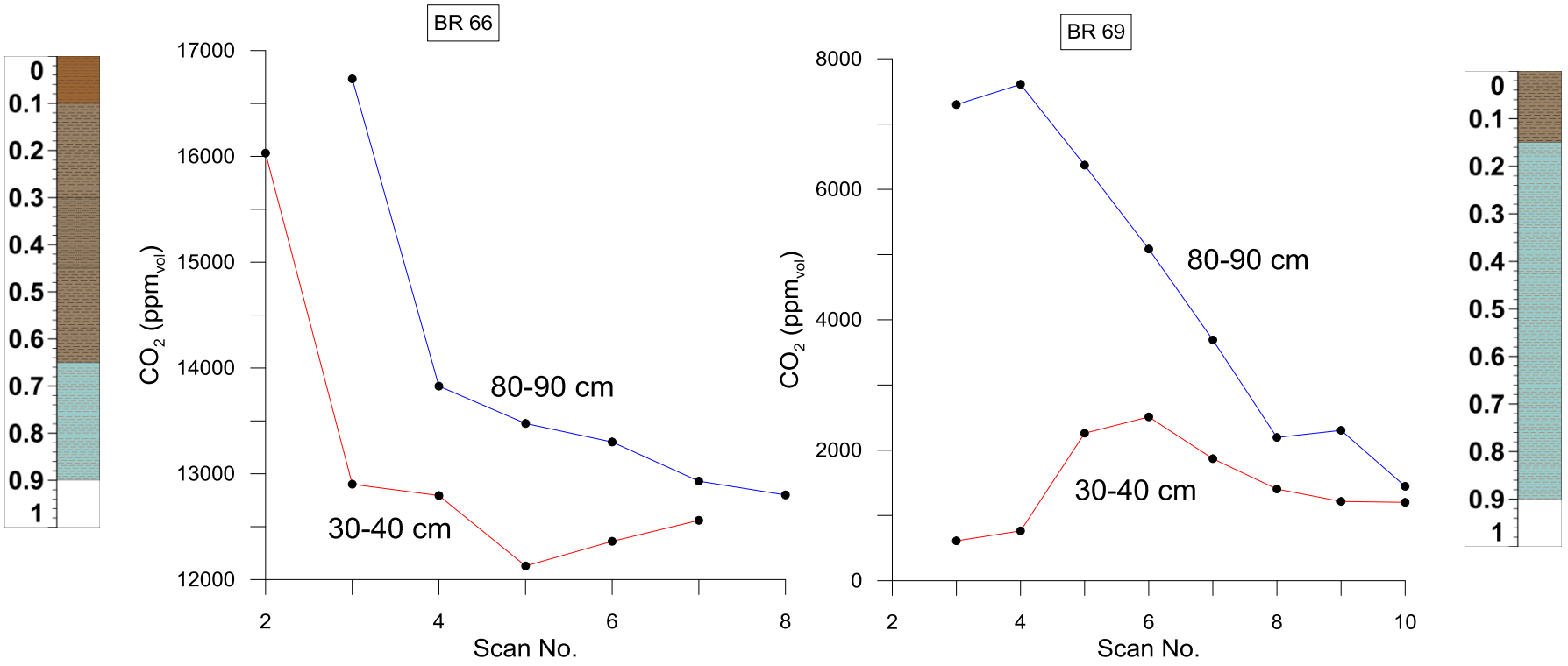
Automatic CO2 / methane IGS station

Instalation of the IGS station

Continuous CO_2 measurements



Clay dominated soil profile



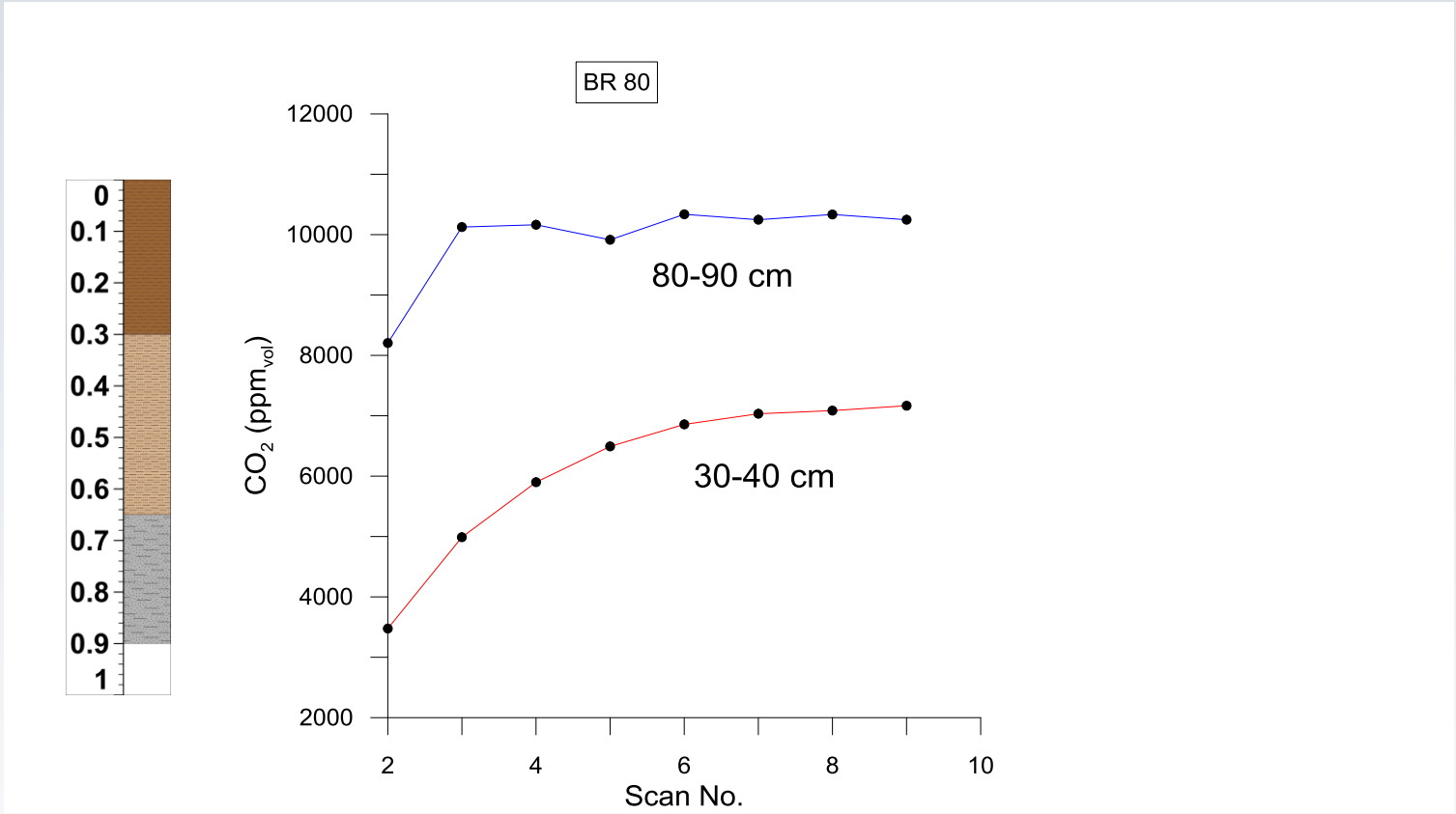
Less permeable clay-rich soil and subsoil

Gas inflow limited - Shalow measurements air contaminated

Deeper measurements – higher CO_2 ,

further pumping brings air contamination

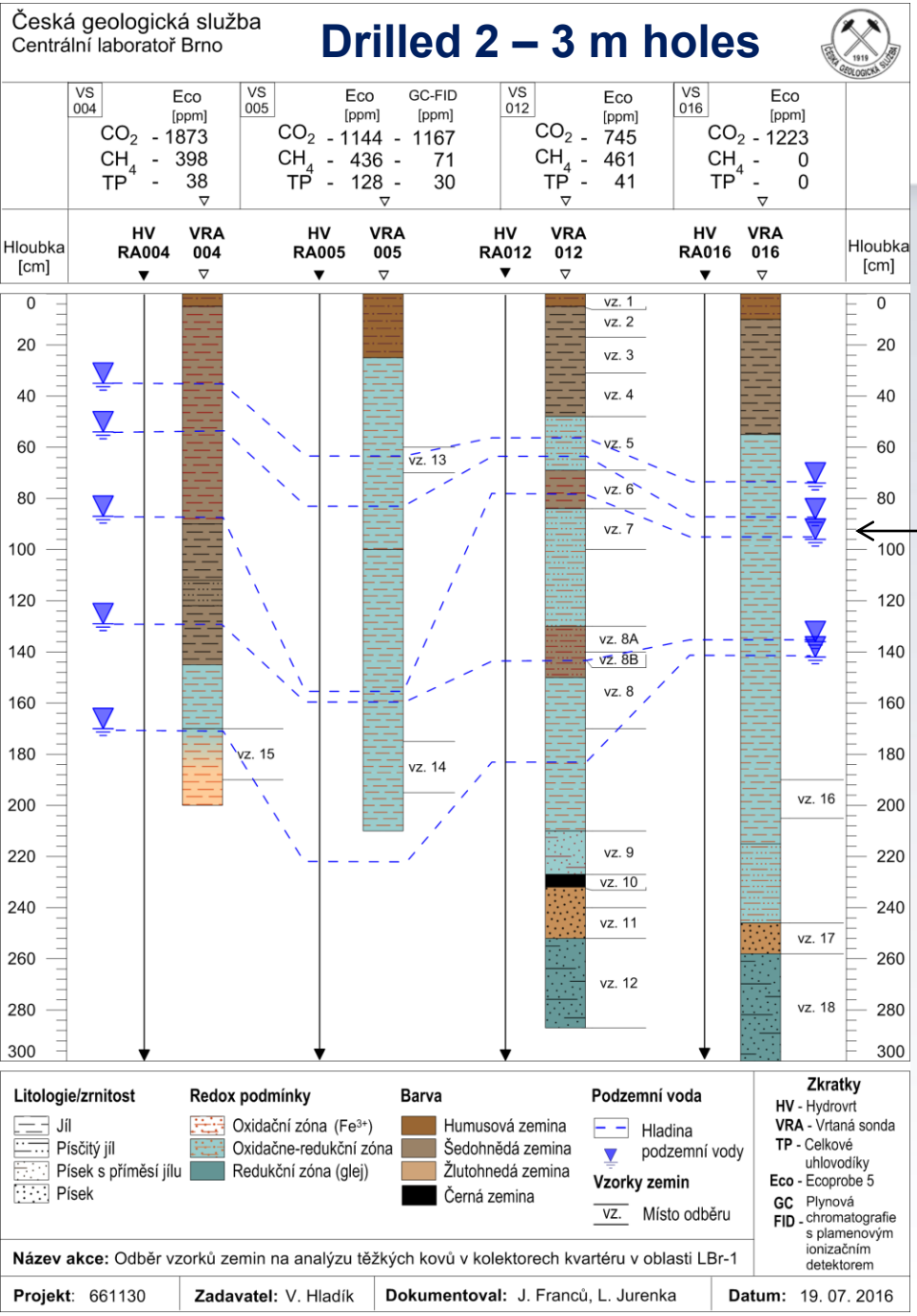
Sandy-silty soil profile



Permeable sandy soil and subsoil

Gas inflow sufficient - the steeper incipient part of the curve indicates the gas flux

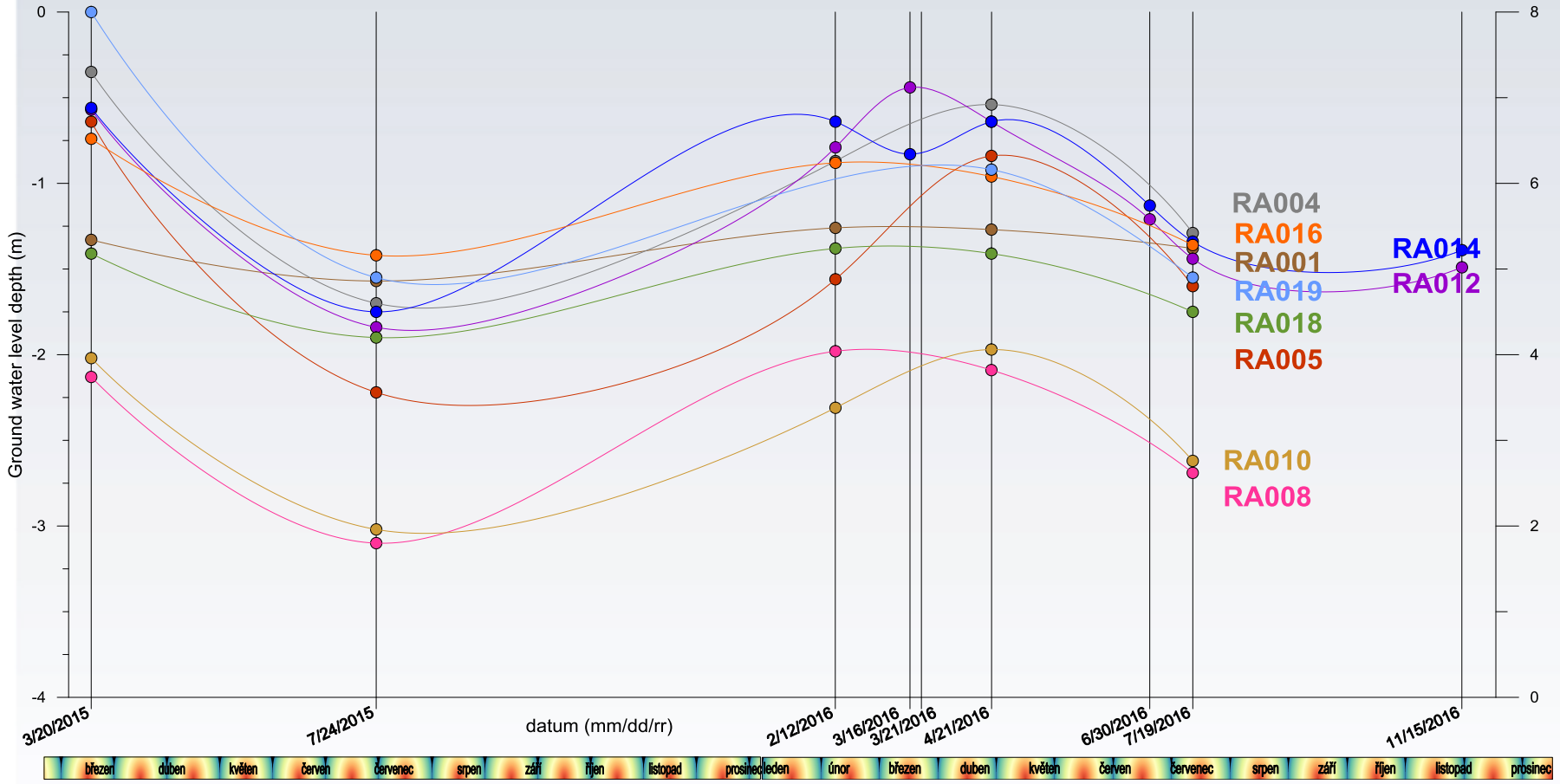
Lithology



Lithological profiles Of the Soil / Subsoil

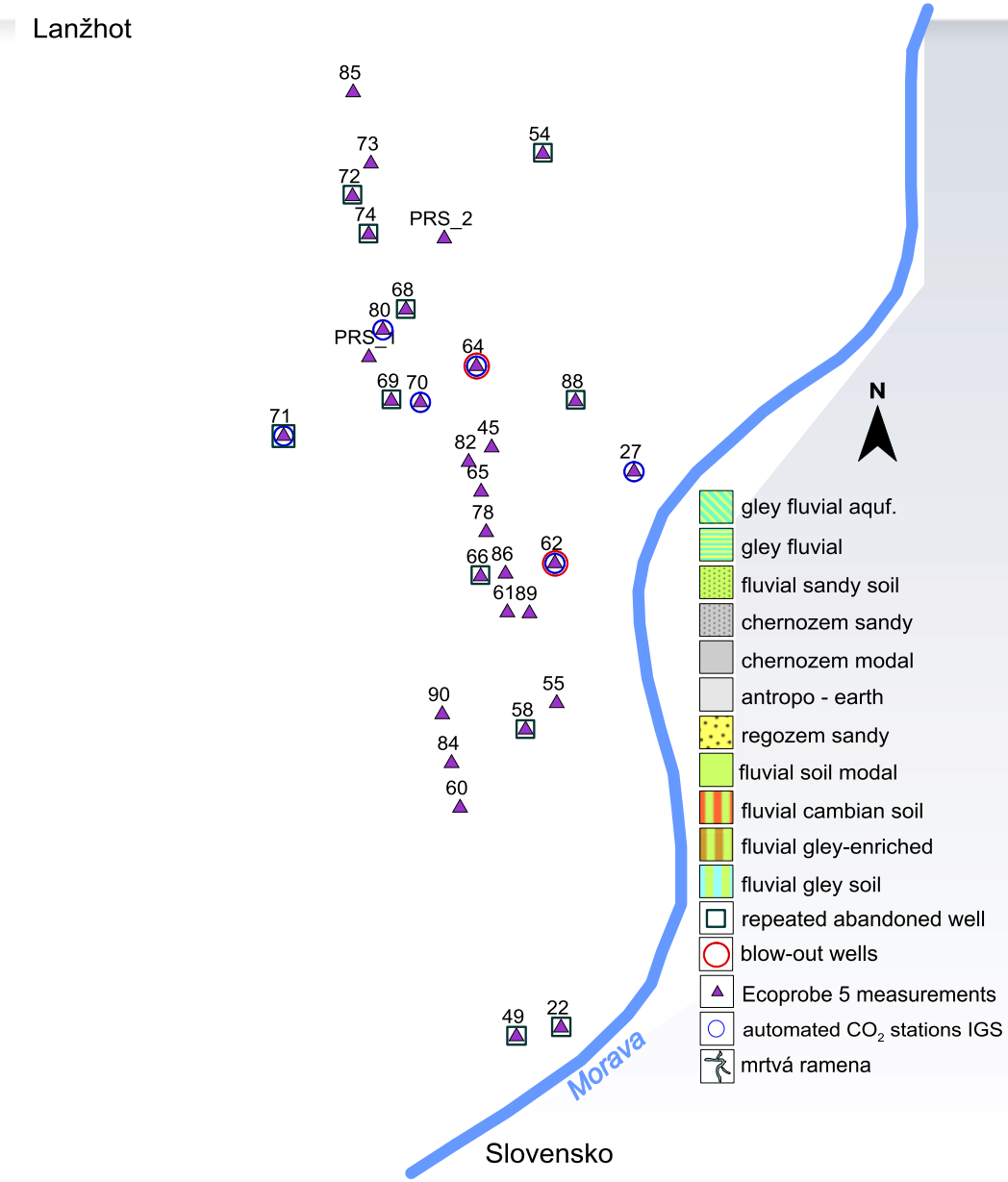
Ground Water Level measurements

Effect of ground water level fluctuation



Winter Summer Winter Summer Winter

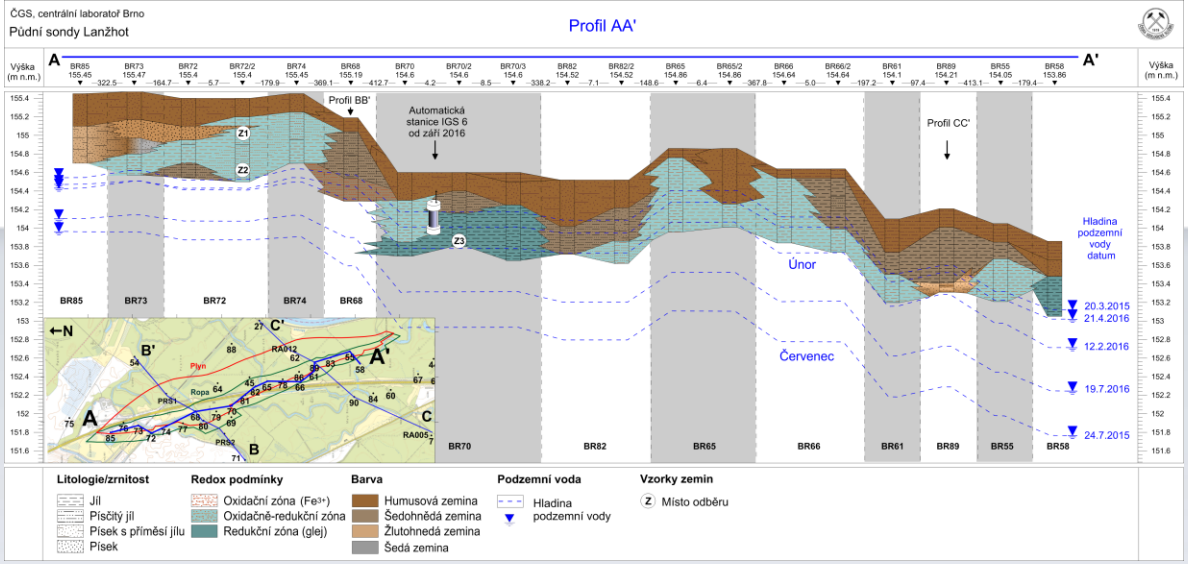
Effect of soil type

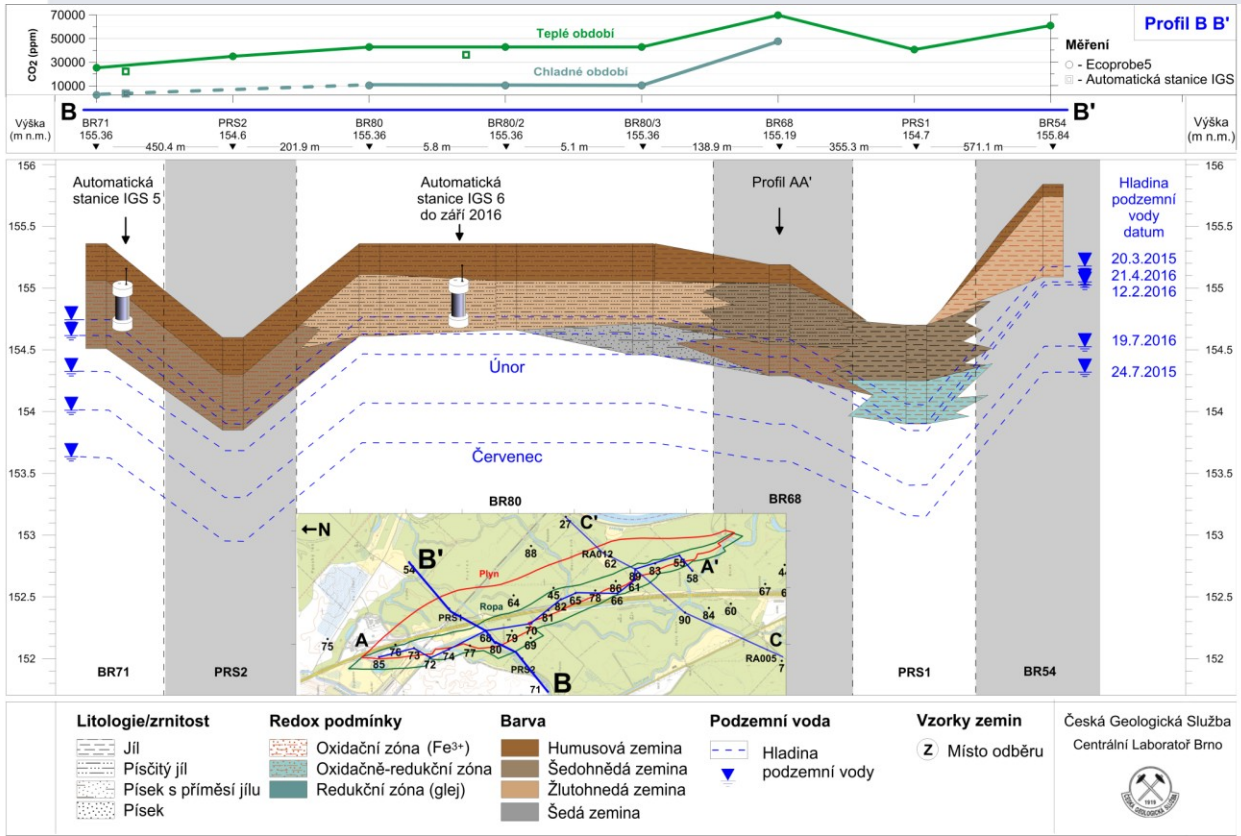


At least once a year Controled flooding

Gley rich soils form Quaternary sedim. are poor in $CaCO_3$

Oxbows meanders
- Sandy channels
- Overbank sed. enriched in clay

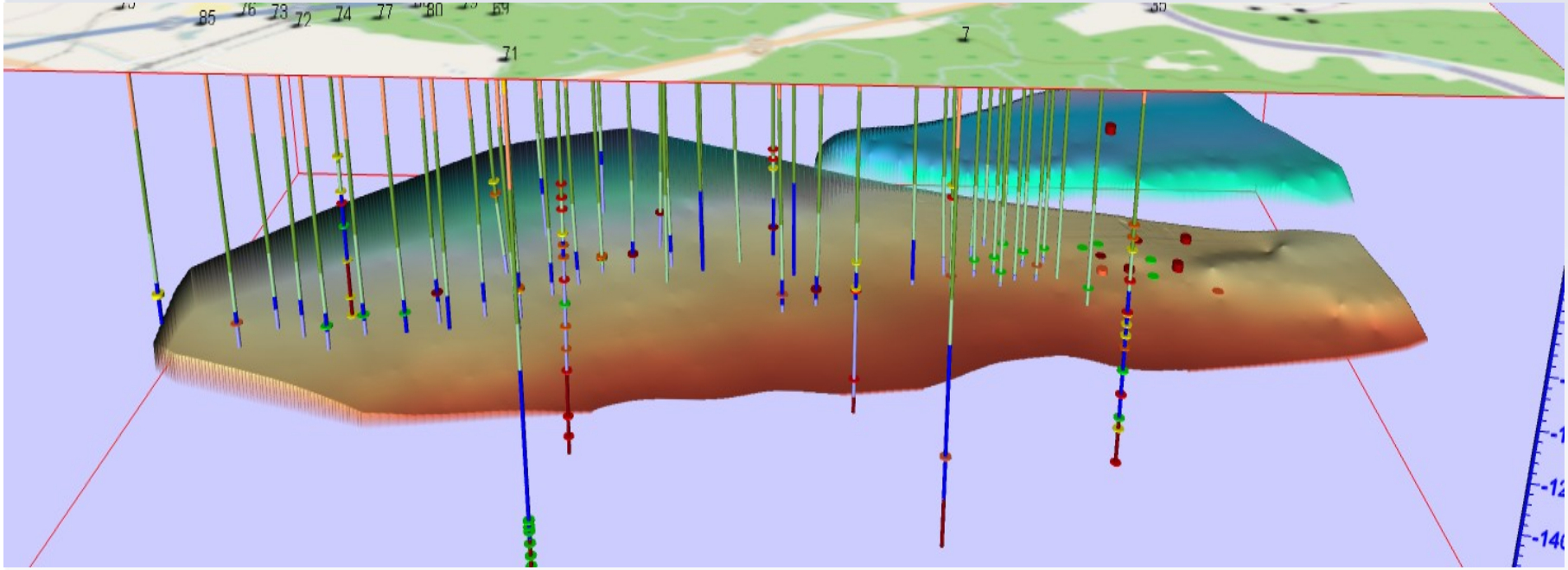




Effect of clay/ sand content

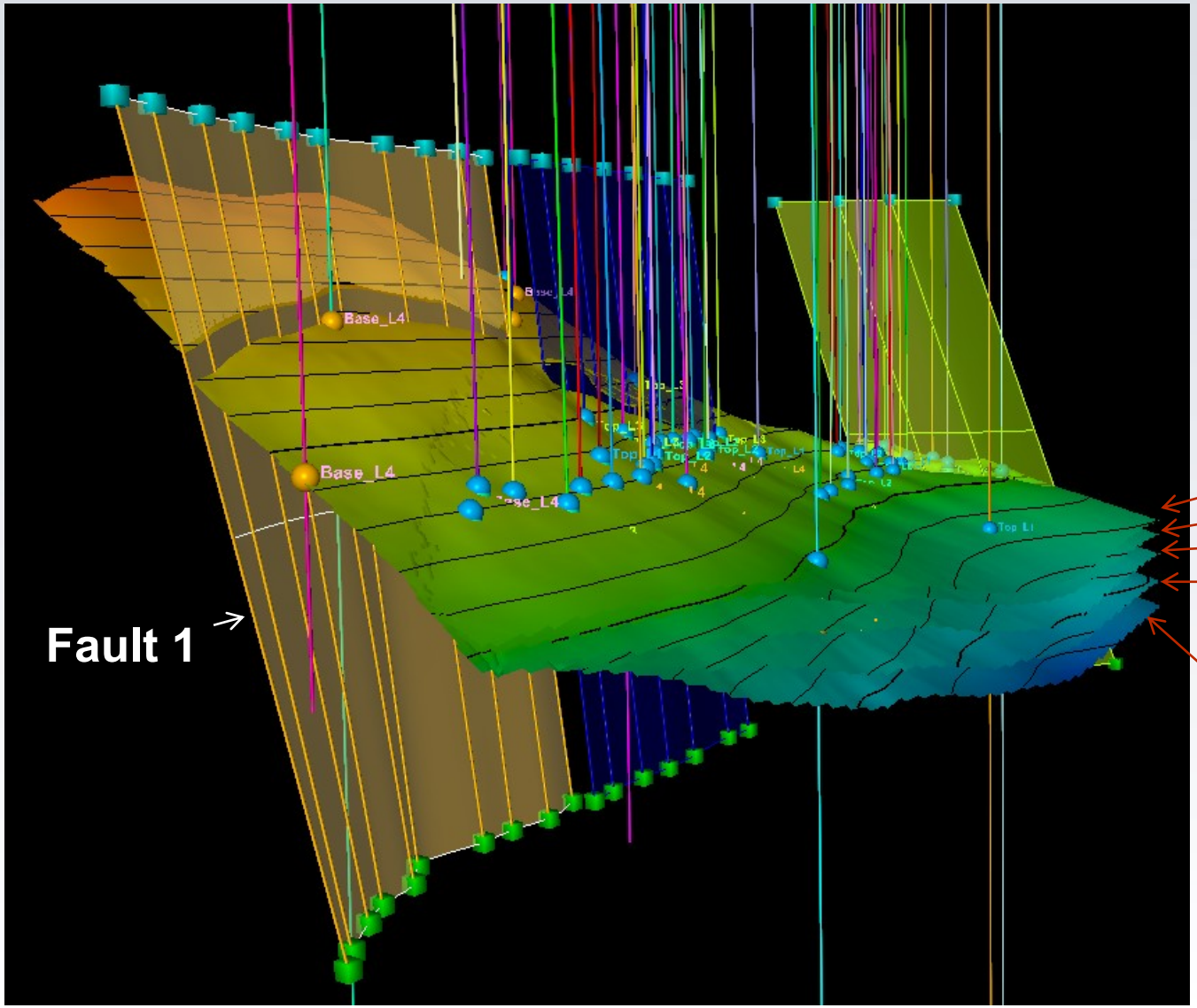
2D Soil Profiles help to understand the regional trends

Effect of Oil and Gas accumulation and wells



55 Deep exploration wells, oil and gas field at depth of 1080-1110 m Mid. Badenian reservoir

3D Model in Petrel of the CO_2 Storage Complex



4 tops of the partial layers of the Lab reservoir

L1

L2

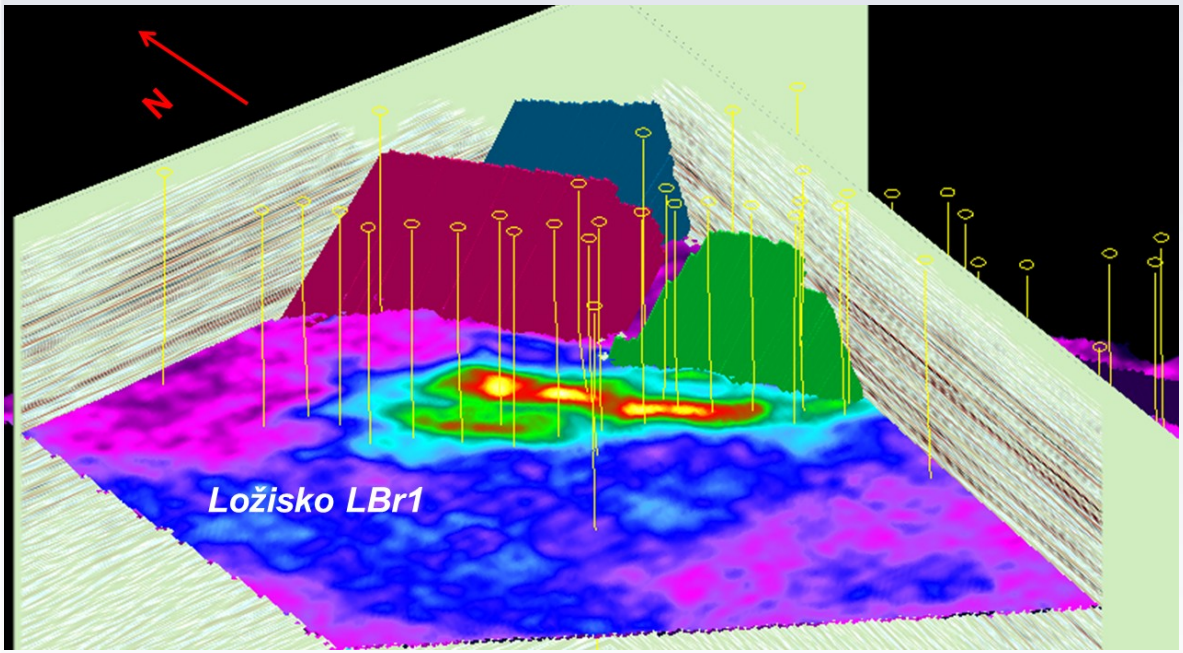
L3

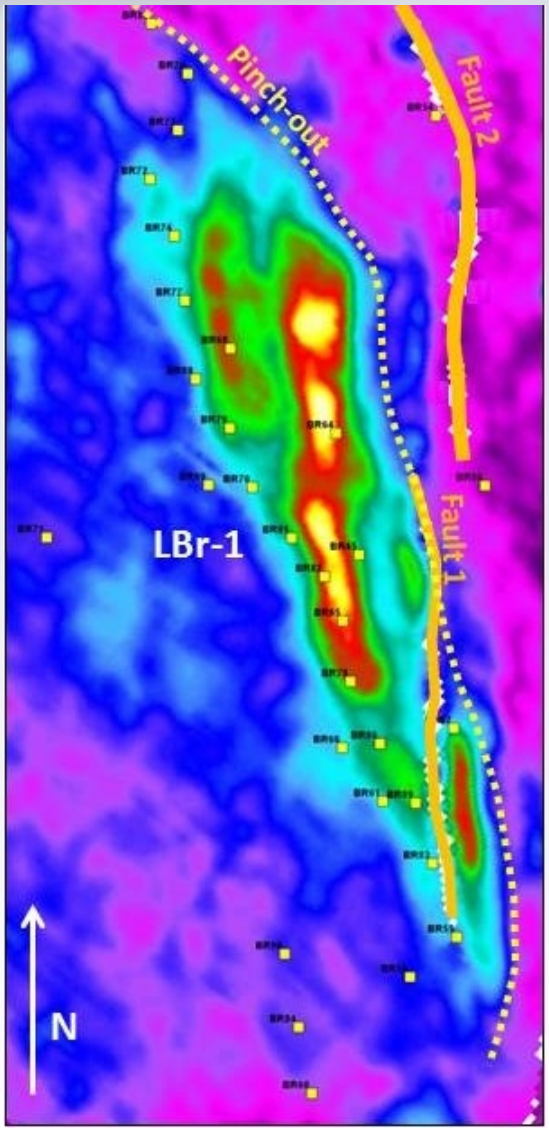
L4

Base of the Lab reservoir

Seismic Attributes Analysis

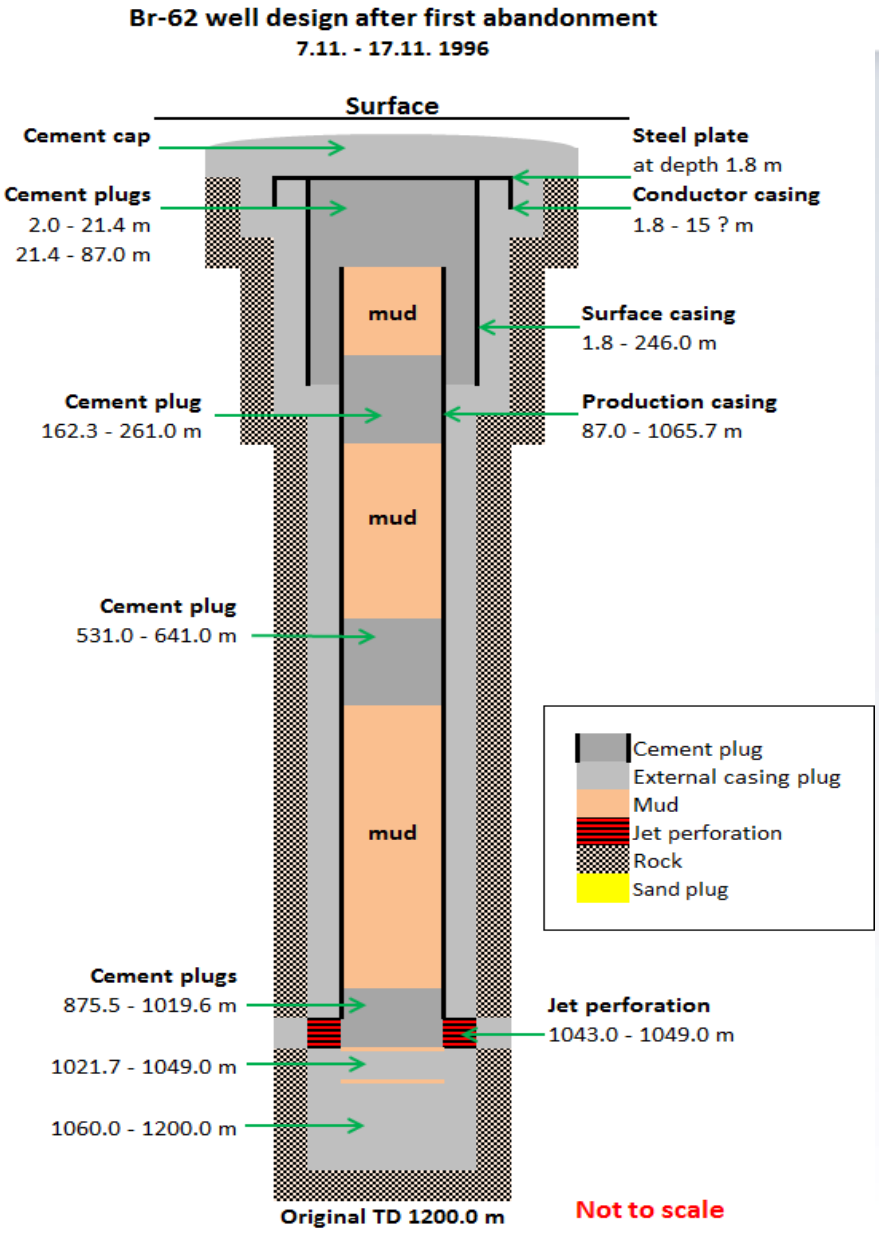
3D view of the Lab reservoir Attribute: Average Absolute Amplitude





Reveals residual Oil & Gas saturation

Risk of Methane/ CO_2 Leakage



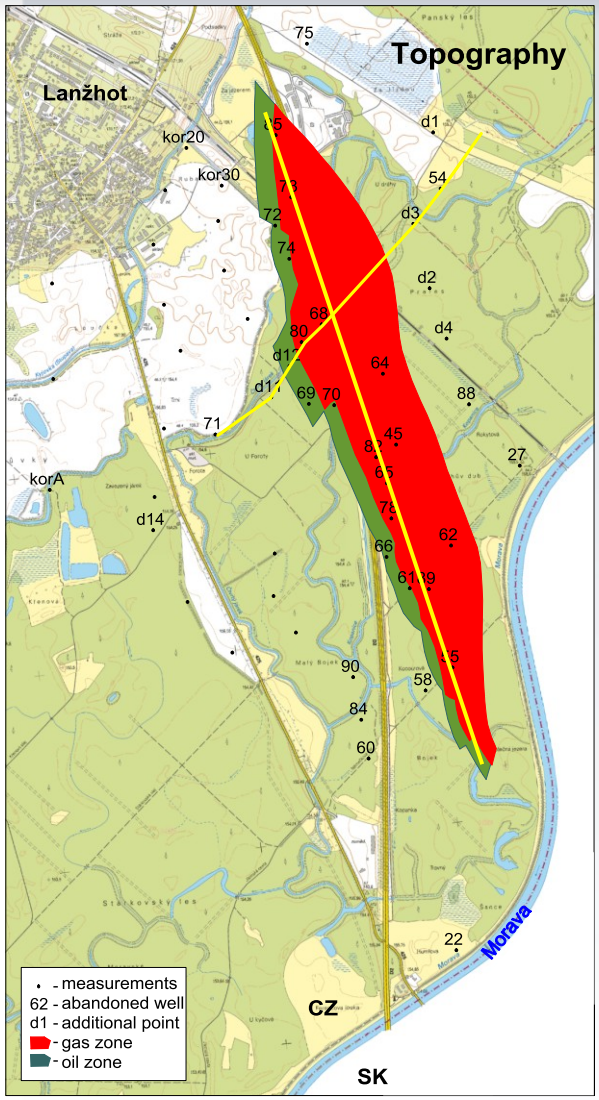
Abandoned BR Wells Well design

Mud and Cement Plugs

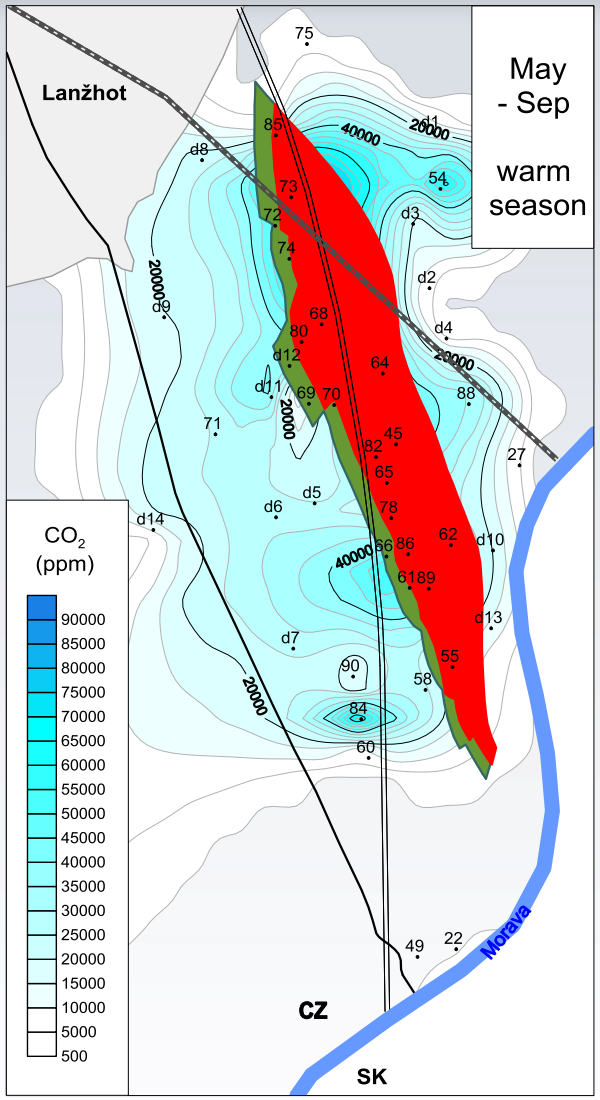
In spite of plugging The old wells Make potential conduits for minor gas migration and often show increased values of methane and CO_2

Maps of CO_2 in Soil Gas

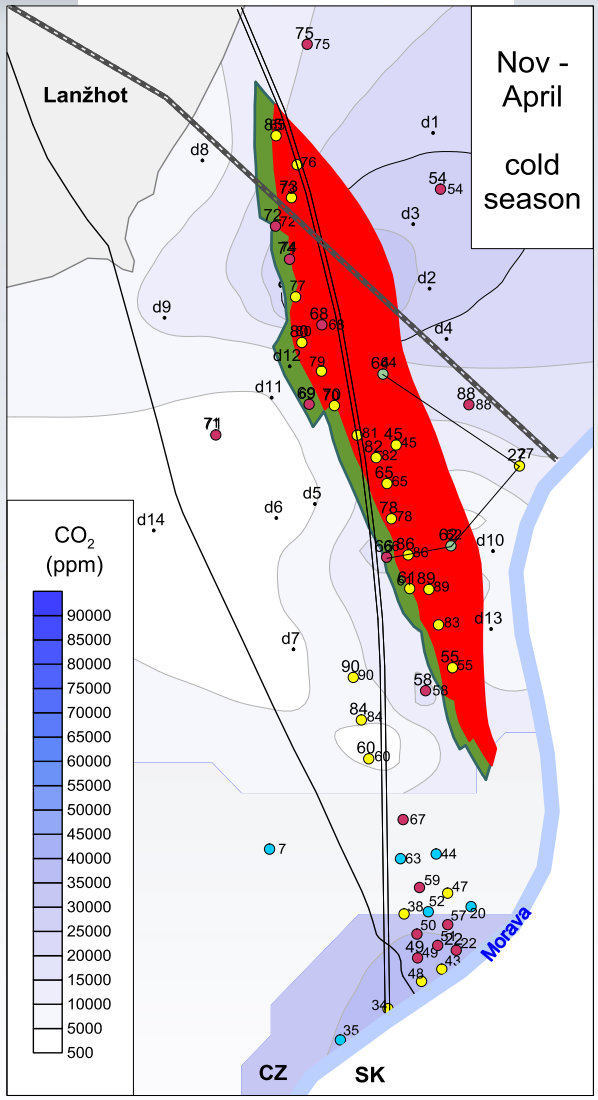
Oil and Gas zones



Warm Season



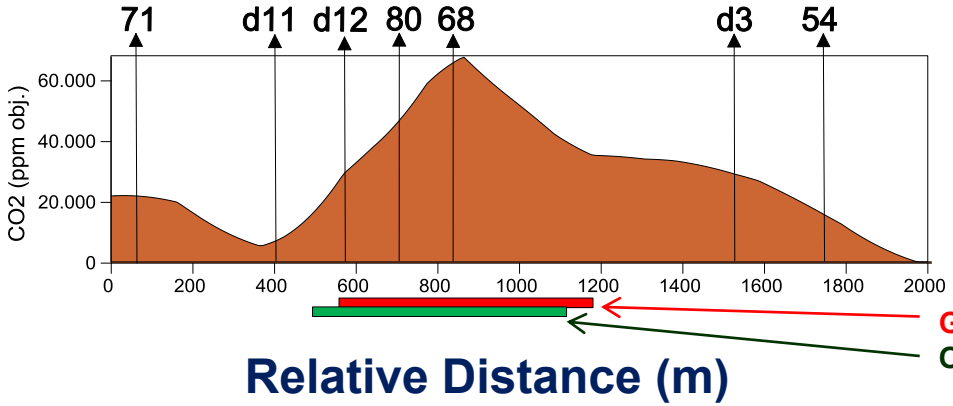
Cold Season

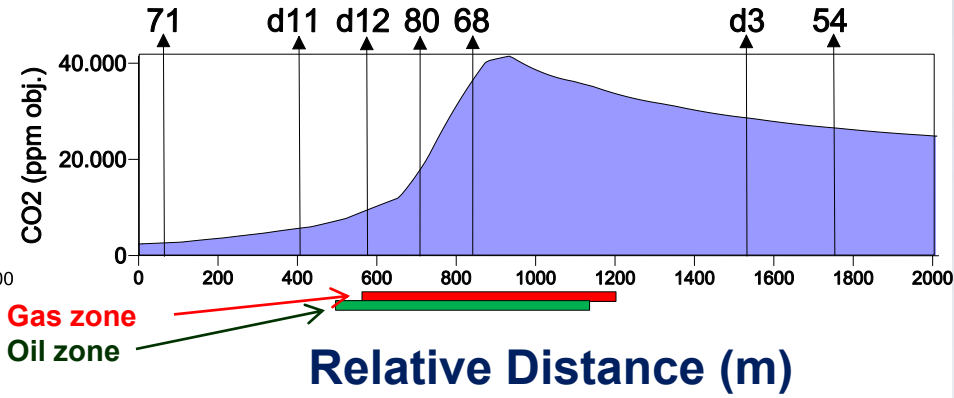


• repeated abandonment • one abandonment • missing documentation • gas blow outs

CO_2 in Soil Gas – 2D Profiles

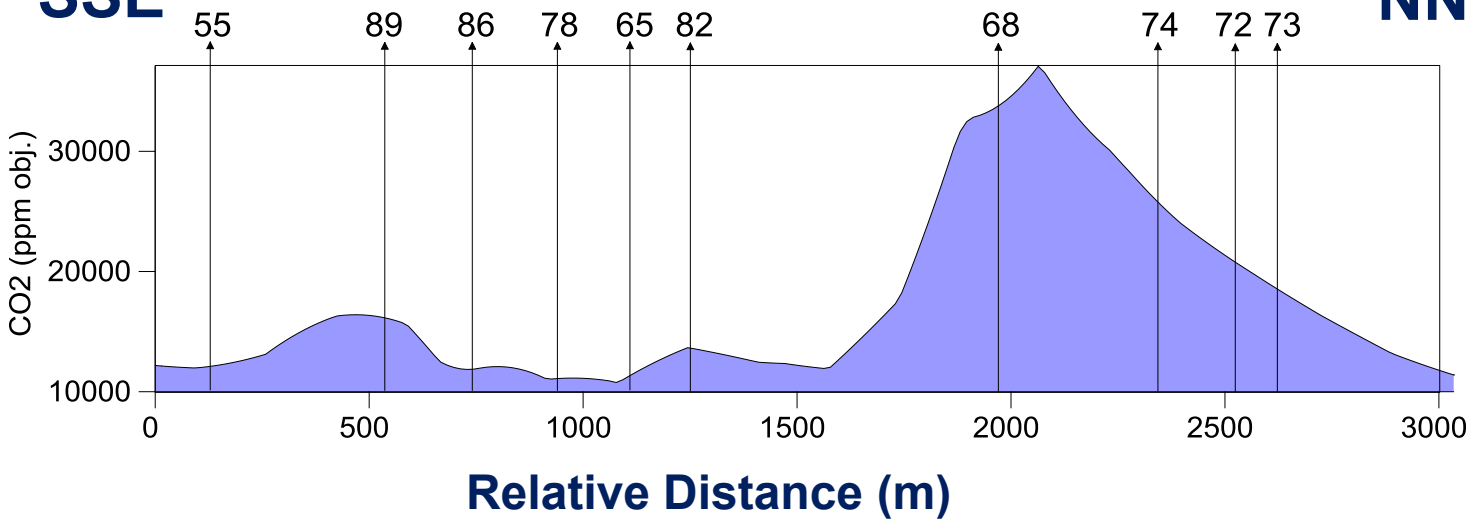
SW Warm Season NE SW Cold Season NE



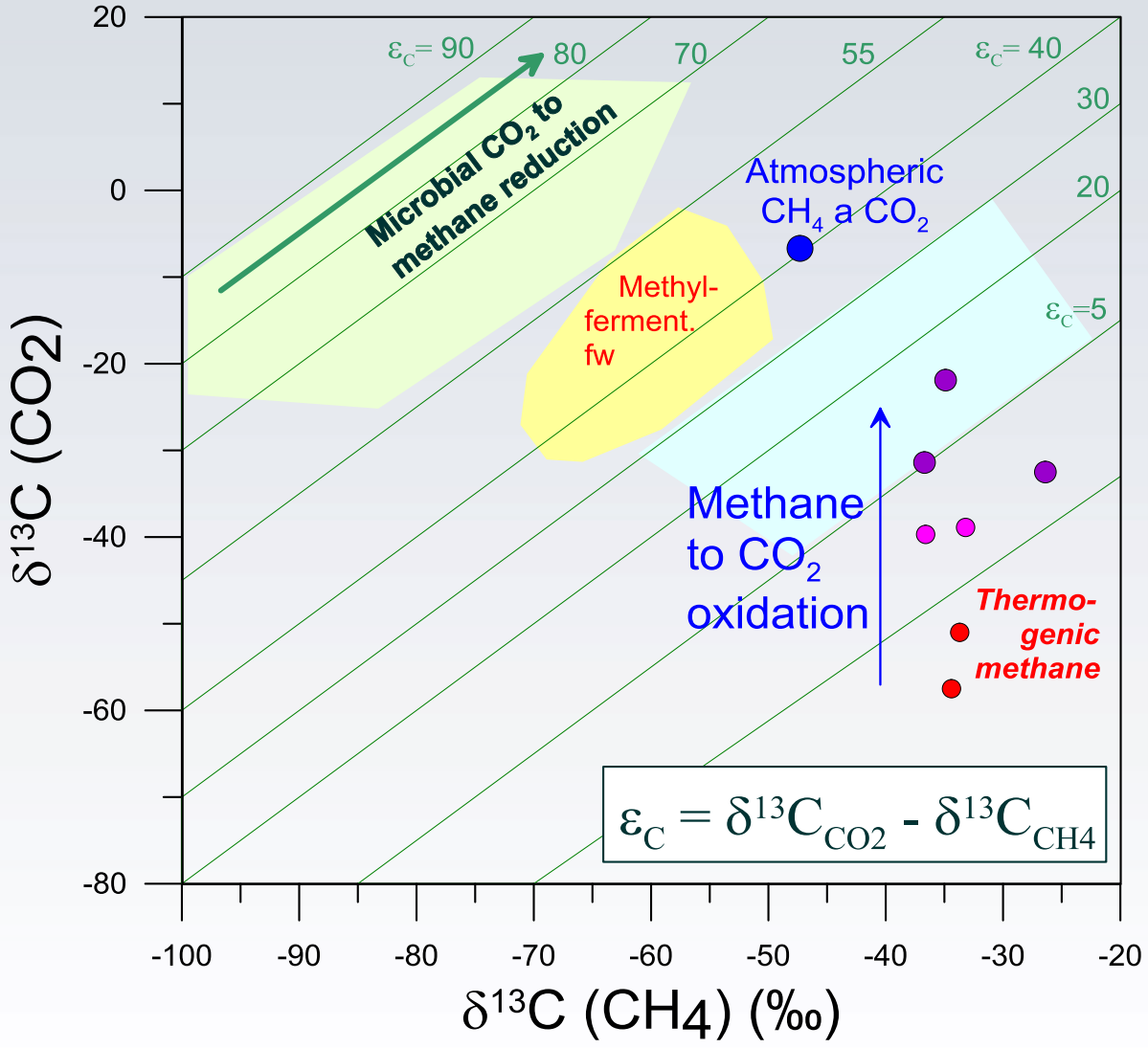


Cold Season

SSE NNW

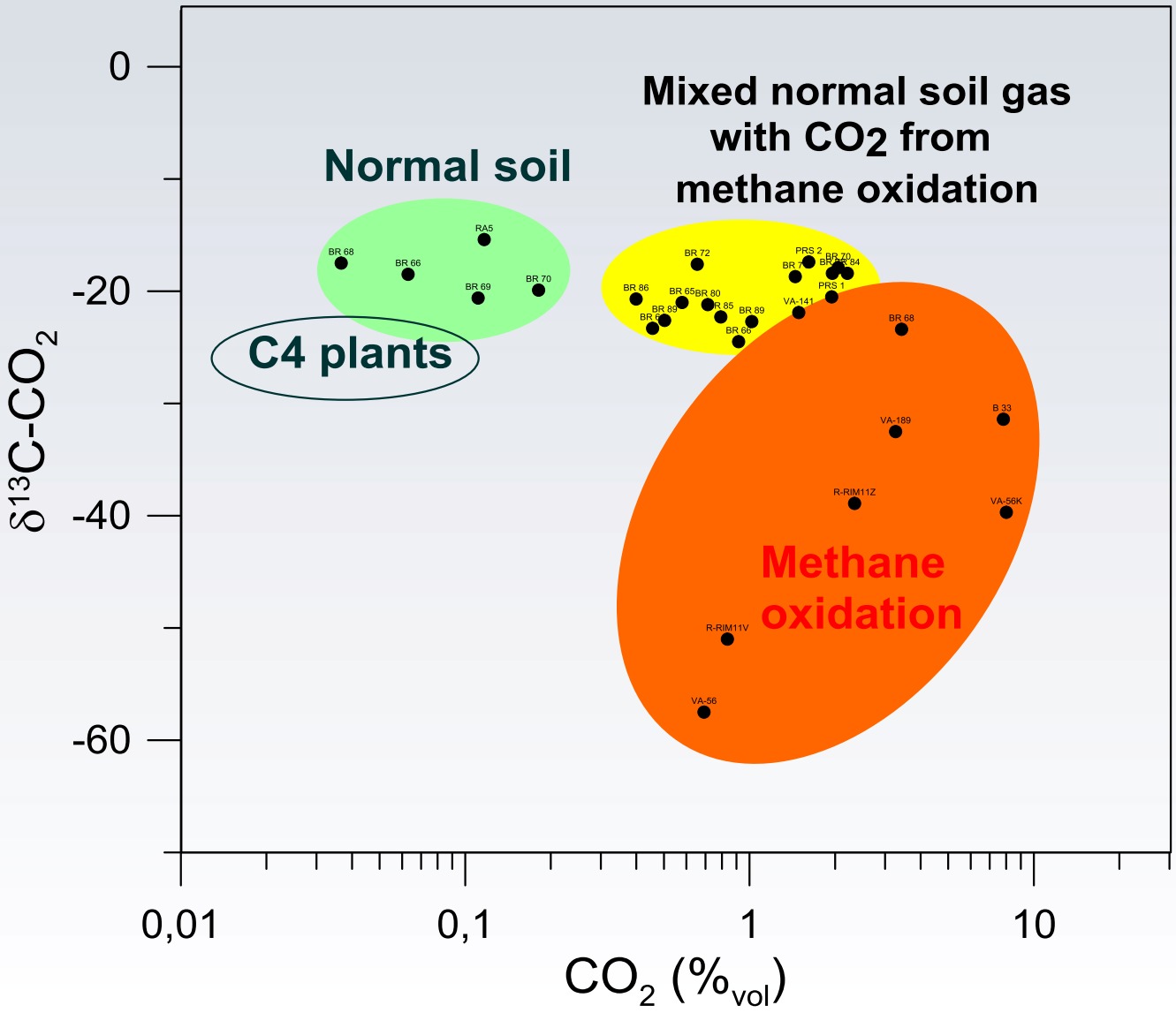


Isotopes – Evidence of Methane – to – CO_2 oxidation



Soil gas has a surprisingly elevated amount of CO2 when compared to normal forest soil CO_2 is isotopically very light

Isotopes delta^{13}C CO_2



We can distinguish three types of CO_2 :

1. Normal
2. Mixed
3. CO_2 from microbial oxidation of methane

Principle steps in Soil Gas Baseline Monitoring

1. Screening data - > very dependent on p,T, time, daily/ seasonal variations
2. Maps of CO_2 and CH_4
3. Every hour sampling - > details
4. Drop in Atm. Pressure - > more gas
5. Soil clay = seal / sand permeable zone
6. Old wells – migration avenues
7. Ground water level rise - > more CO_2 met
8. Isotopes - > Microbial methane oxidation
9. Background 0.5-1% Anomalies 1-8% CO_2

Thank you for your attention

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