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

Lessons from constructing a 3D geological model of LBr-1, a depleted oilfield from the 1960s - is this at all possible?

Norway Grants

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Overview of the work - Activity 2

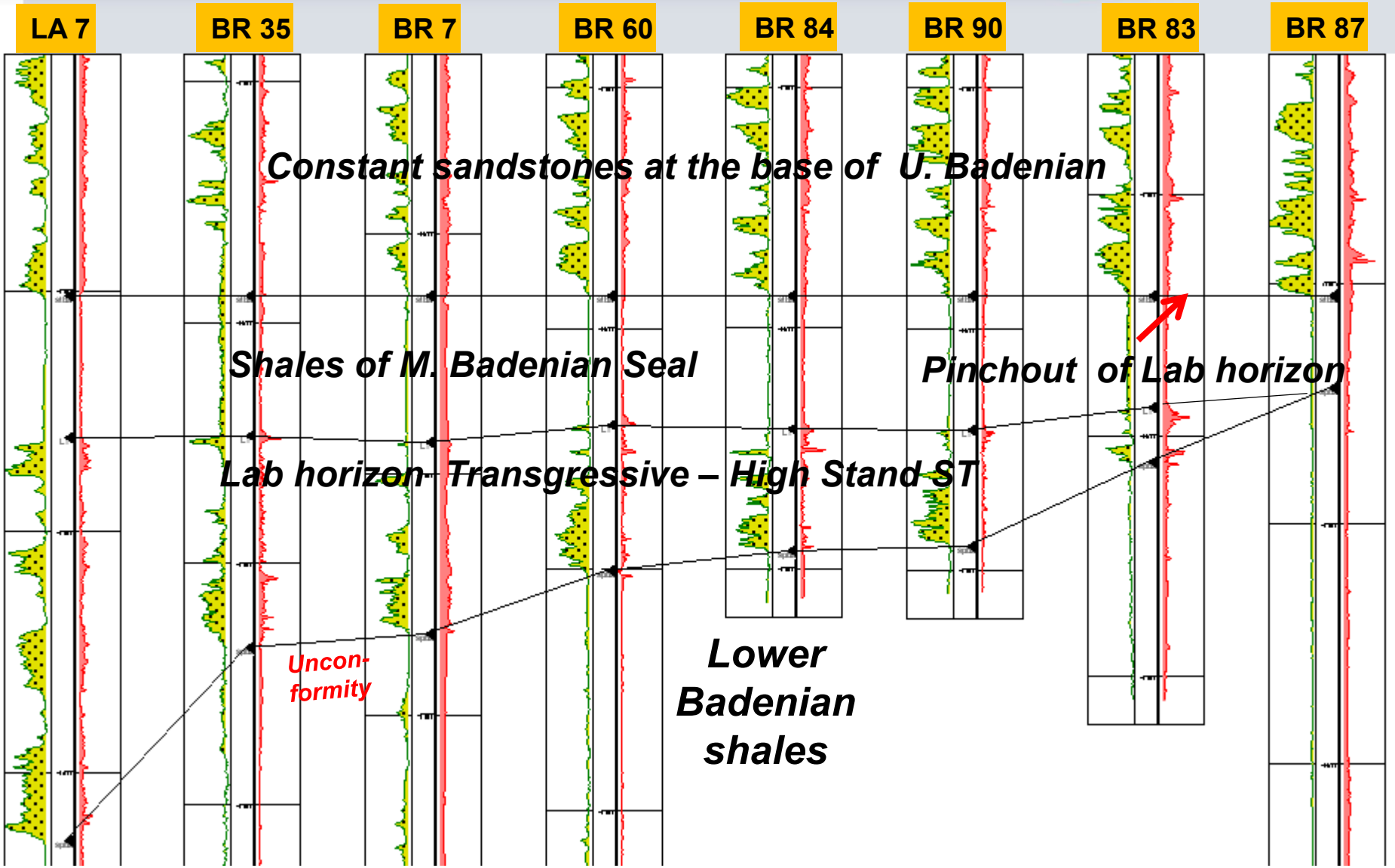
December 2015 – April 2016

1. **Old vs. New understanding of the field**
   - Archival data → **Database**
   - 3D static model - Tops
     - Petrophysical properties in maps
     - Oil and gas types

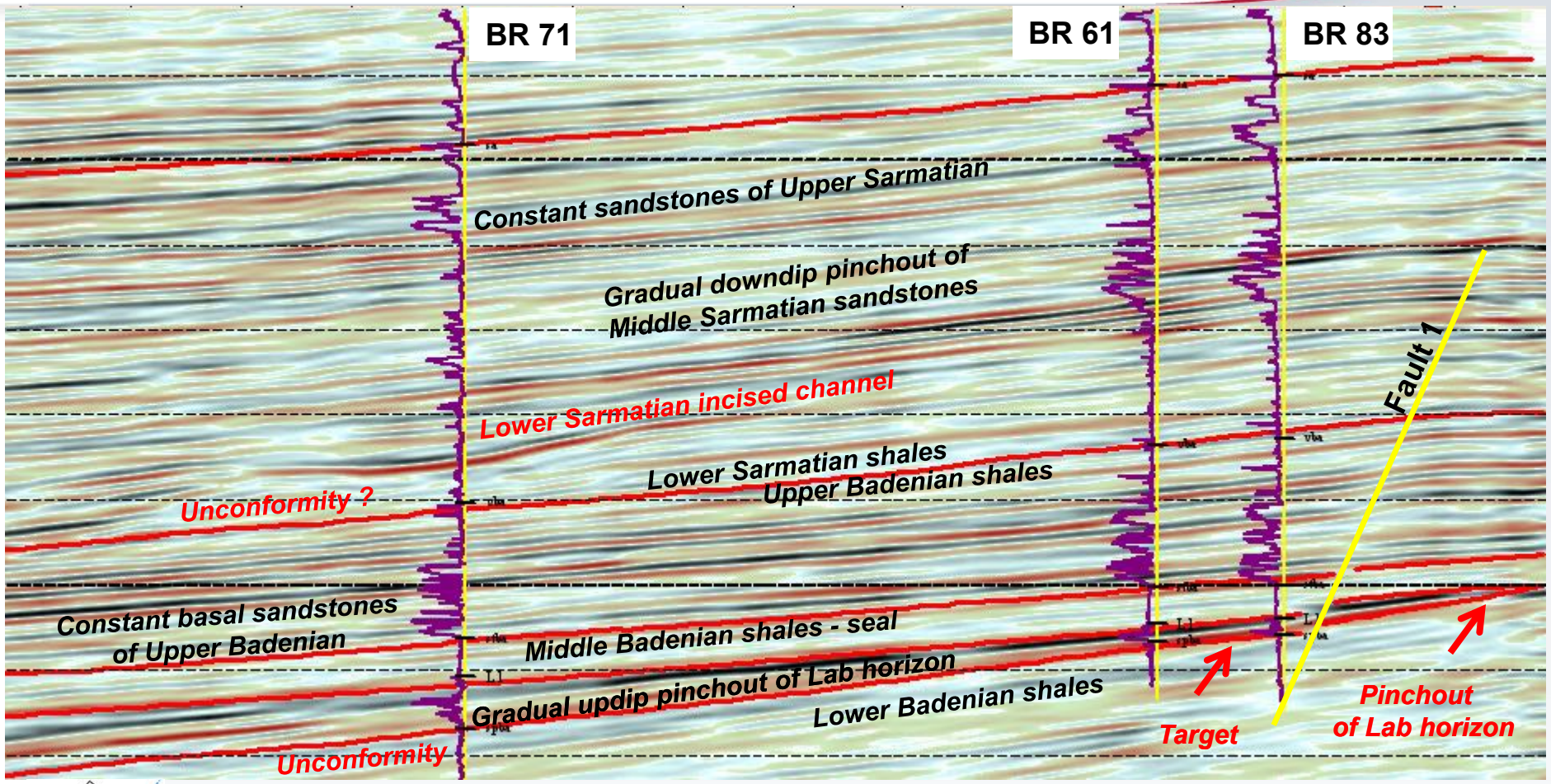
2. **Production history for individual wells**
   - Pressure data

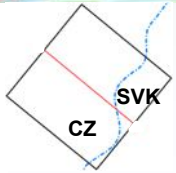
3. **Well completion after abandonment**
   - casings, perforations

Sequence stratigraphic interpretation of well log data

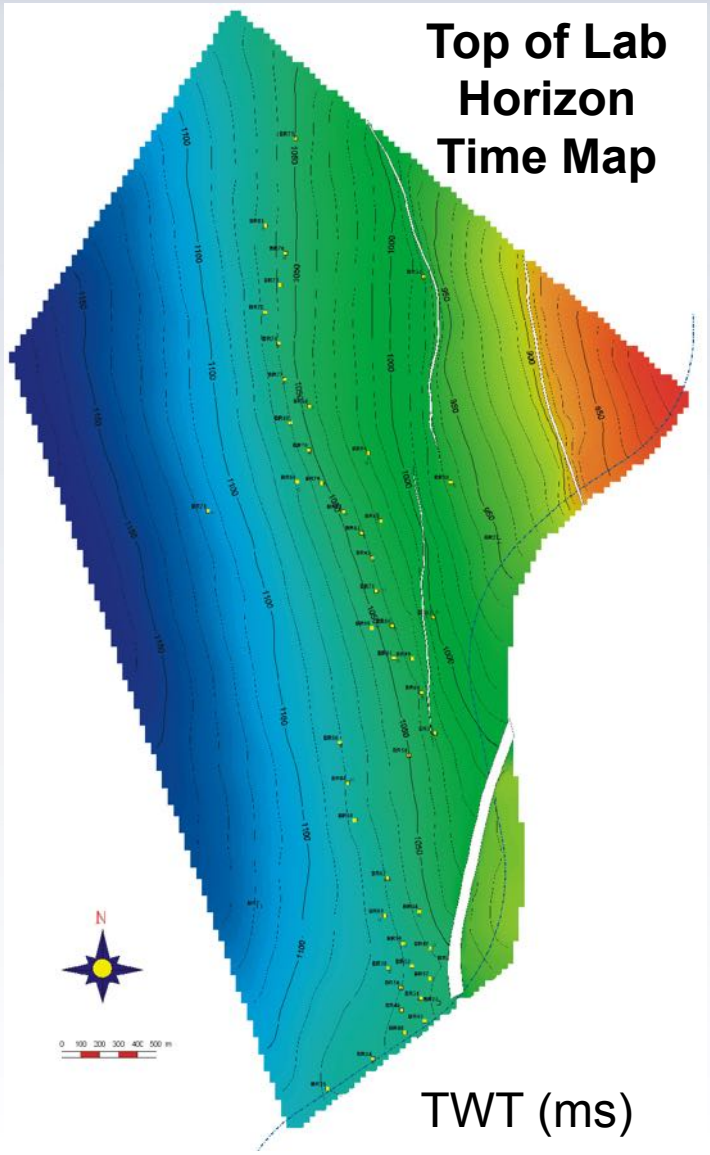


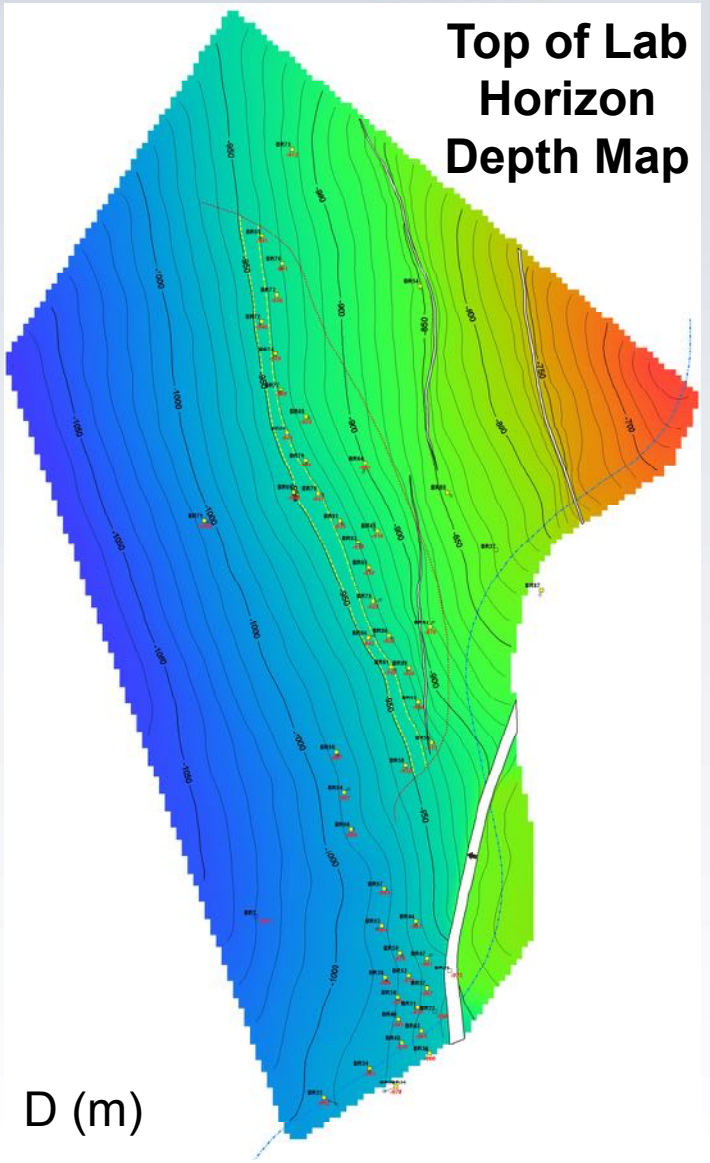
Seismic Stratigraphy – Unconformities, Pinchouts, Faults



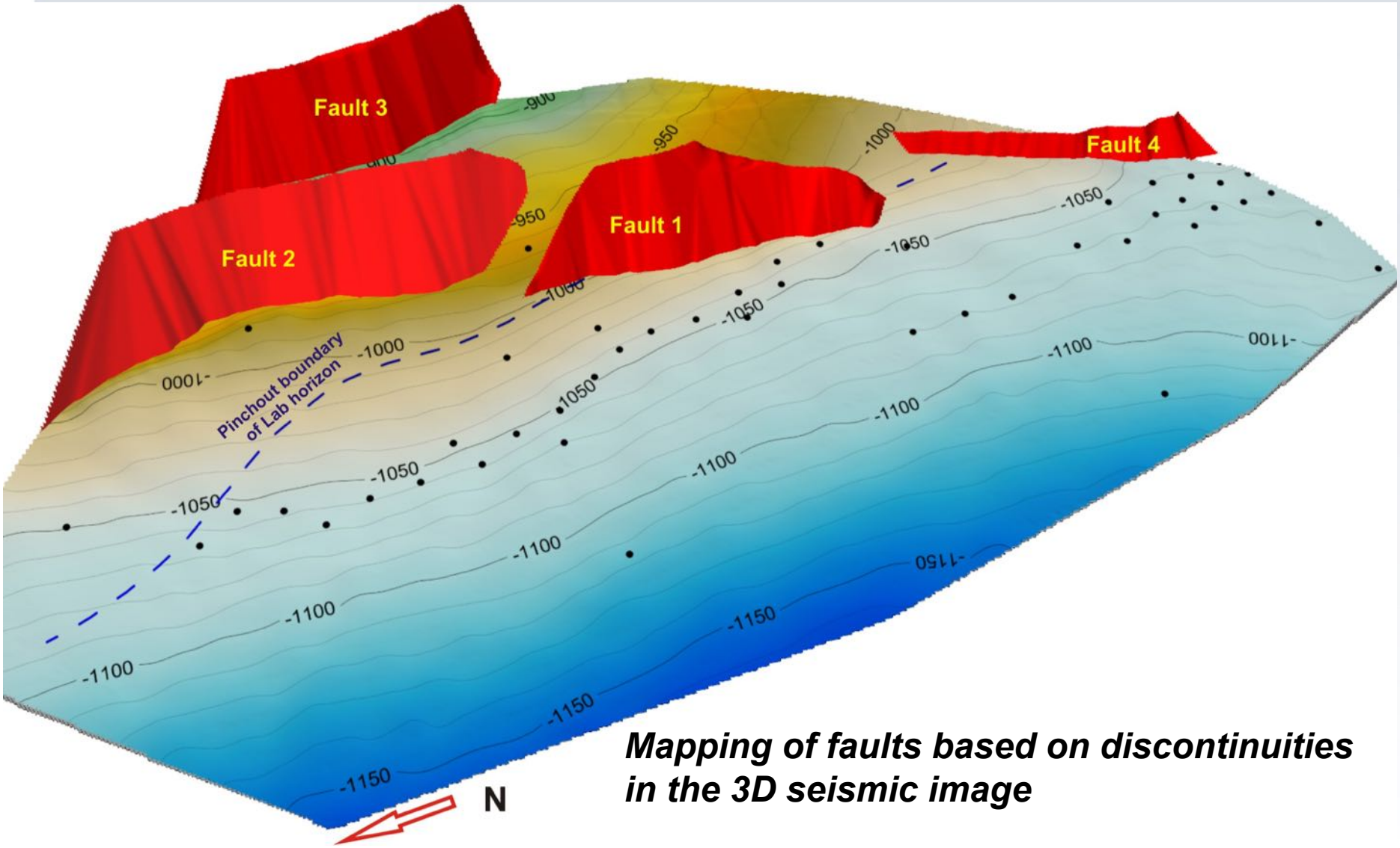


Transformation of the mapped seismic boundaries, horizons and faults from time to depth domain





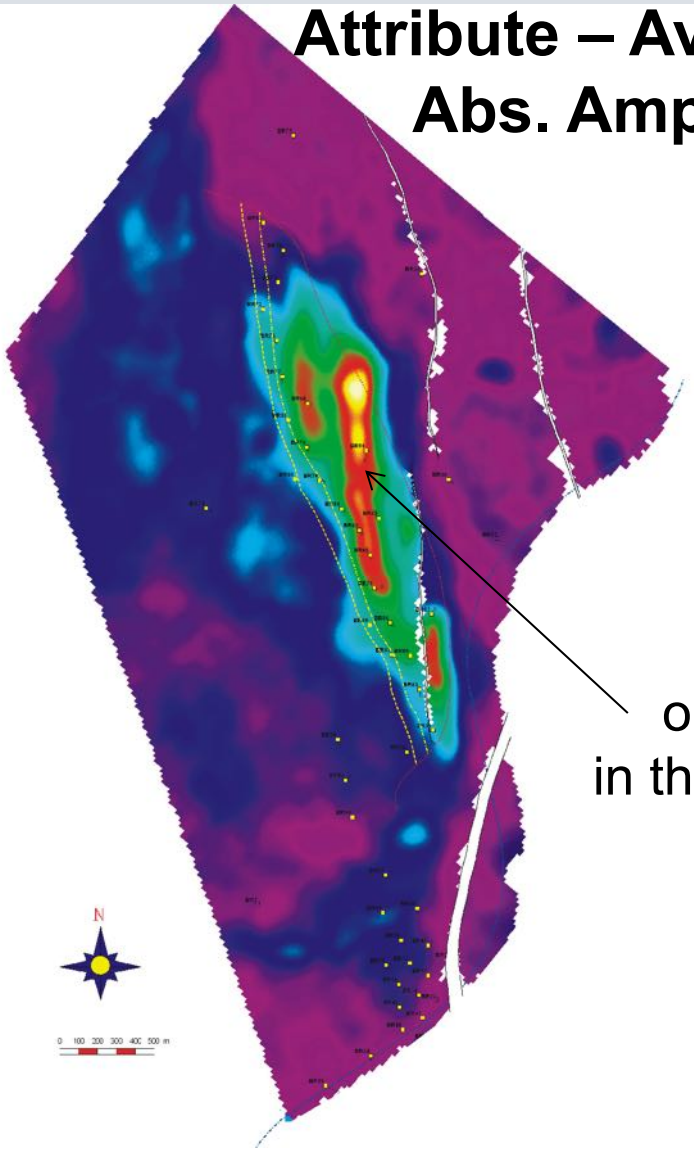
Mapping of seismic horizons and stratigraphic boundaries



Mapping of faults based on discontinuities in the 3D seismic image

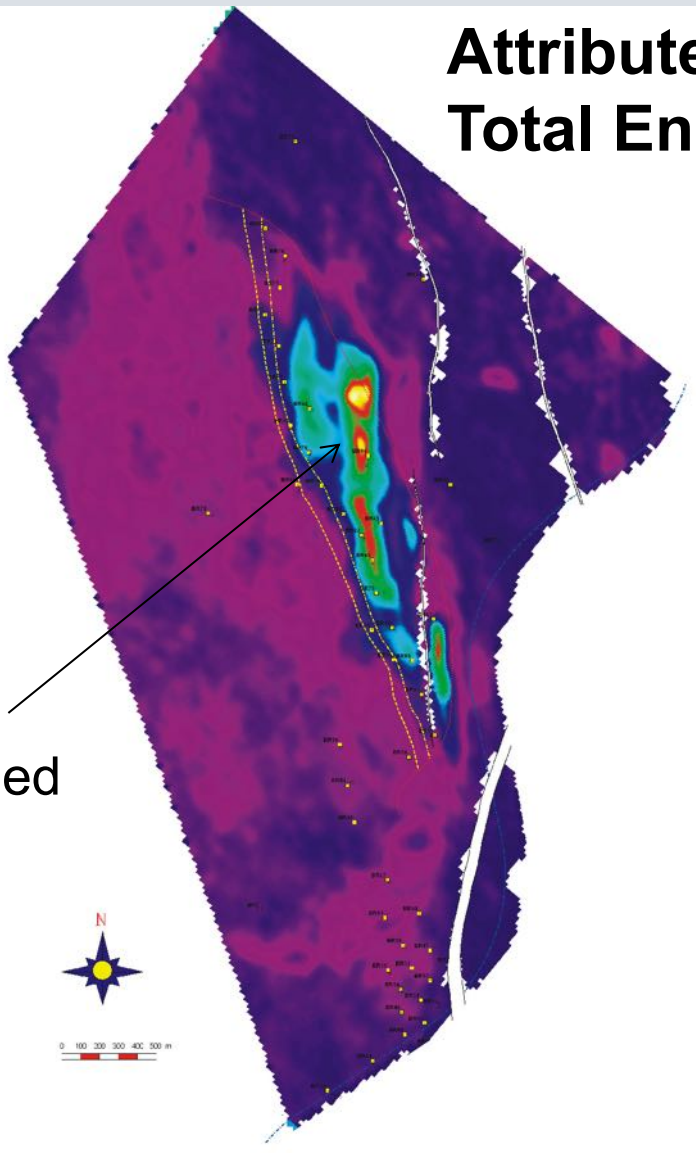
Testing of seismic attributes at the level of the Lab horizon

Attribute – Average Abs. Amplitude

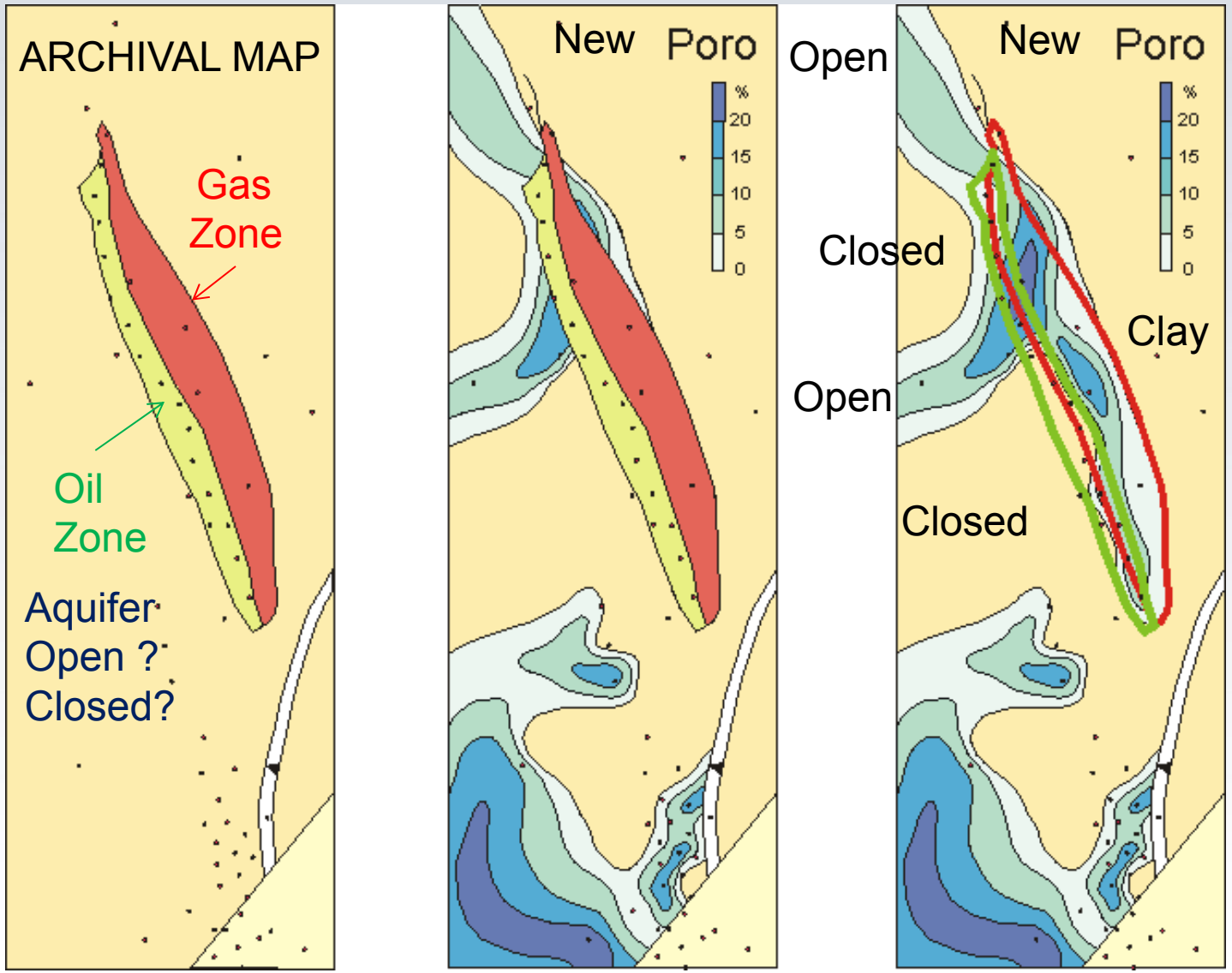


Residual oil and gas in the abandoned LBr field

Attribute – Total Energy

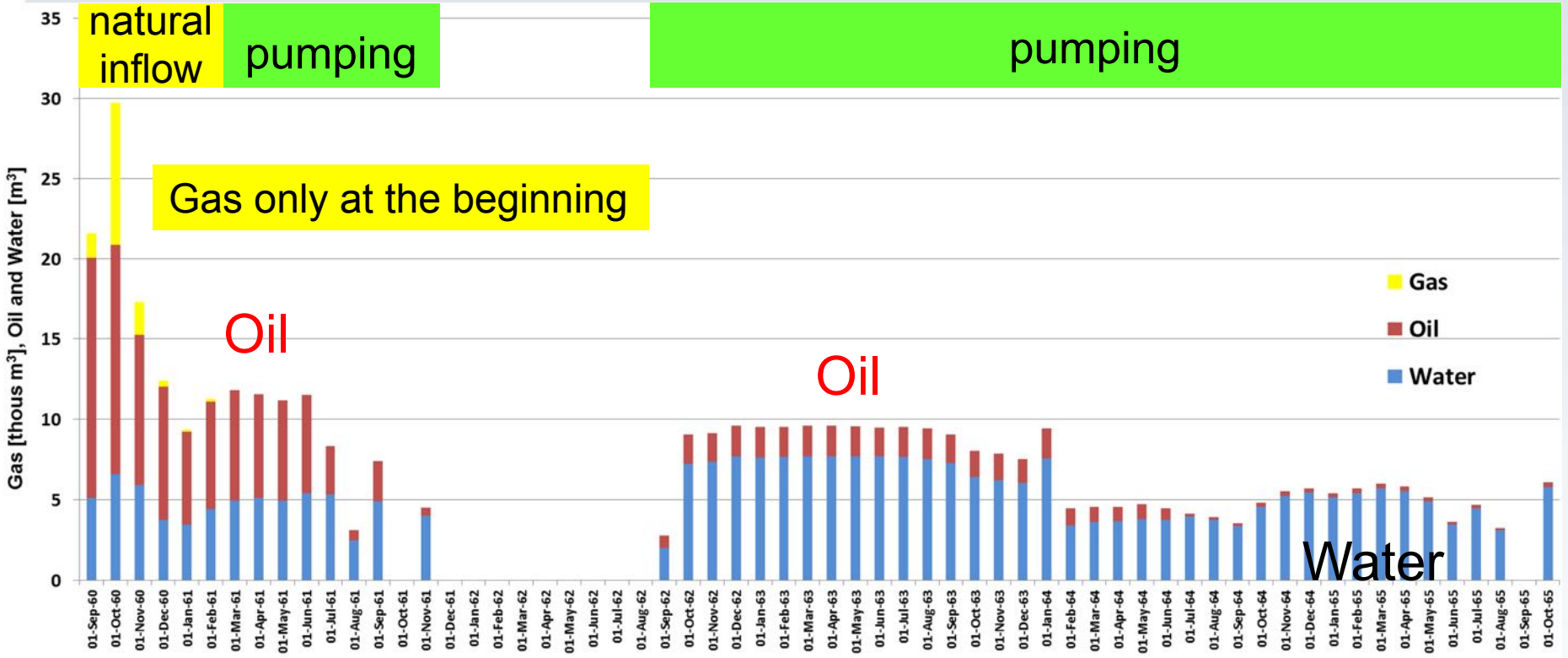


Comparison of Archival and New Interpretation



History Matching

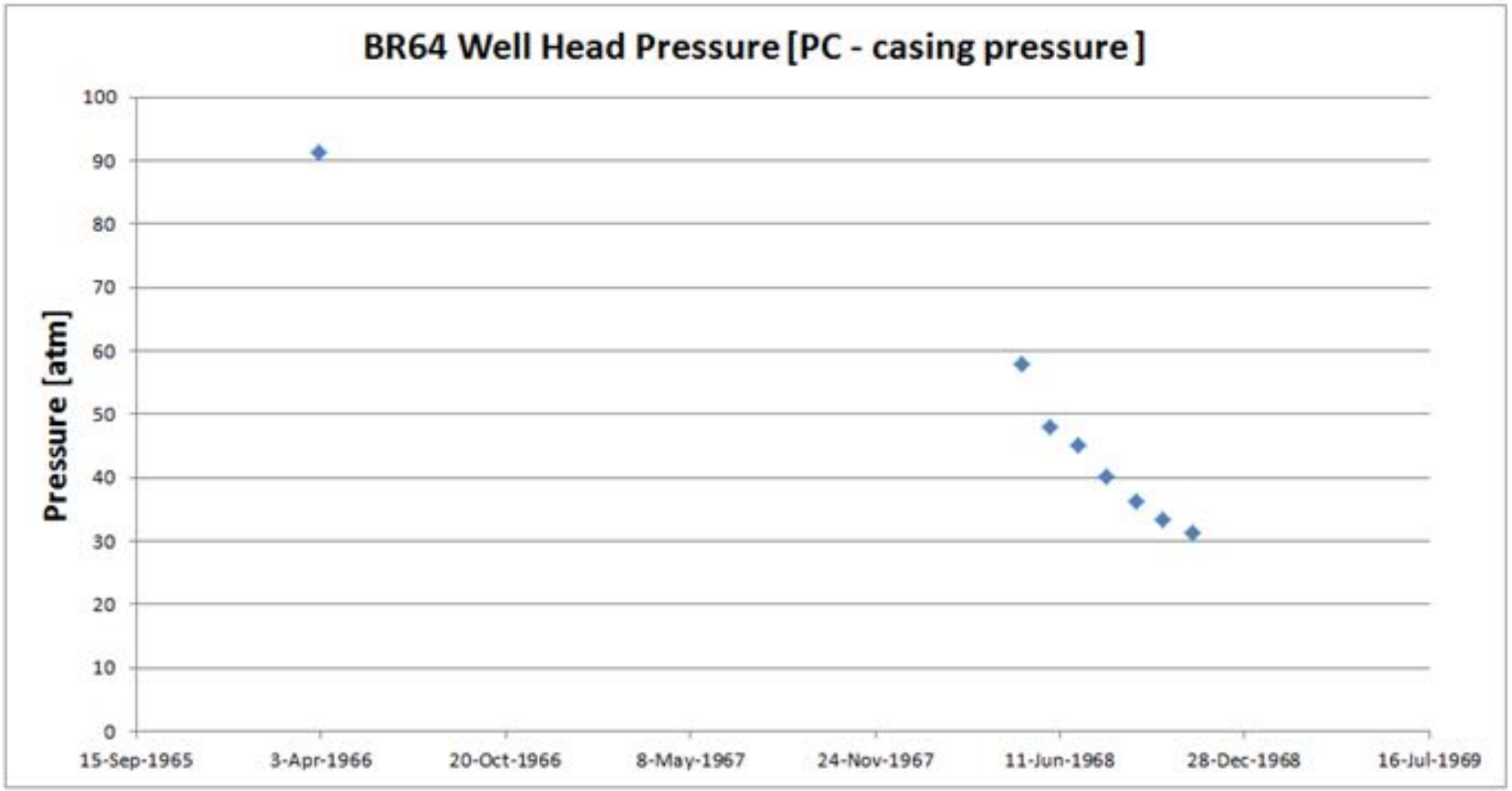
Average daily production per month well BR 89
Perf. 1101-1102 m 1084-1087.5 m



Sep 1960

Oct 1965

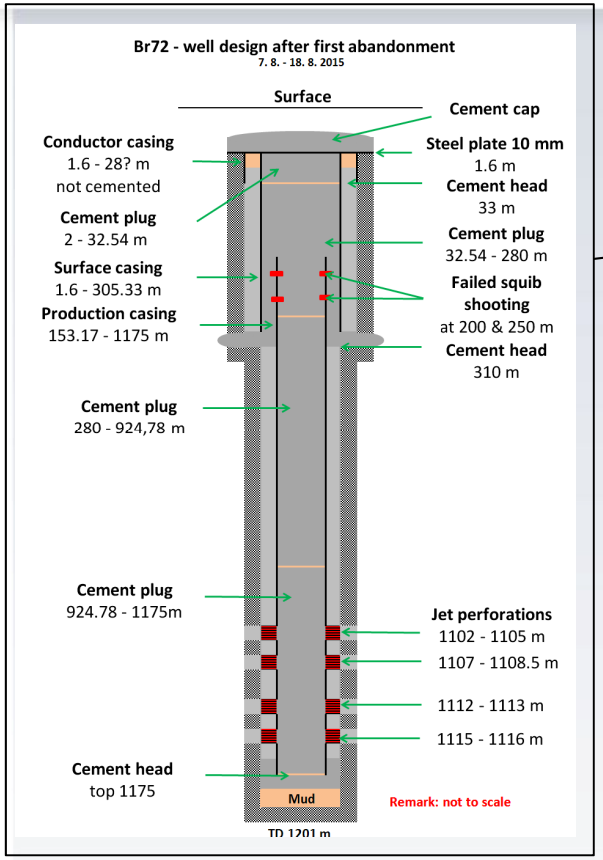
Production, pressure and test data individual wells with time

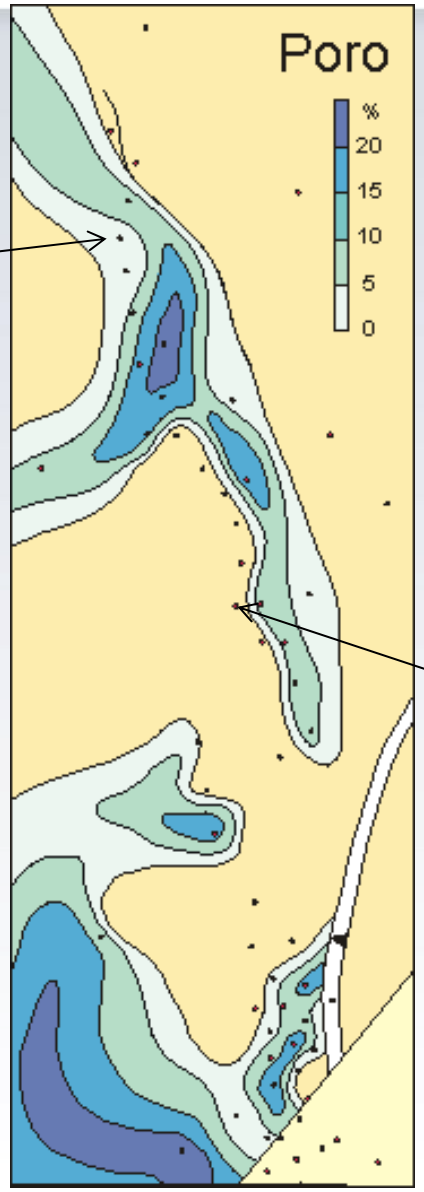


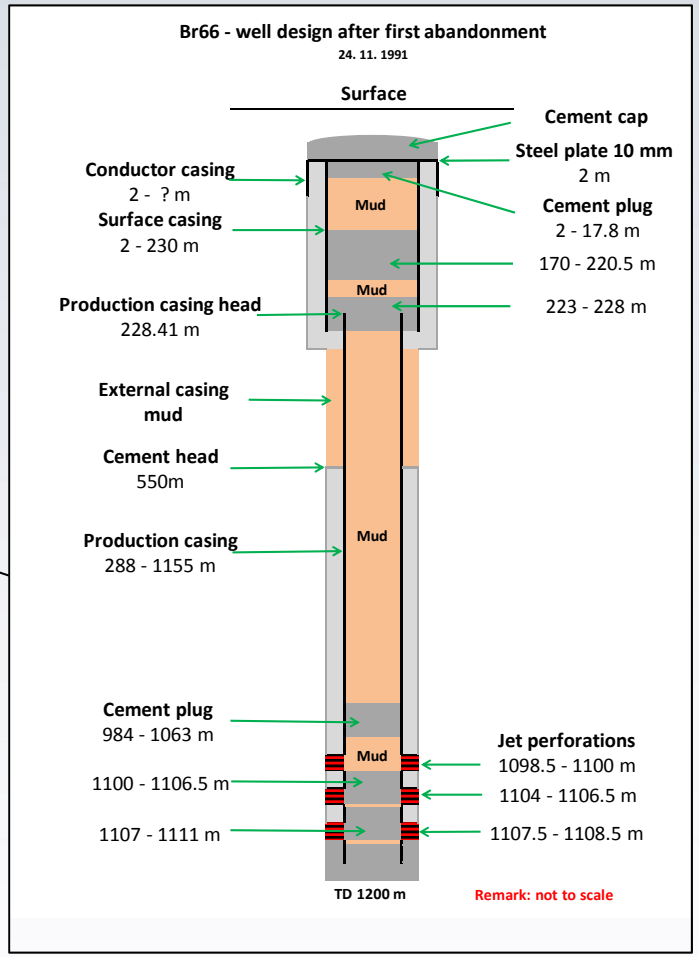
Sep 1965 July 1969

Calibration data for the History matching of gas production

Well design - GIS



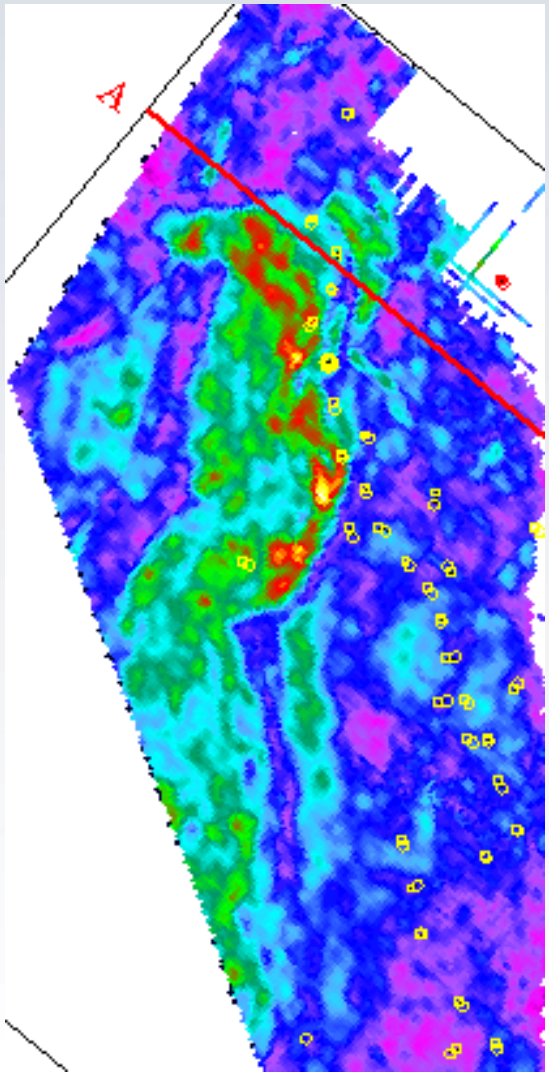




Well design database is prepared – you hit a well point and get an overview

Overburden details by Seismic Stratigraphy

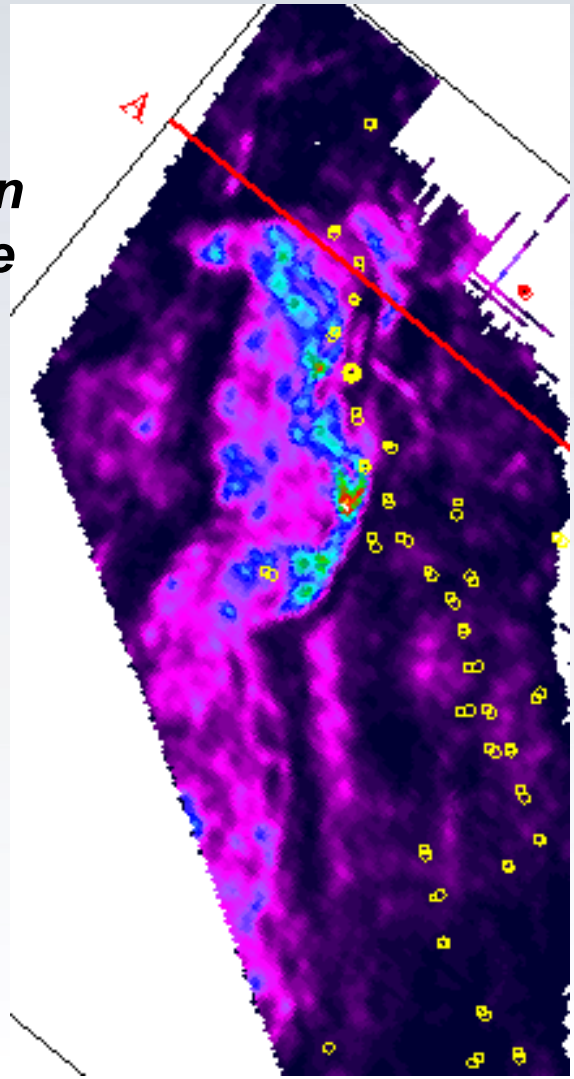
Attributes analysis



Maximum Absolute Amplitude

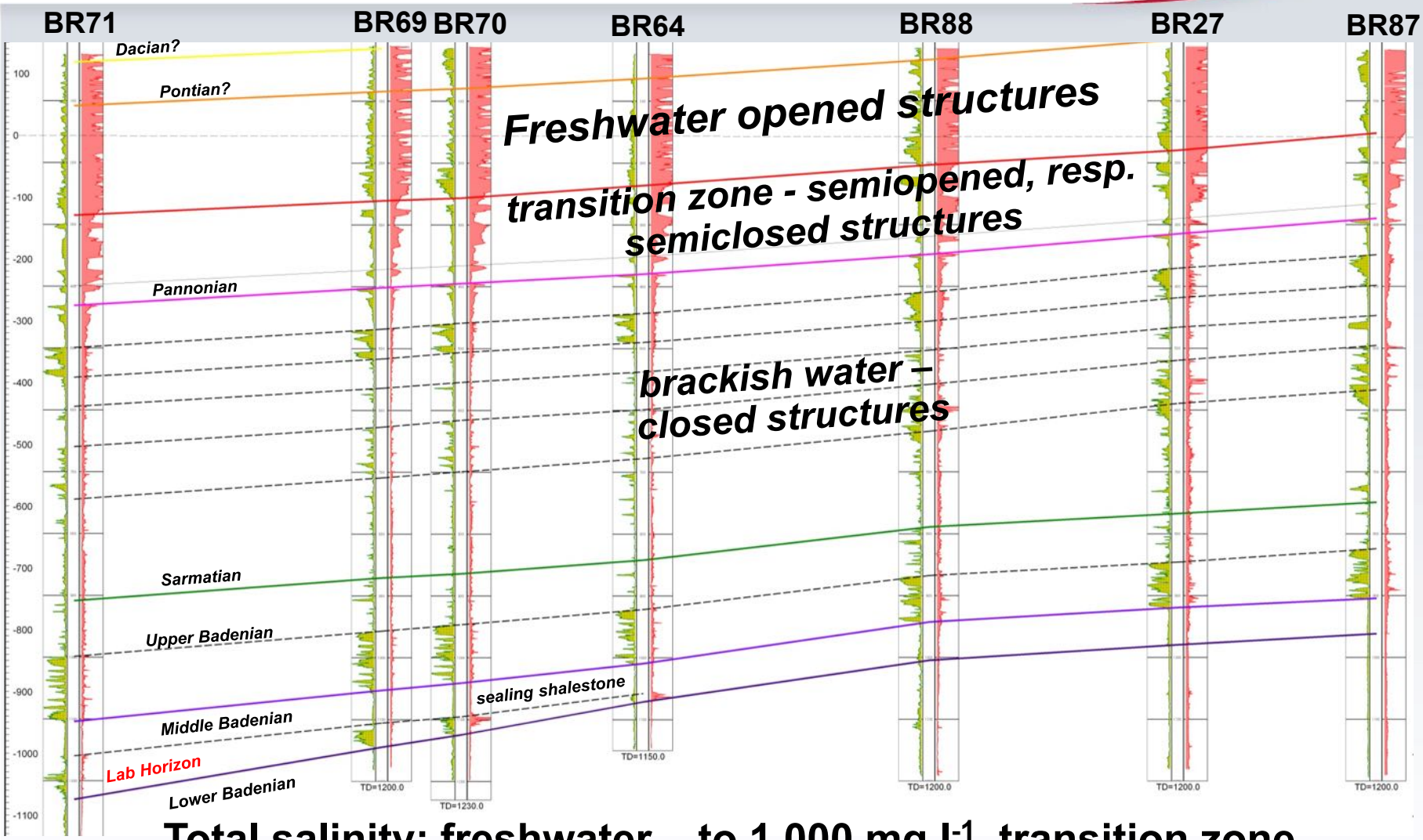
Kurtosis in Amplitude

Attributes analysis



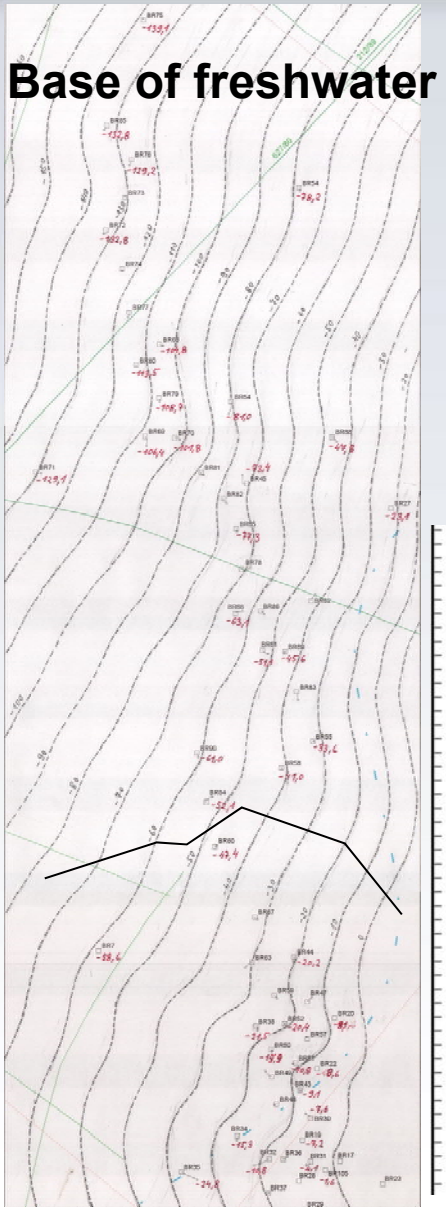
Lower Sarmatian incised channel filled with sand (small reservoir with gas)

Hydrogeology – evidence of closed vs. open system for migration

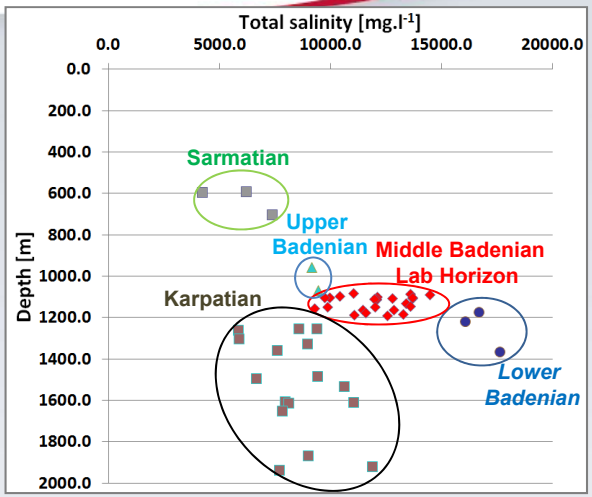


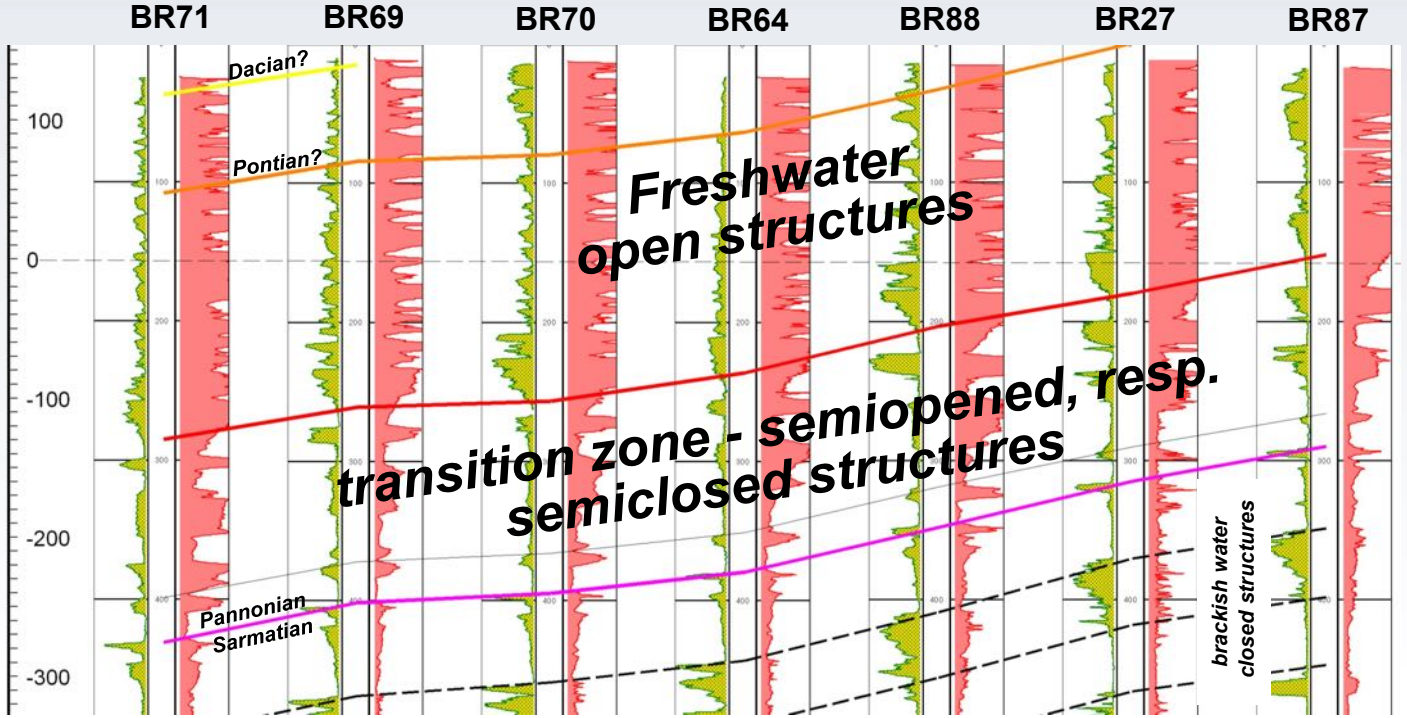
Total salinity: freshwater – to 1 000 mg.l^{-1}, transition zone – from 1 000 to 3 000 mg.l^{-1}, brackish water – over 3 000 mg.l^{-1}

Structural Maps - Base of Freshwater Formation Fluids



Hydro-geochemistry Shows five types of formation water





Conclusions

1. Improved **porosity and permeability maps** based on well tests and production, clarification of pinch-out zones are provided as input for the Dynamic modeling

2. Production history - gas pressure directly measured
   - in oil wells needs to be calculated from well head data + height oil and mud column

3. Details on well design in GIS for Risk modeling