AVO classification verifying by petrophysical logs

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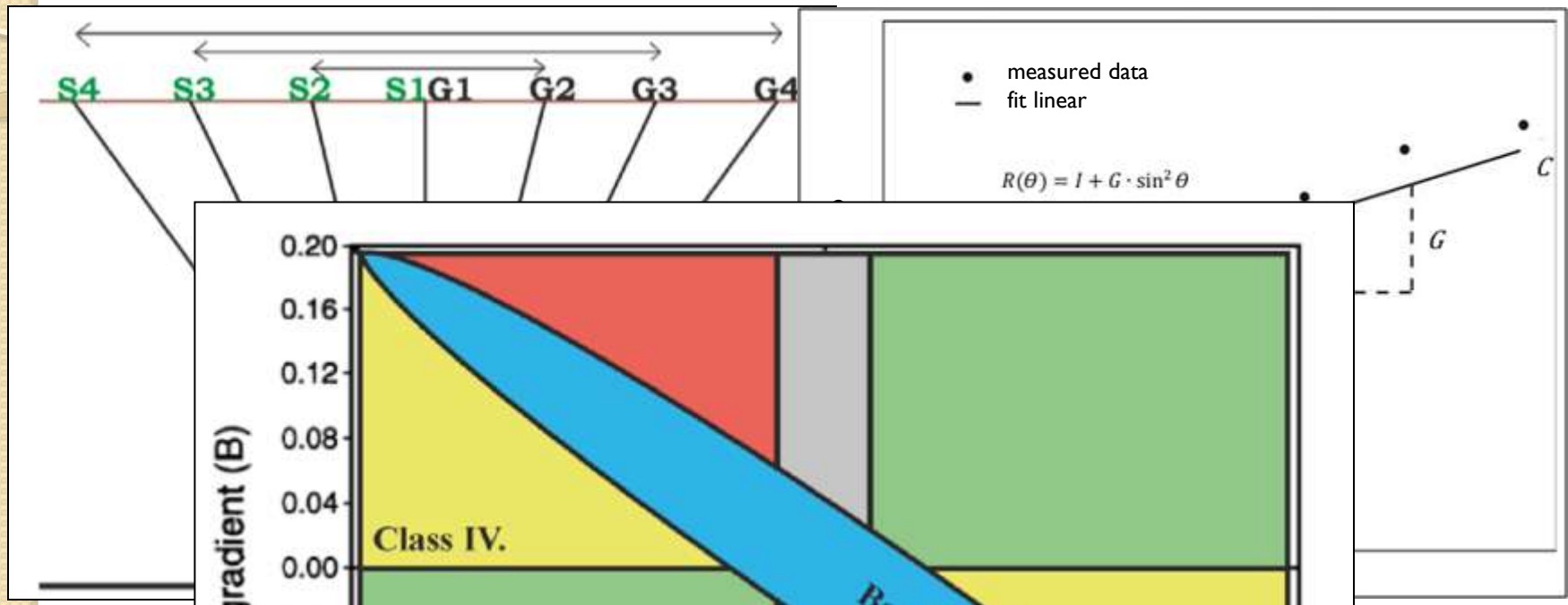
Objectives and Motivations

- Motivations: One of the most frequently used tool of hydrocarbon industry is the analysis of Amplitude Versus Offset (AVO) attributes. It is important to analyse the reasons of wrong anomalies, which give useful information in the future.
- Objectives: Verifying of examination of AVO classification in case of productive and unproductive boreholes is a known researh area.

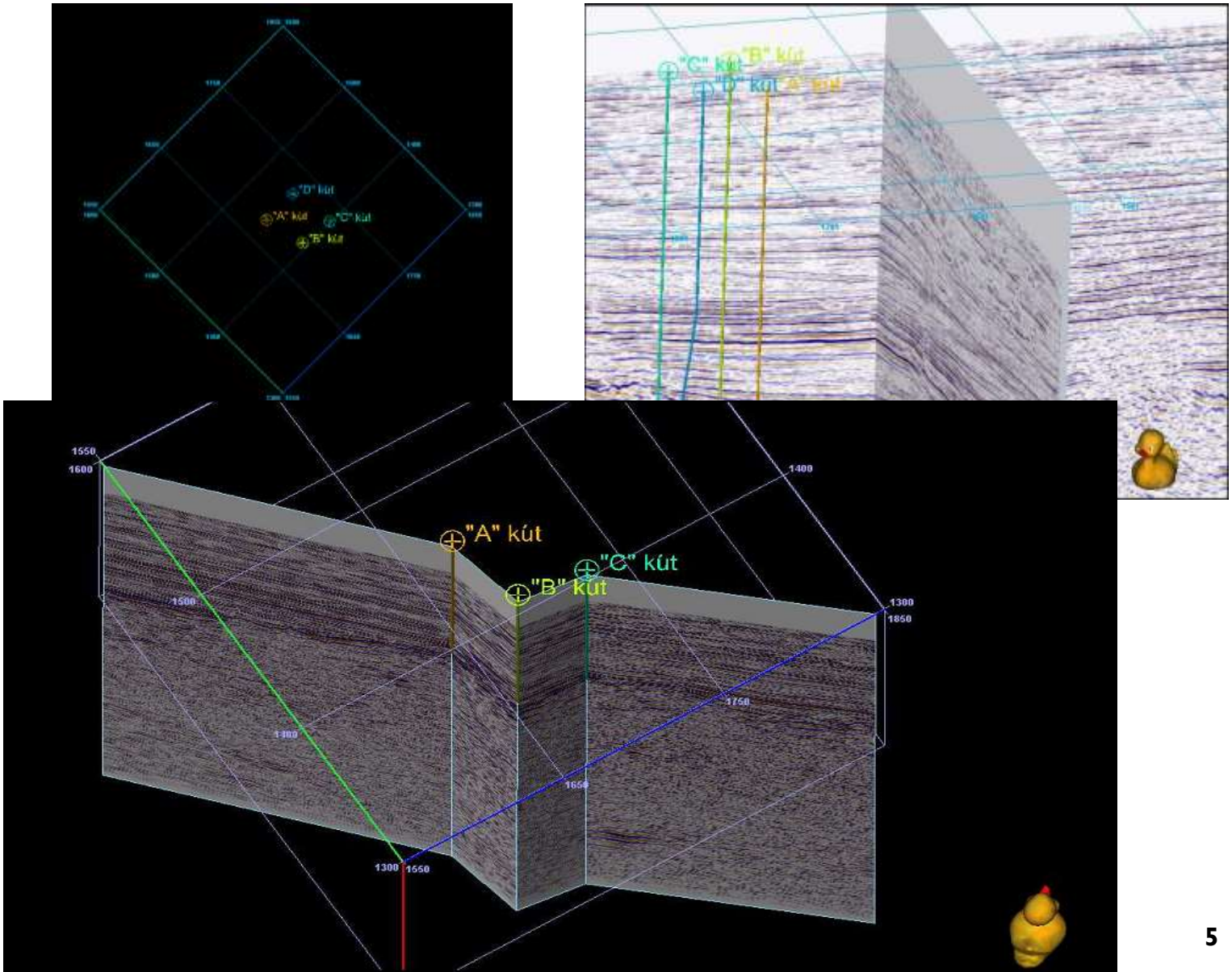
Objectives and Motivations

- The main points are:
  - completion of AVO classification,
  - evaluation of petrophysical logs,
  - examination of acoustic and elastic parameter of research zone,
  - comparison of productive and unproductive borehole,
  - the measured values checked by modelling the acoustic velocities and velocity answer.

Theory of the Amplitudo Versus Offset (AVO)



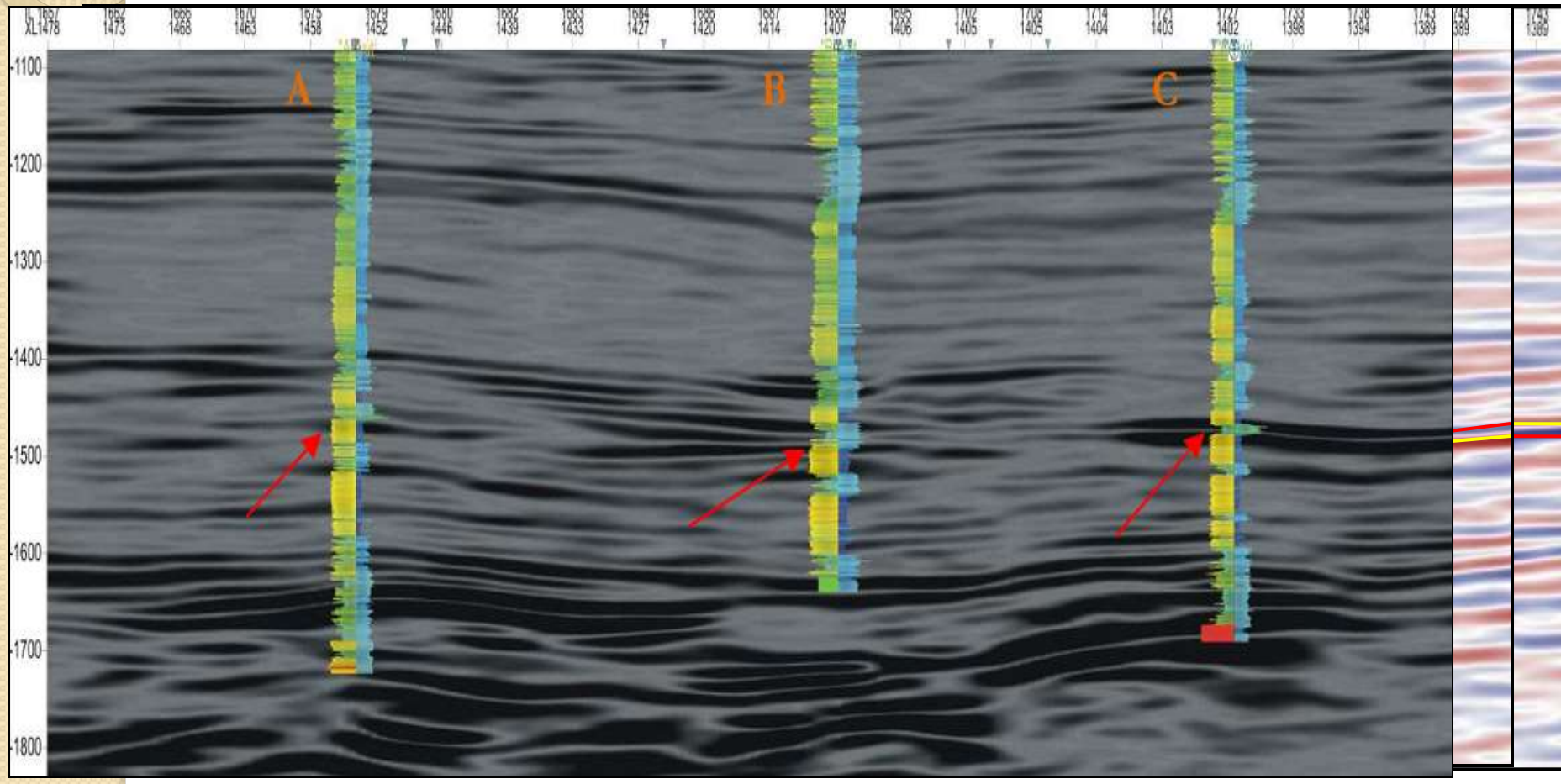
Research area

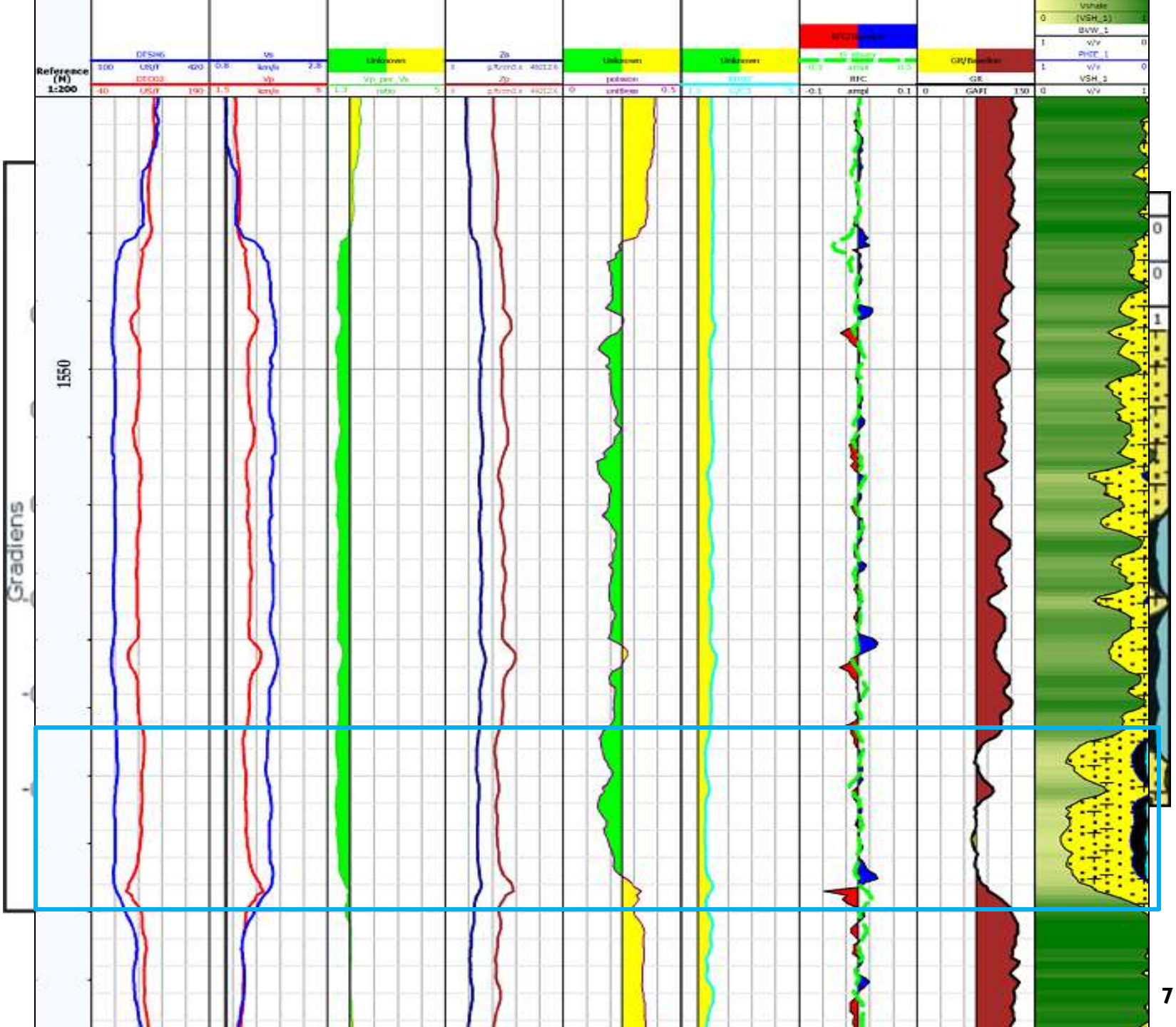


AVO classification I.

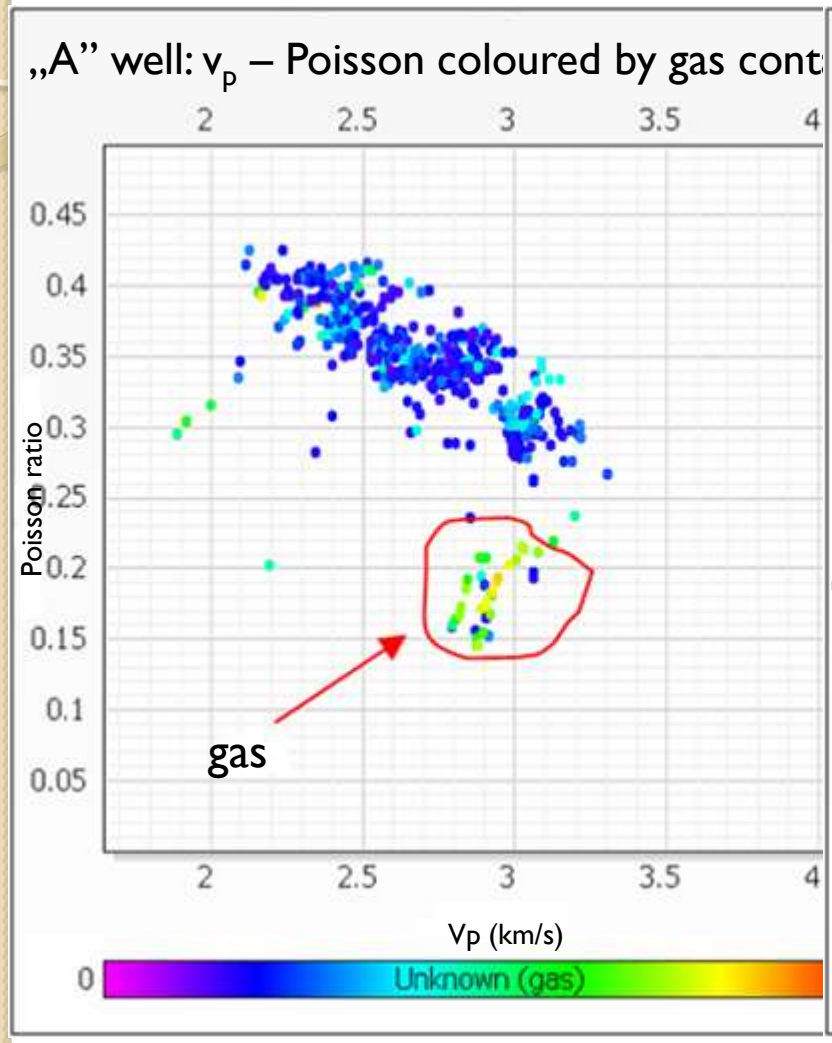
Intercept

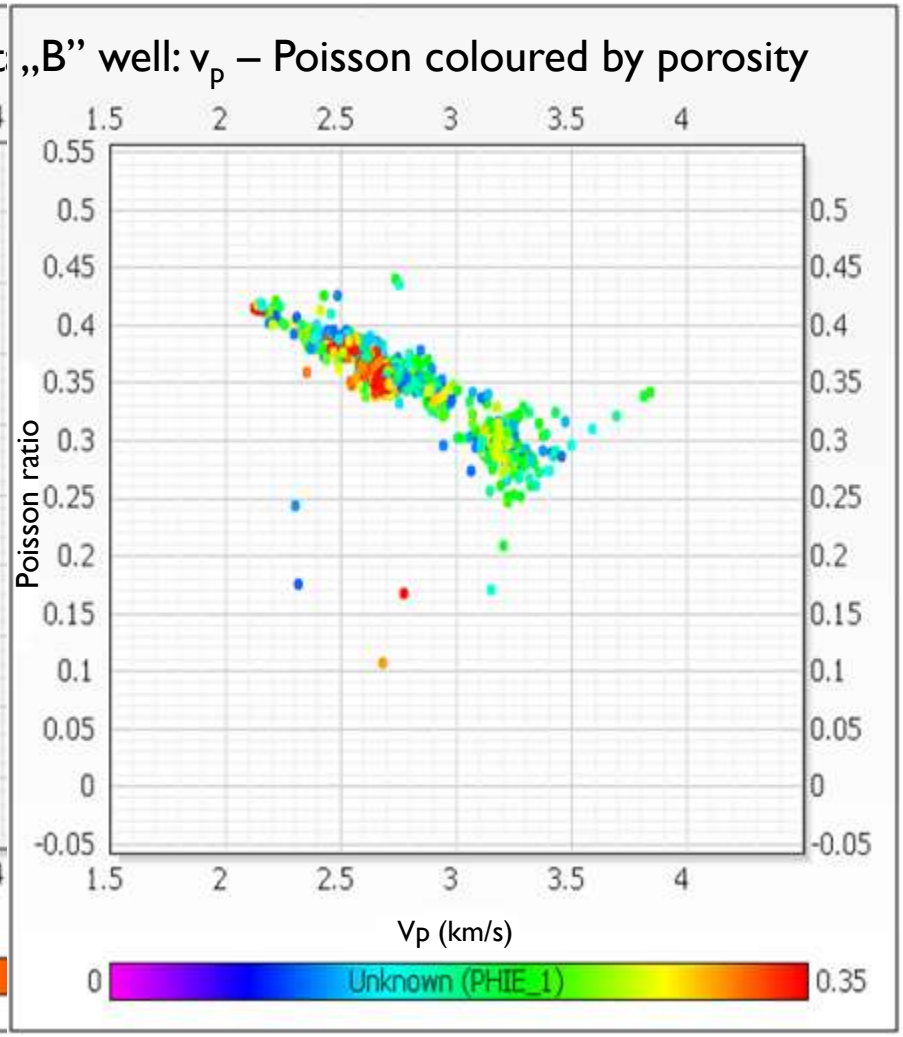
Gradient



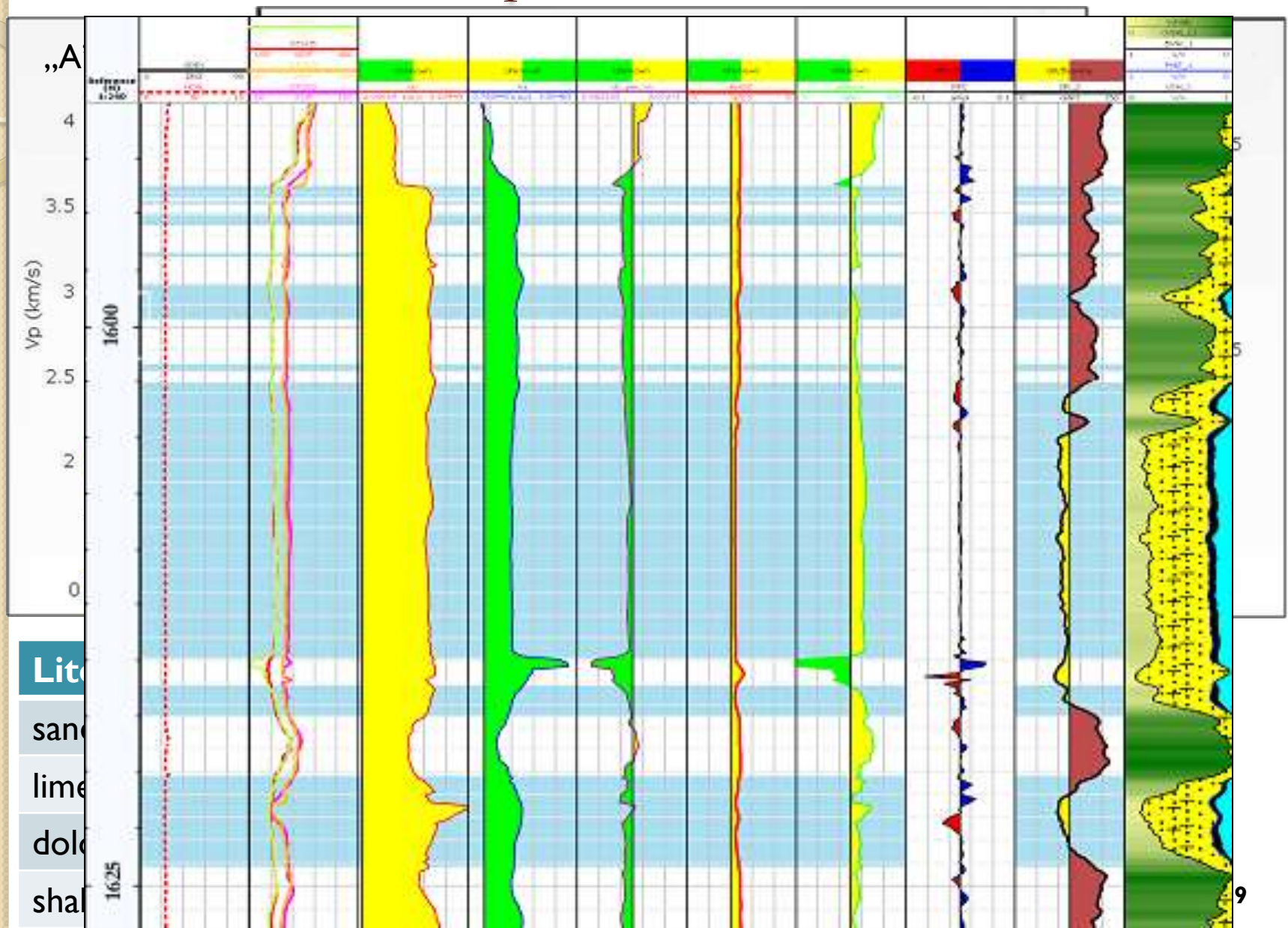

Reference (M) 1:200
DTSHS
DTCO
Vs
Vp
Vp_per_Vs
Zp
poisson
RHC
GR
GAPI
Vshale
(VSH_1)
BVW_1
PHIE_1
VSH_1
1550
Gradiens

Crossplots: v_p - σ

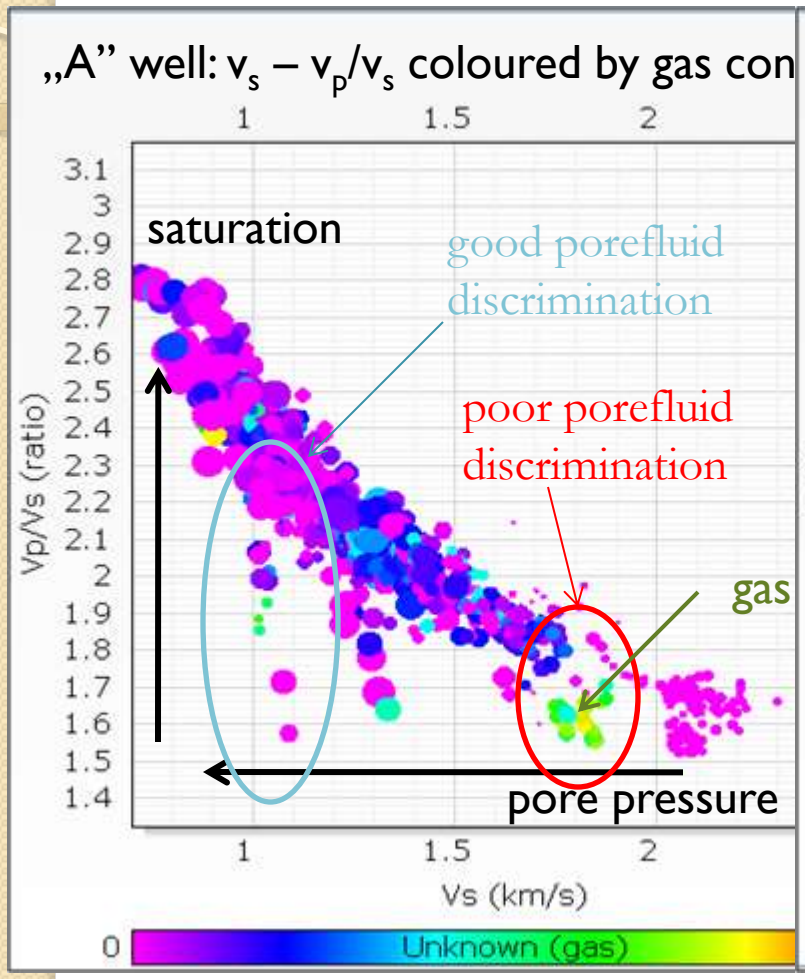


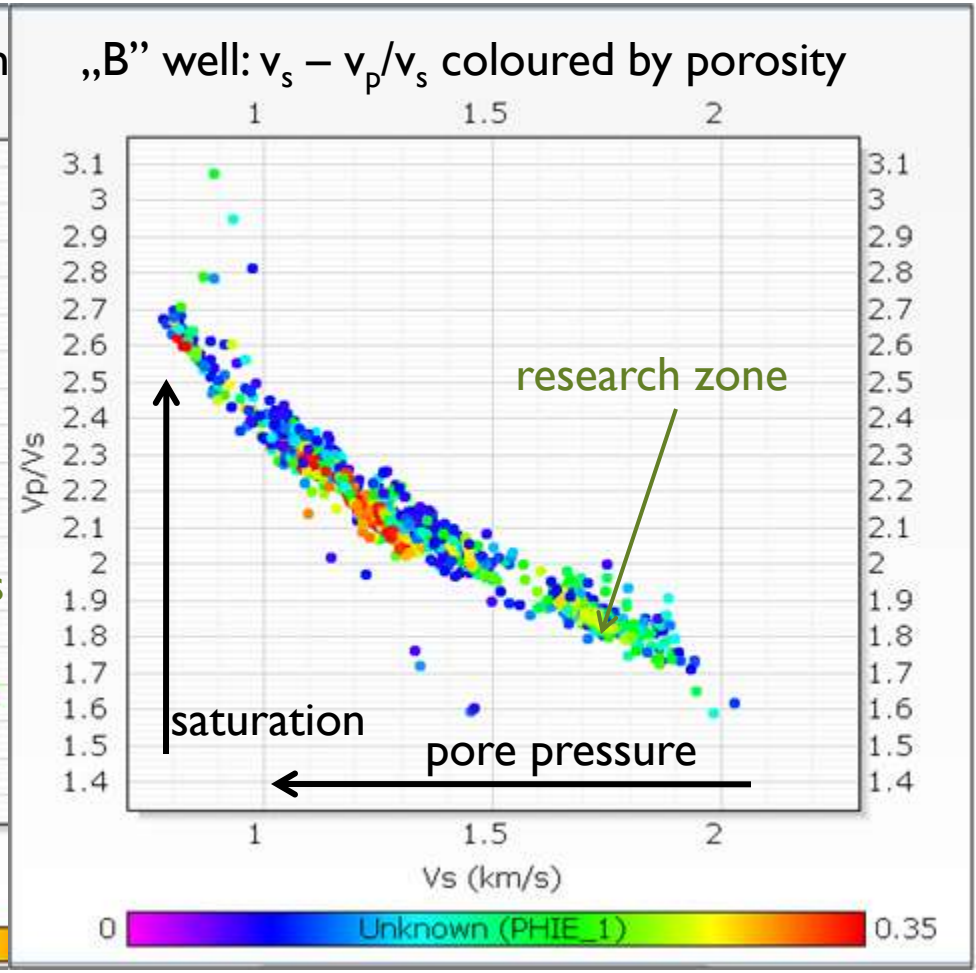


Crossplots: v_p - v_s

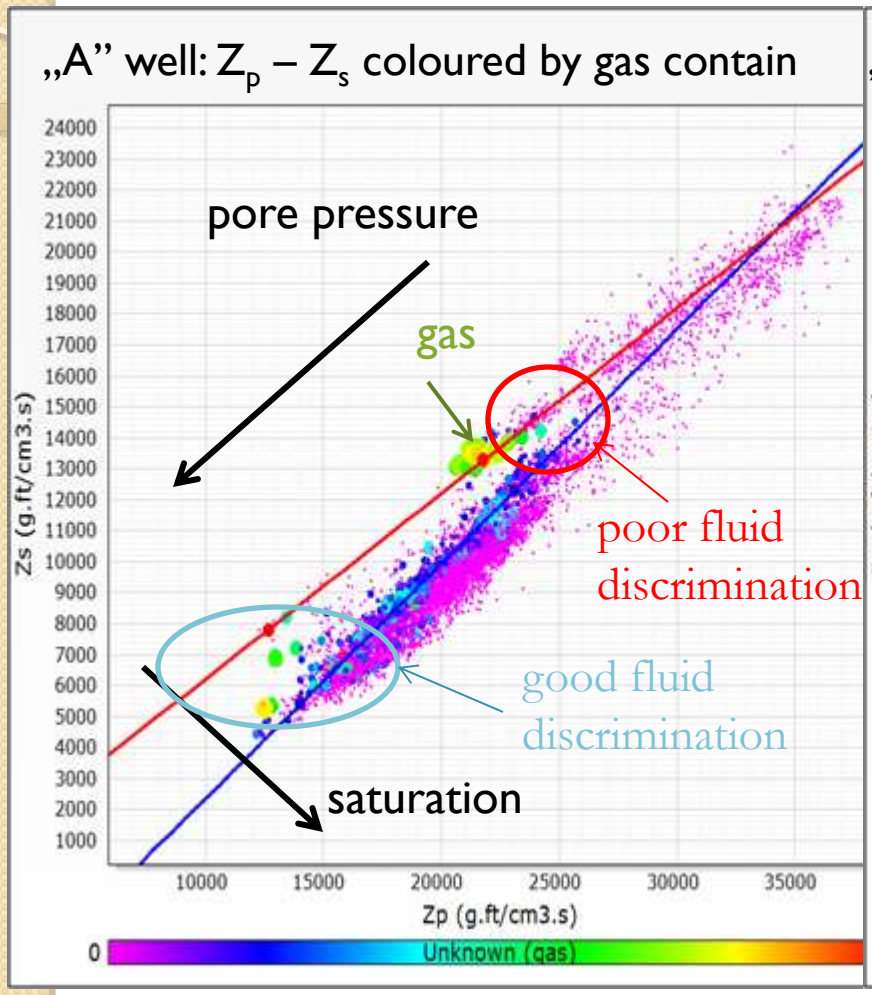


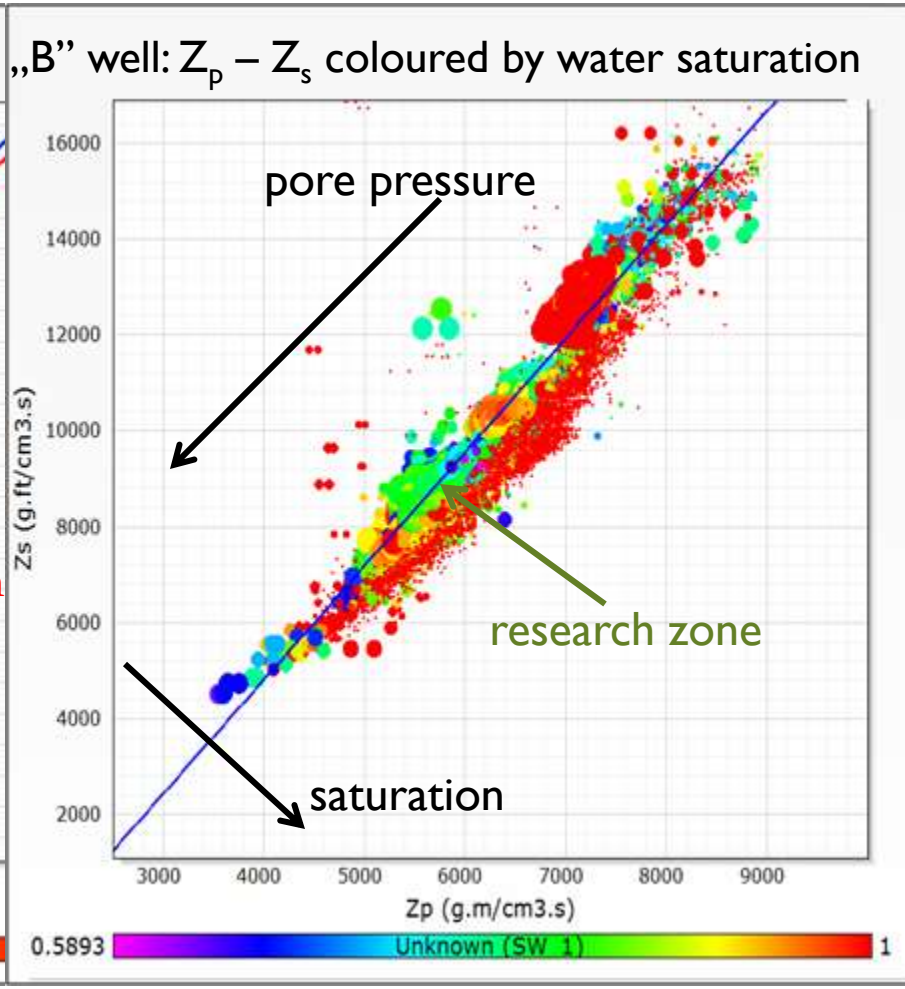
Crossplots: v_p/v_s - v_s





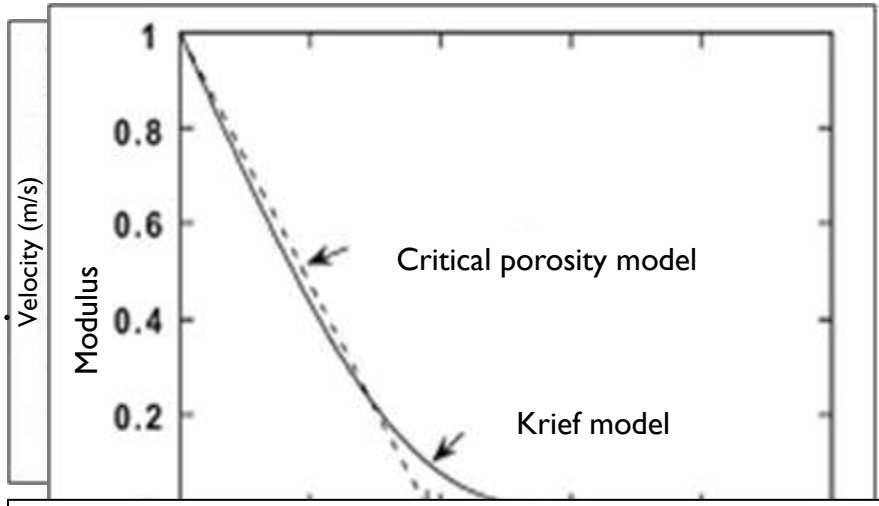
Crossplots: Z_p - Z_s

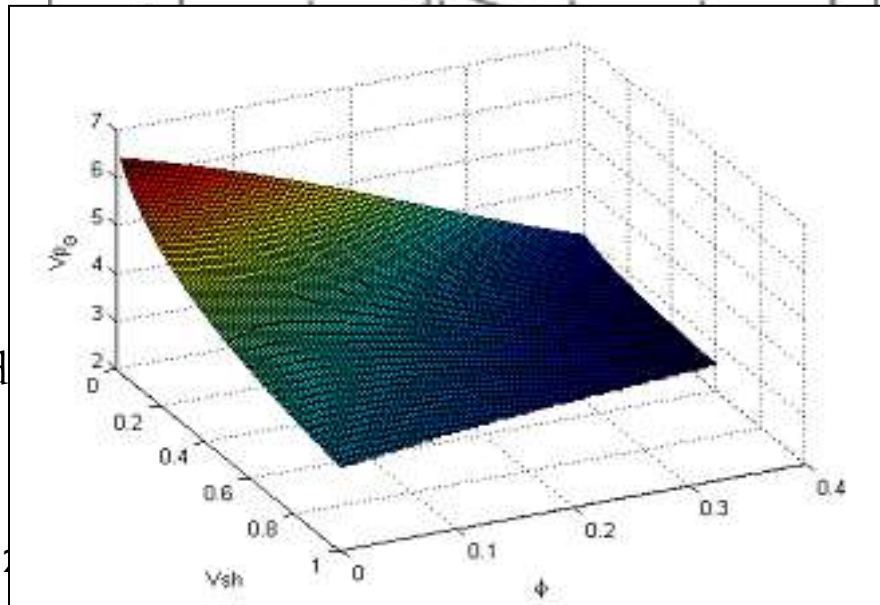




Velocity modeling: theory

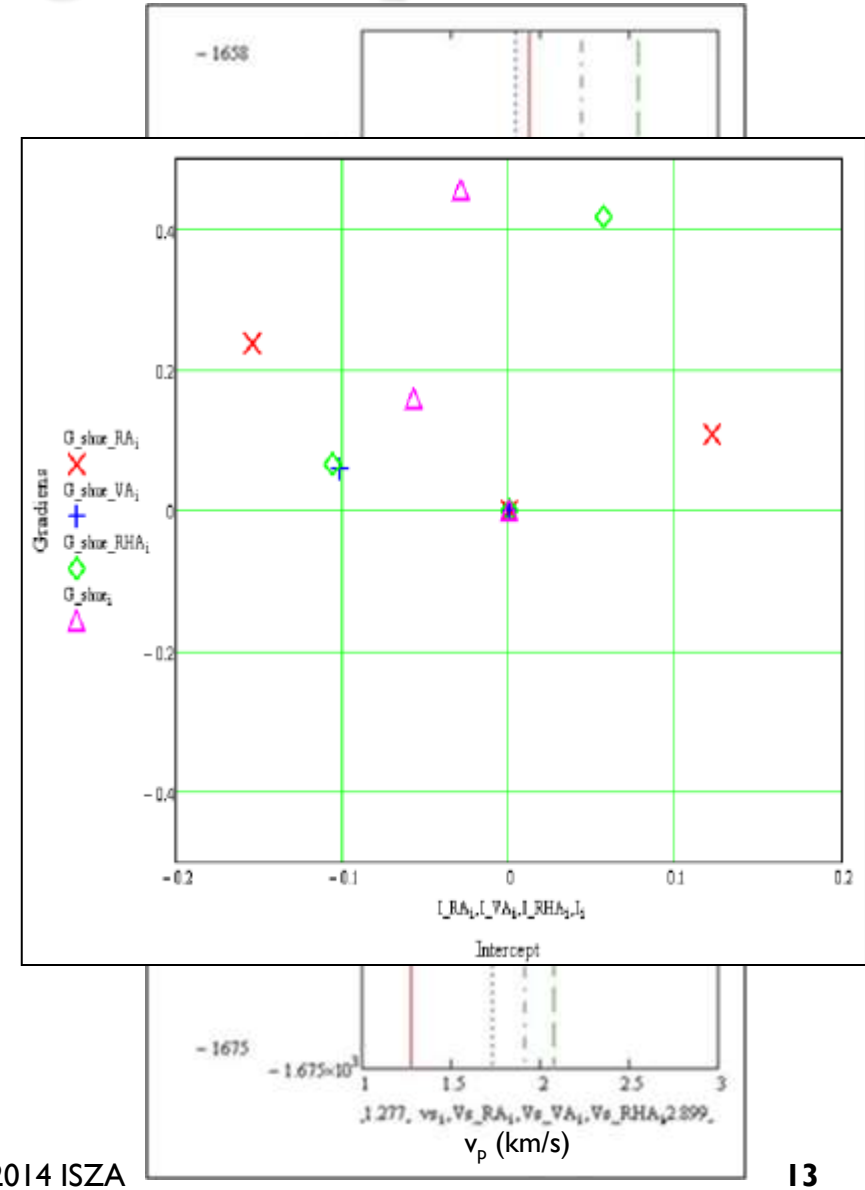
- Problems: The equations can't include all effects if in complex rock.
  - Effect of shale,
  - Porosity,
  - Effect of hydrocarbon and water .
    - Determination of the different incompressibility values.
- Model: Uses the Geerstma equation, which needs different incompressibility values:
  - The matrix mixing with shale (Reuss-, Voight- és Reuss-Hill average formulas),
  - Including porosity to previously calculated values by Gasmann and Krief equations.





Velocity modelling: example

- P wave velocity differs significantly from measured data.
- Result of the averaging formulas shows specific effect of gas.
- Two of calculated S wave velocity show too high velocity increase in the gas content layer. Except the Reuss formula, which shows little velocity increase.



Summary

- The AVO attributes are equal to apriori knowledge.
- By evaluation of borehole logs the layer with hydrocarbon content was successfully determined. But the AVO classification of seismic section does not correspond to petrophysical logs, because the measured P wave velocity is not good enough.
- It can be shown by the evalution of acoustic and elastic parameters that gas content layers can be separated. At the unproductive borehole the parameters do not show such behavior.
- Important that the research zones are in the poor fluid discrimination zone.
- P wave velocity of hydrocarbon content layer was exemined by different velocity models. But results of these models are unsatisfactory.

- AVO anomaly of the unproductive borehole could not be explained by results of petrohysical logs.

Thank you for your attention!