

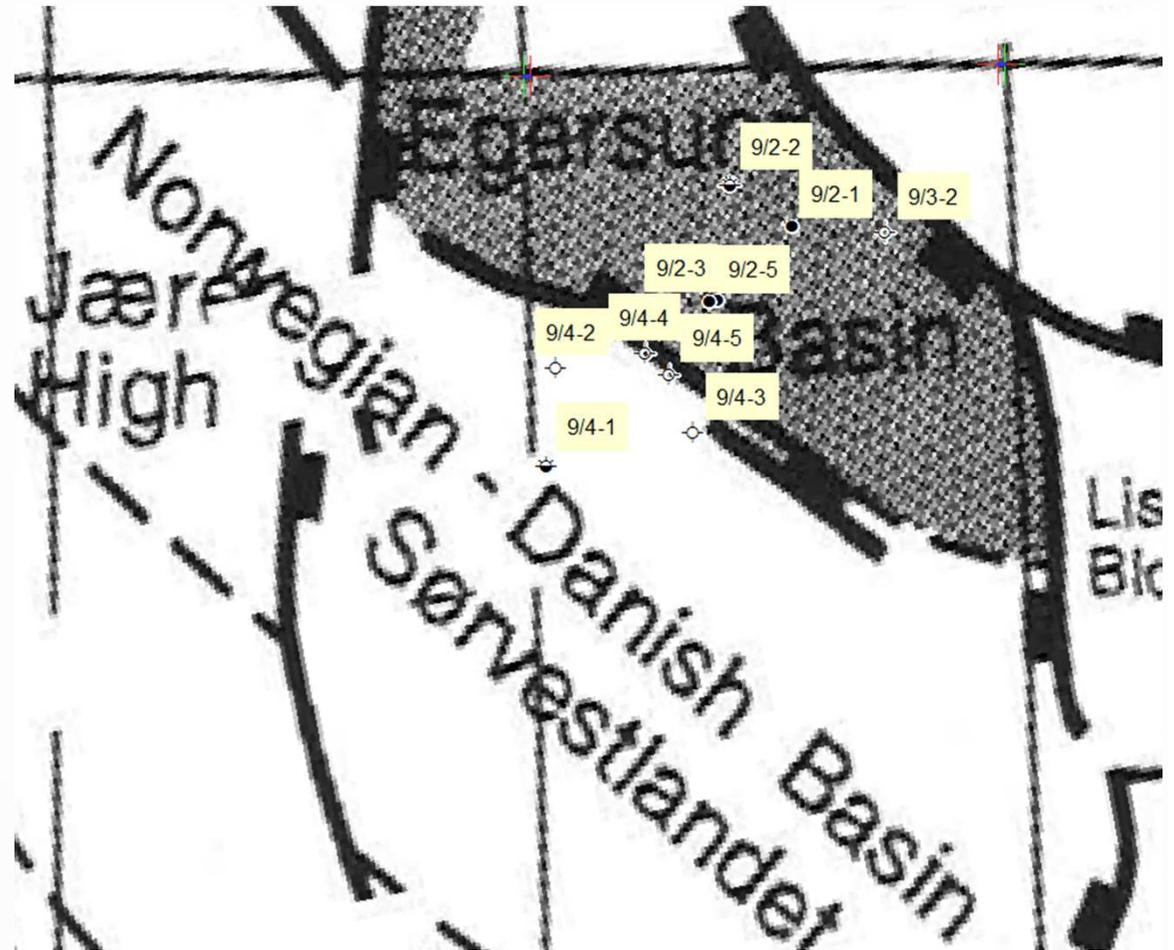
Petropysical properties of clay dominated stratigraphic units in the Egersund and Norwegian-Danish basins

M. Kalani, N.H. Mondol, J. Jahren, J.I. Faleide

Department of Geosciences/ Faculty of Mathematics and Natural Sciences
The University of Oslo



Geological setting



(adapted from Sørensen and Tangen, 1995)

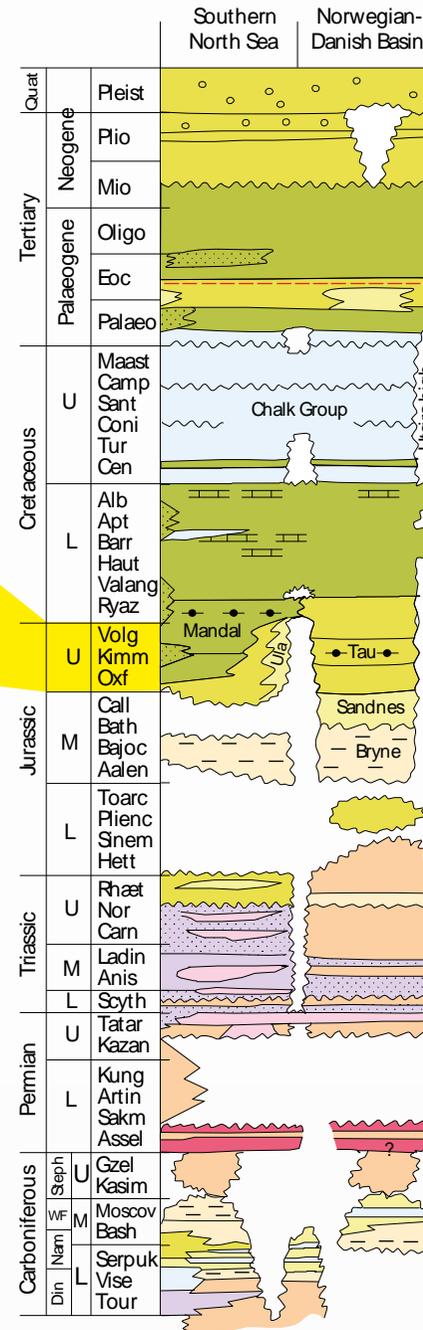


Stratigraphic units

SAUDA FM
TAU FM
EGERSUND FM

- Continental clastics, unspecified
- Continental clastics, mainly sands
- Continental clastics, mainly shales and silts
- Halite
- Marginal evaporite deposits, sabkha
- Coastal-, delta- and flood plain deposits
- Marginal marine and shallow marine deposits, mainly sands
- Shallow marine deposits, mainly shales
- Deeper marine deposits, mainly shales
- Shallow marine carbonates
- Volcanic deposits
- Carbonaceous shales
- Clastic mixing in carbonates, sands in shales
- Source rocks

modified after Brekke et al. (2001)



9/4-1
DEPTH (1711.04 M - 2429 M)

9/4-3
DEPTH (1866.95 M - 2686.25 M)

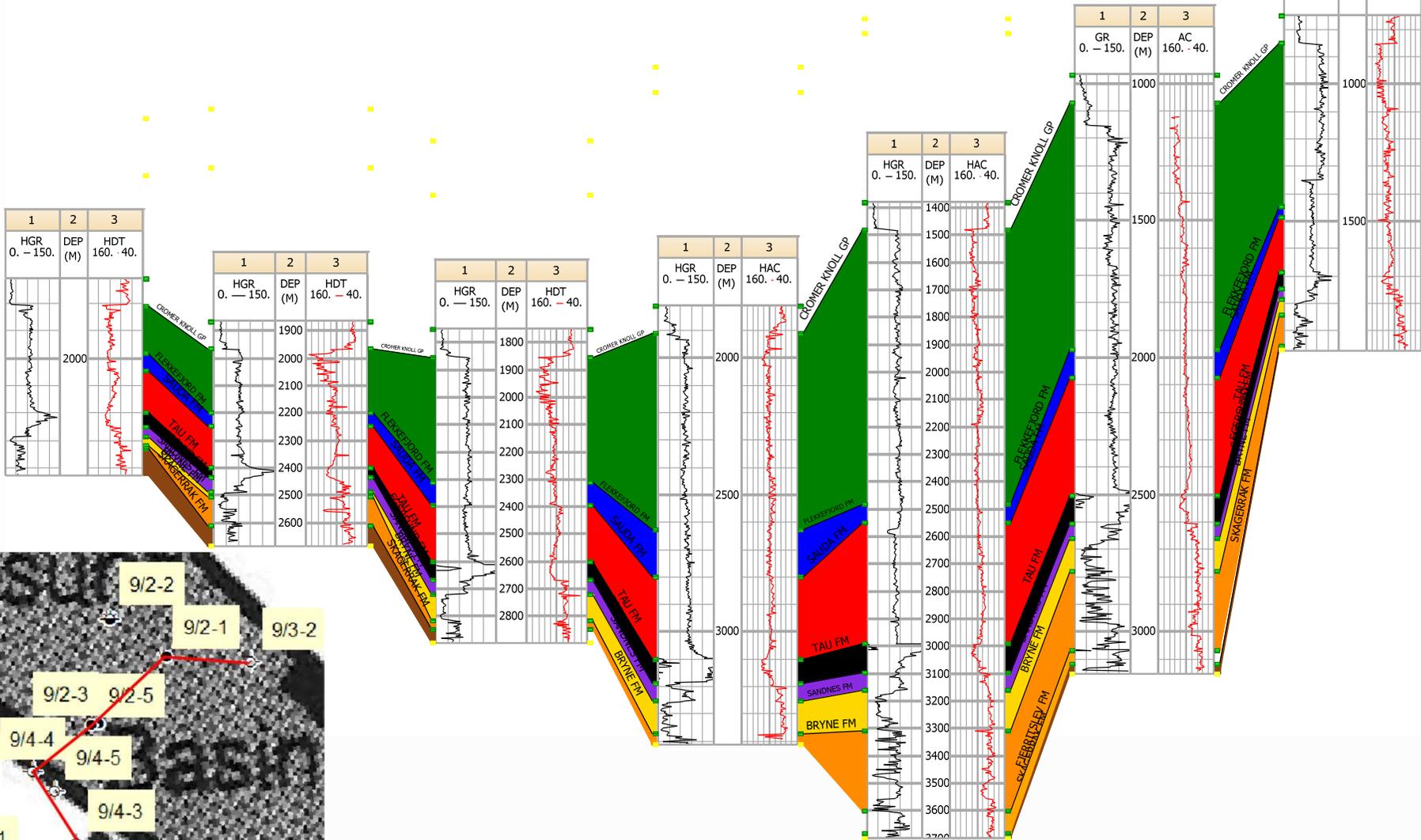
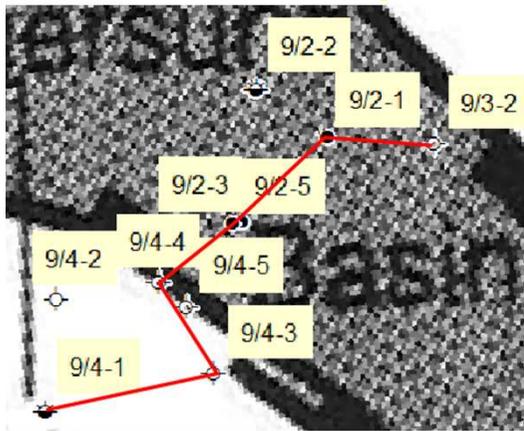
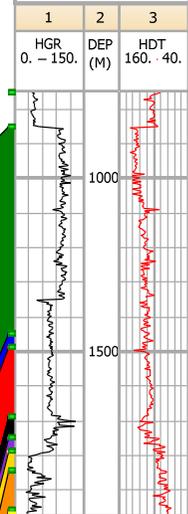
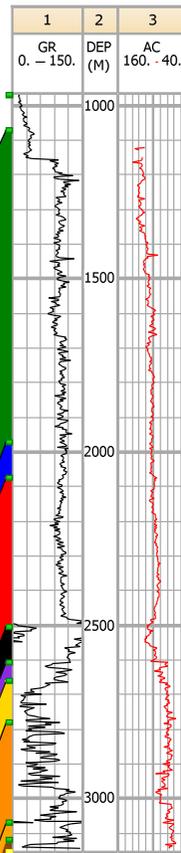
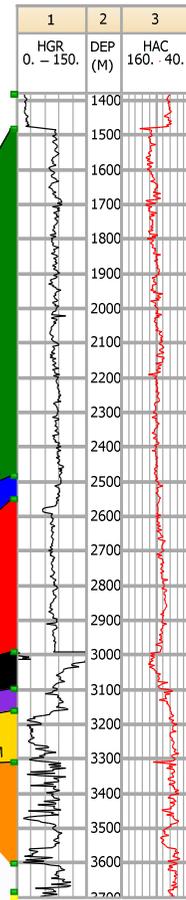
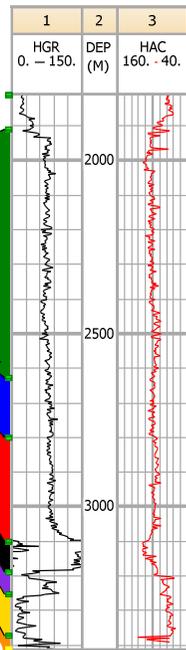
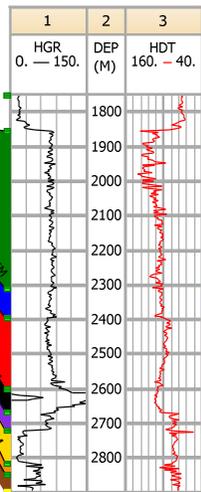
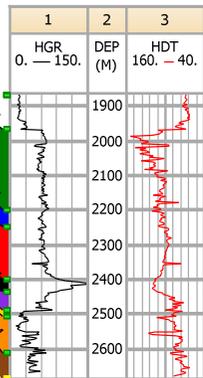
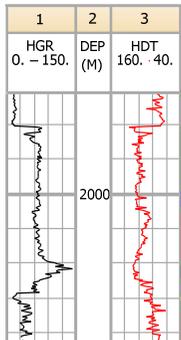
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DEPTH (1752.95 M - 2897.78 M)

9/2-3
DEPTH (1811 M - 3412.13 M)

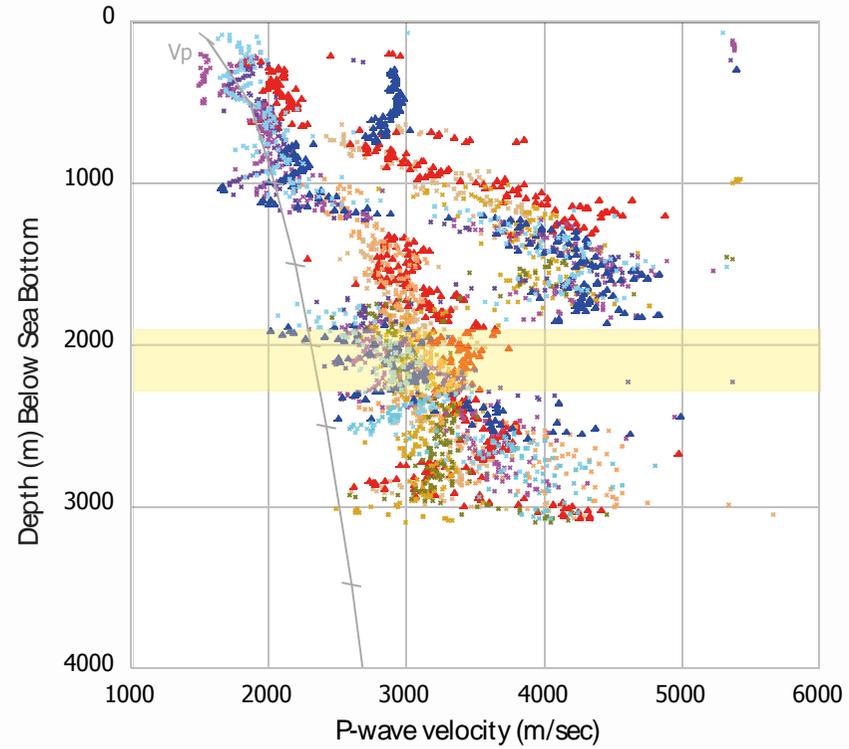
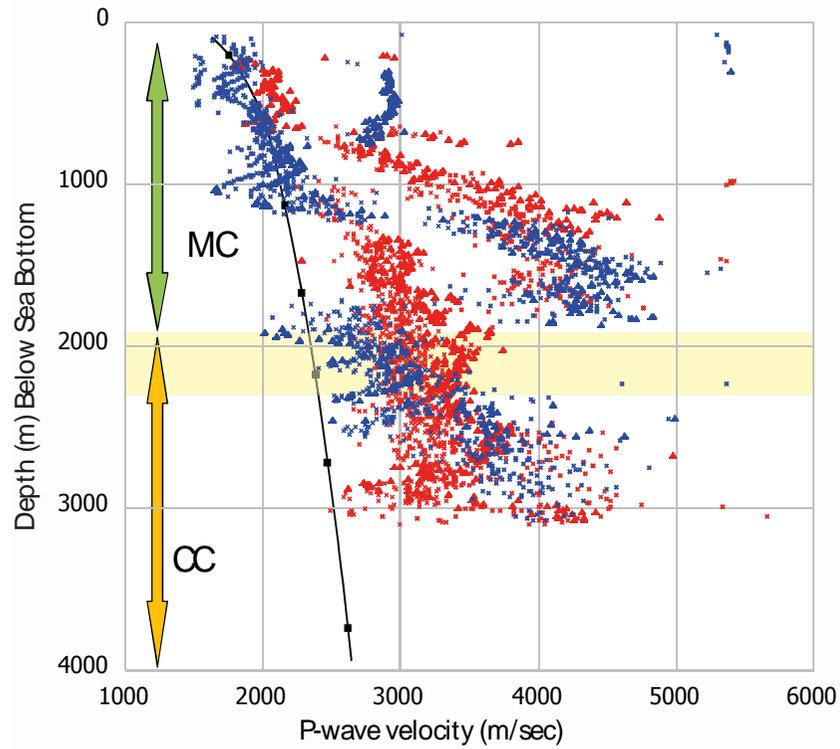
9/2-1
DEPTH (1382 M - 3701 M)

9/3-2
DEPTH (969.01 M - 3154.12 M)

9/3-1
DEPTH (751.99 M - 1973.32 M)



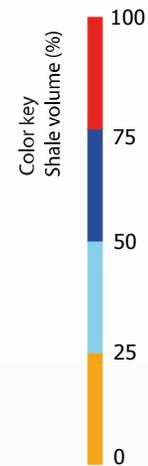
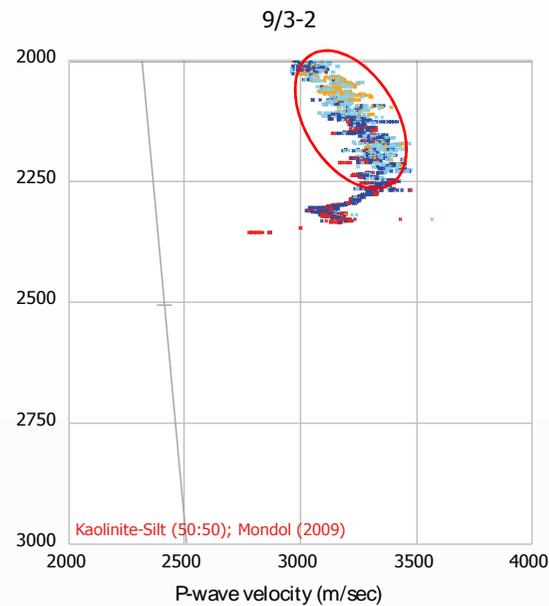
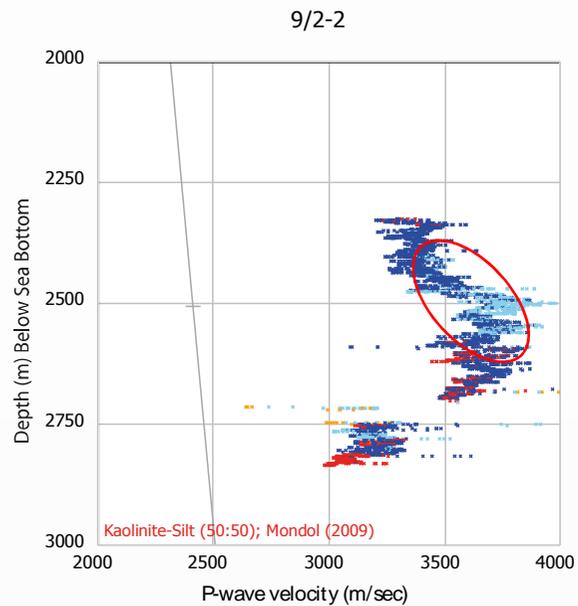
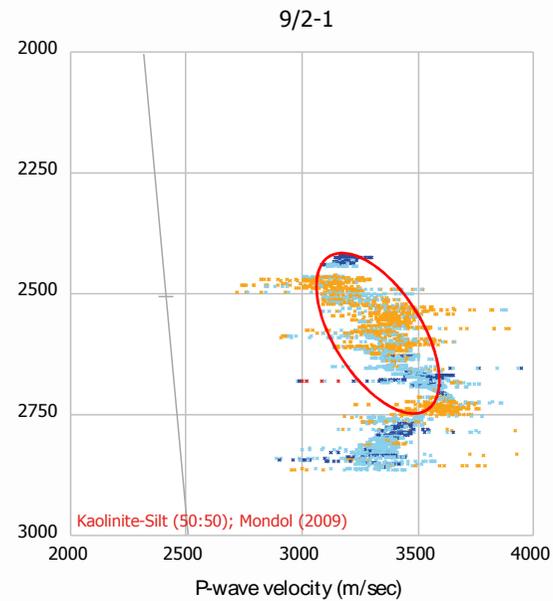
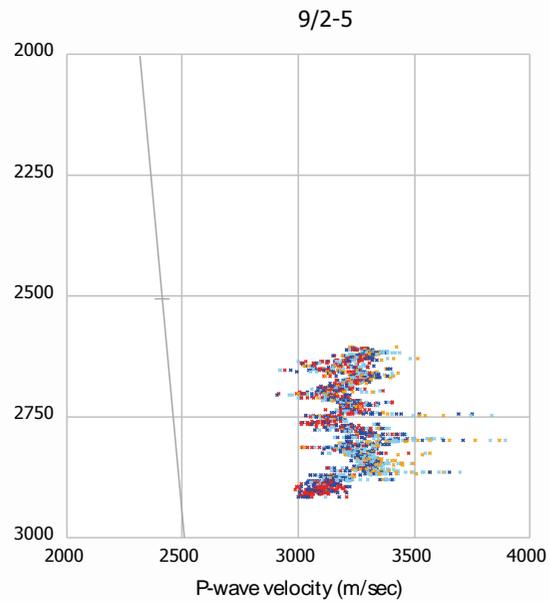
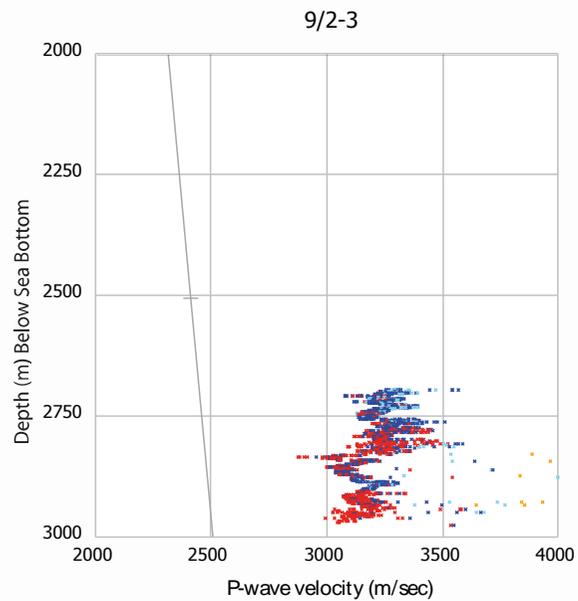
Petrophysical observation



- Well**
- Egersund Basin**
- × 9/2-1
 - ▲ 9/2-2
 - × 9/2-3
 - × 9/2-5
 - × 9/3-2
- Norwegian-Danish Basin**
- × 9/4-1
 - × 9/4-2
 - ▲ 9/4-3
 - × 9/4-4
 - × 9/4-5

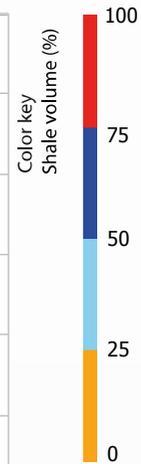
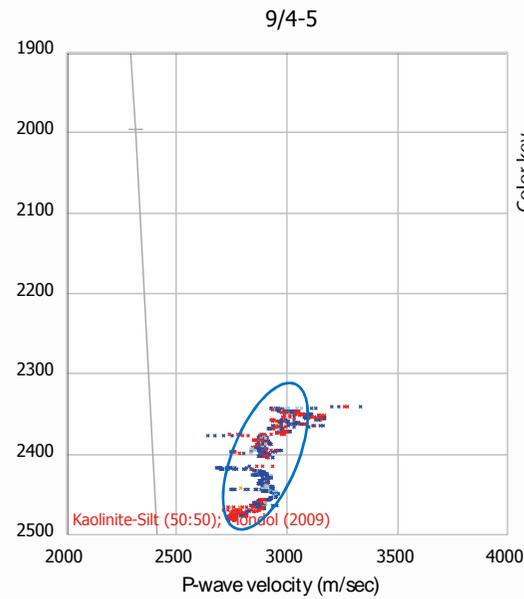
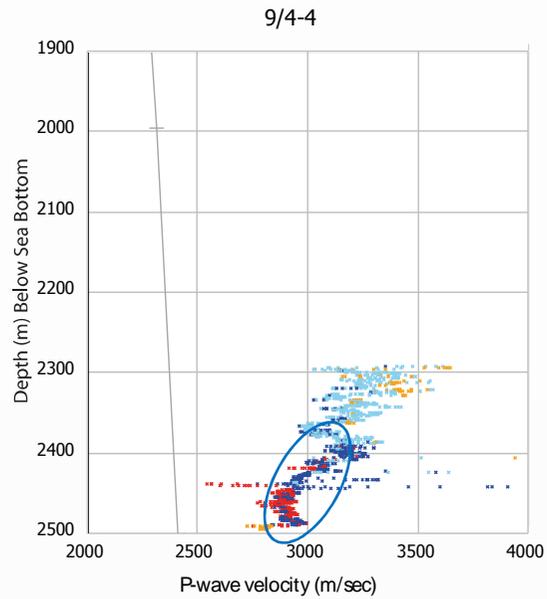
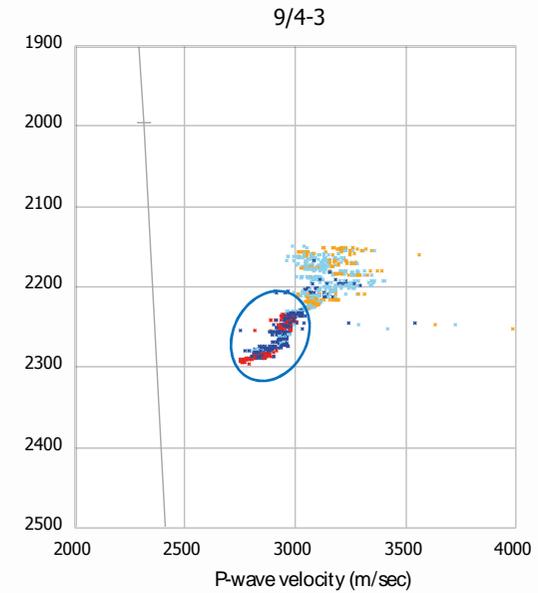
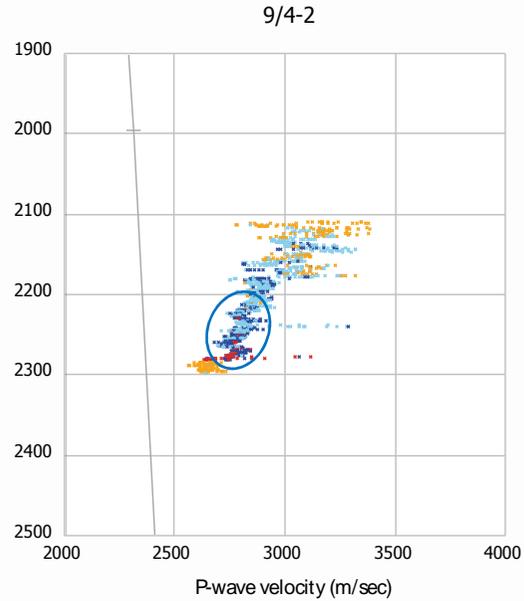
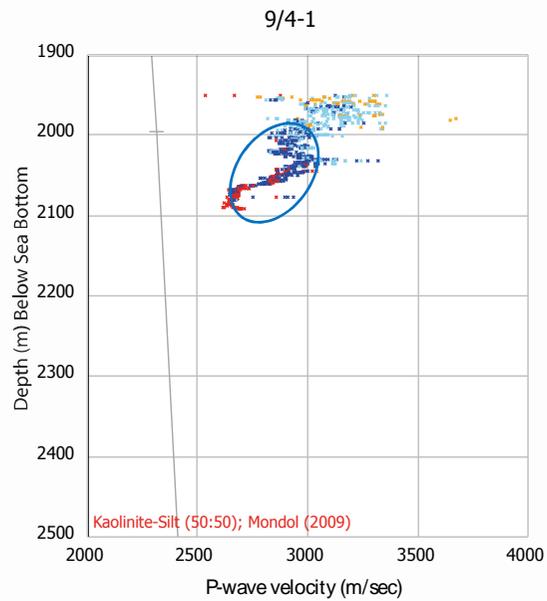
- Egersund Basin
- Norwegian-Danish Basin





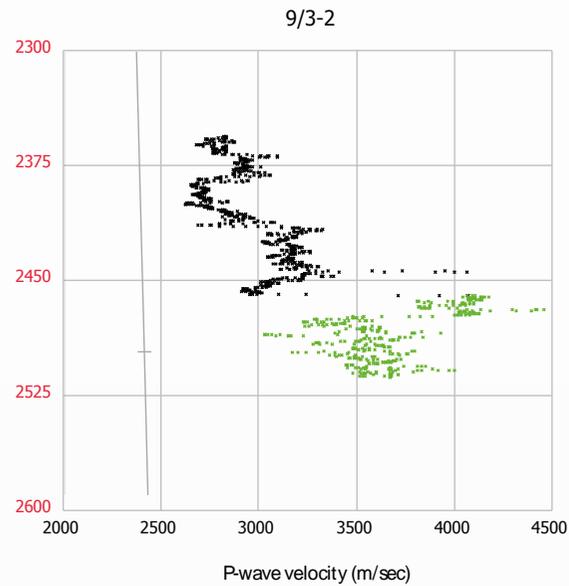
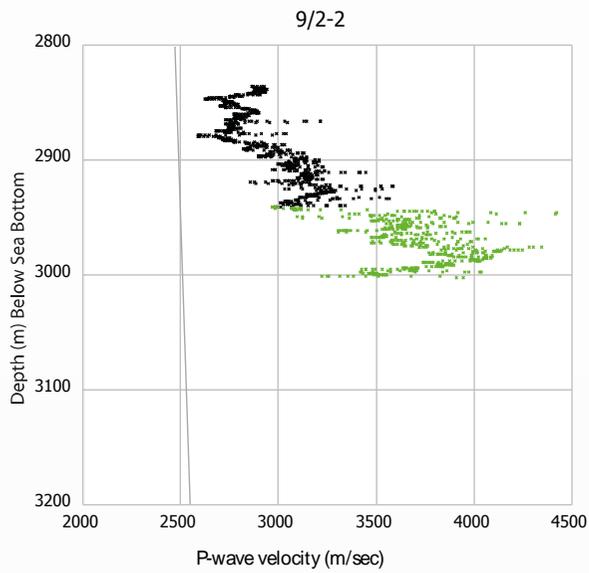
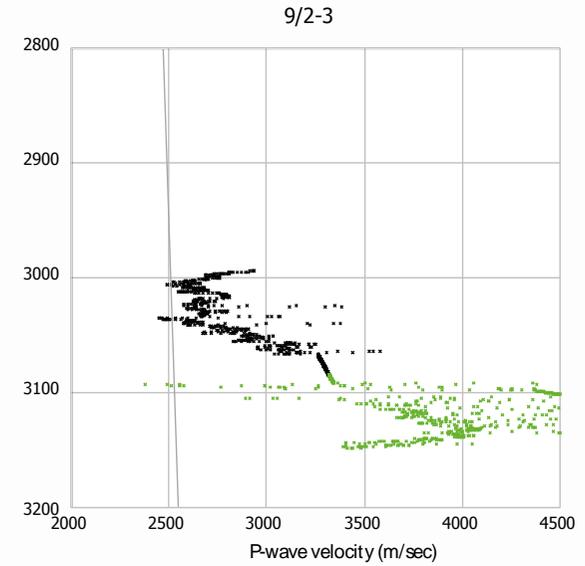
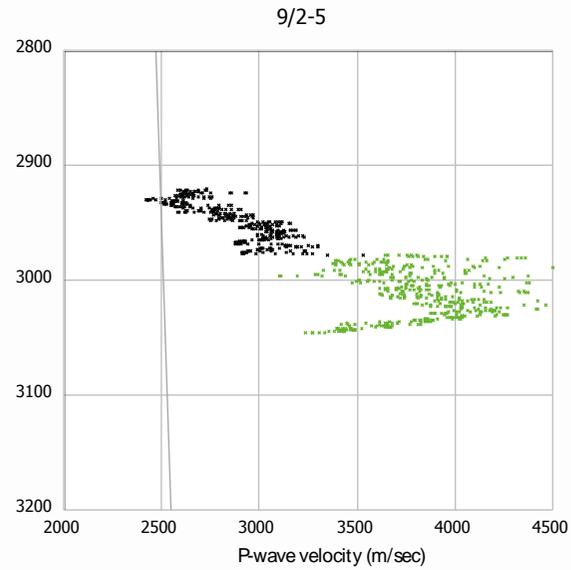
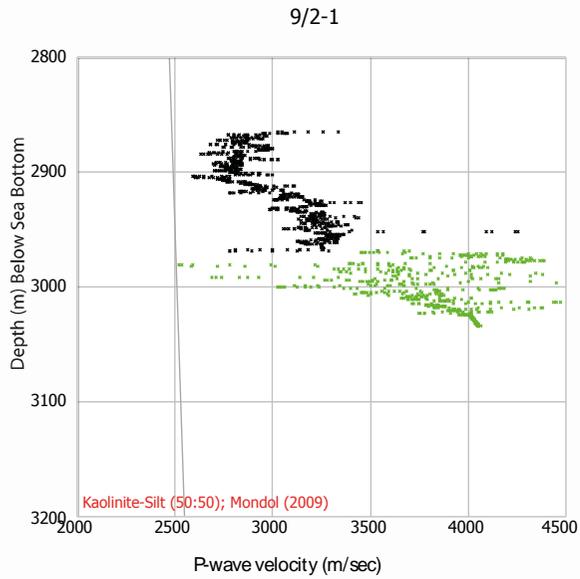
Sauda Formation
Egersund Basin





Sauda Formation
Norwegian-Danish Basin

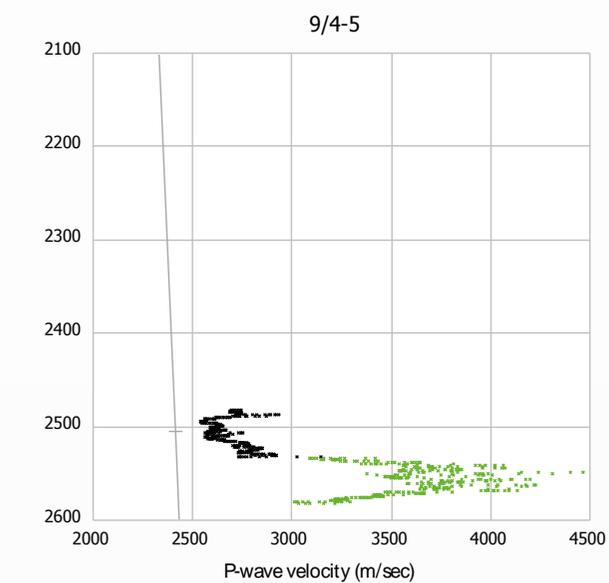
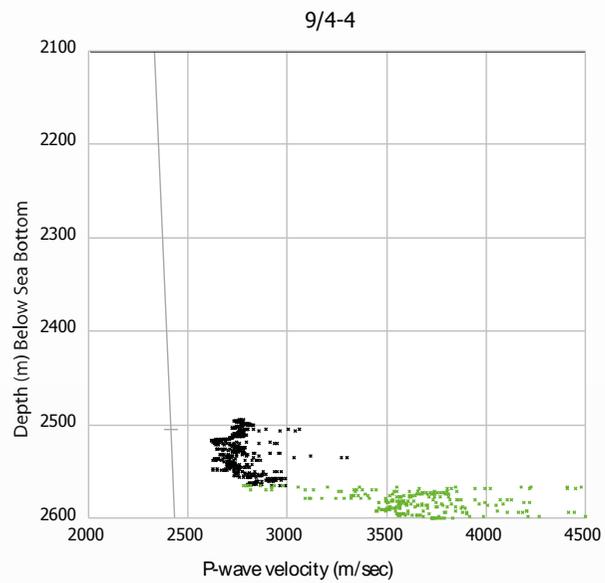
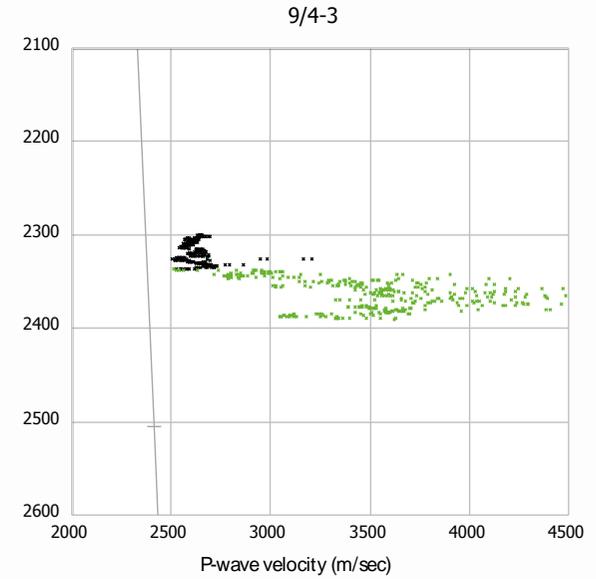
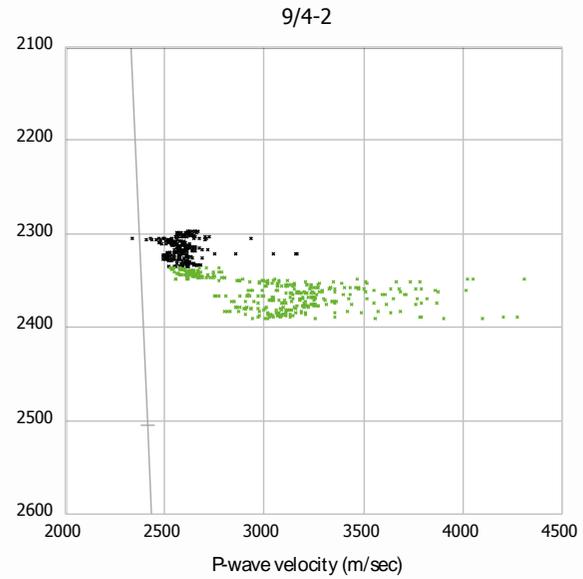
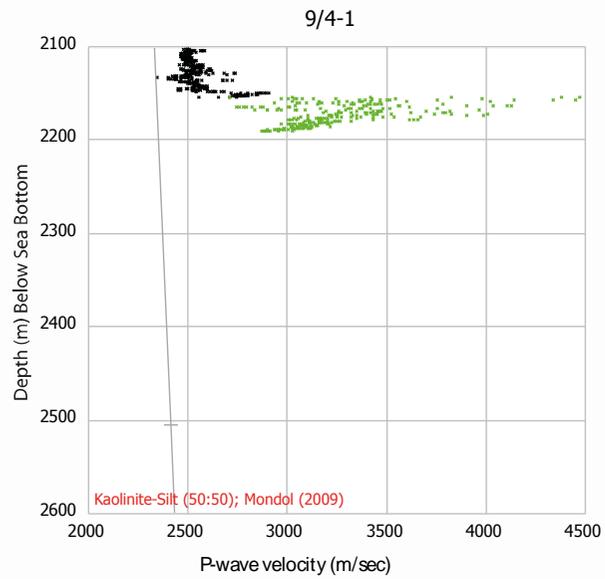




Egersund Basin

- Tau Formation
- Egersund Formation

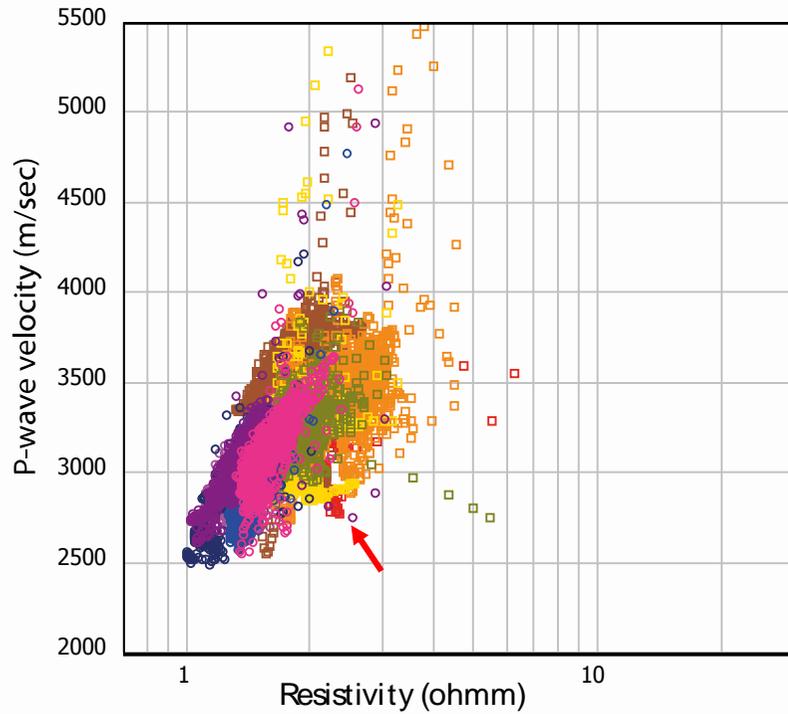




Norwegian-Danish Basin

- Tau Formation
- Egersund Formation

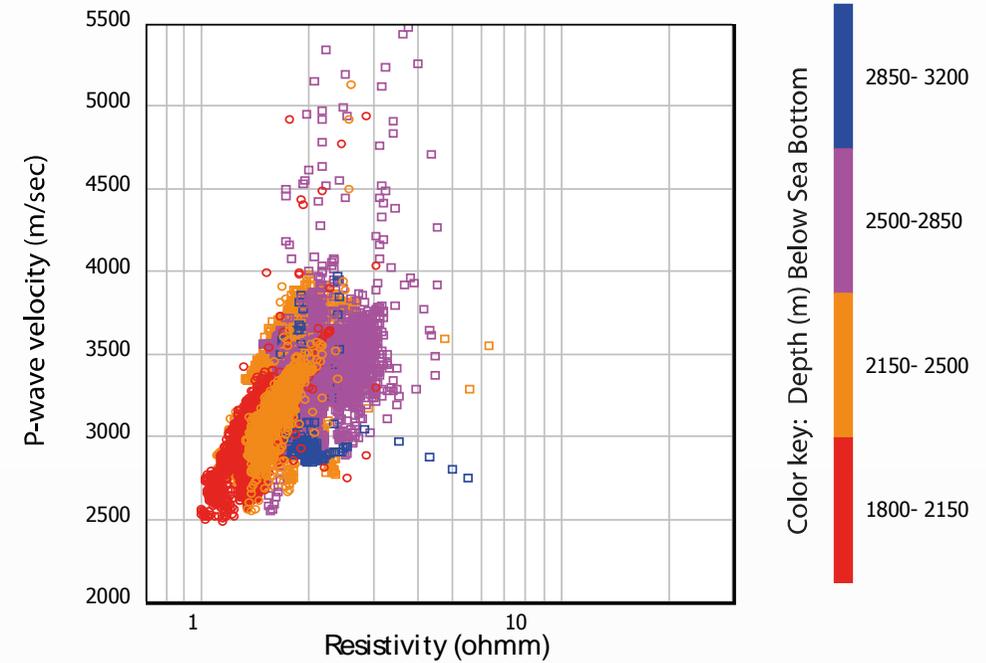




- Well**
- 9/3-2
 - 9/2-2
 - 9/2-1
 - 9/2-3
 - 9/2-5
 - 9/4-1
 - 9/4-2
 - 9/4-3
 - 9/4-4
 - 9/4-5

- Samples from the Egersund Basin
- Samples from the Norwegian-Danish Bas

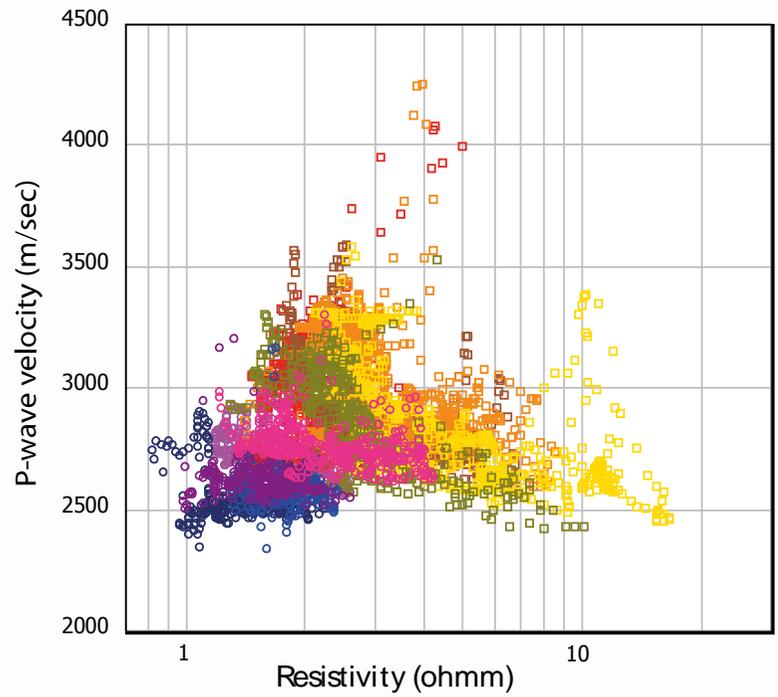
Sauda Formation



Color key: Depth (m) Below Sea Bottom

- 2850- 3200
- 2500-2850
- 2150- 2500
- 1800- 2150

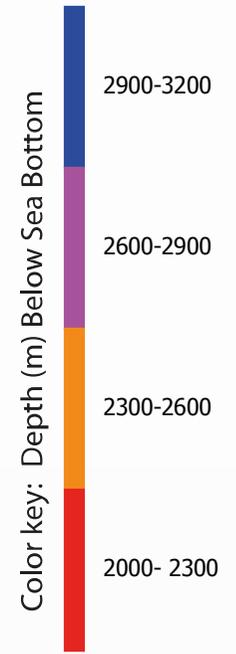
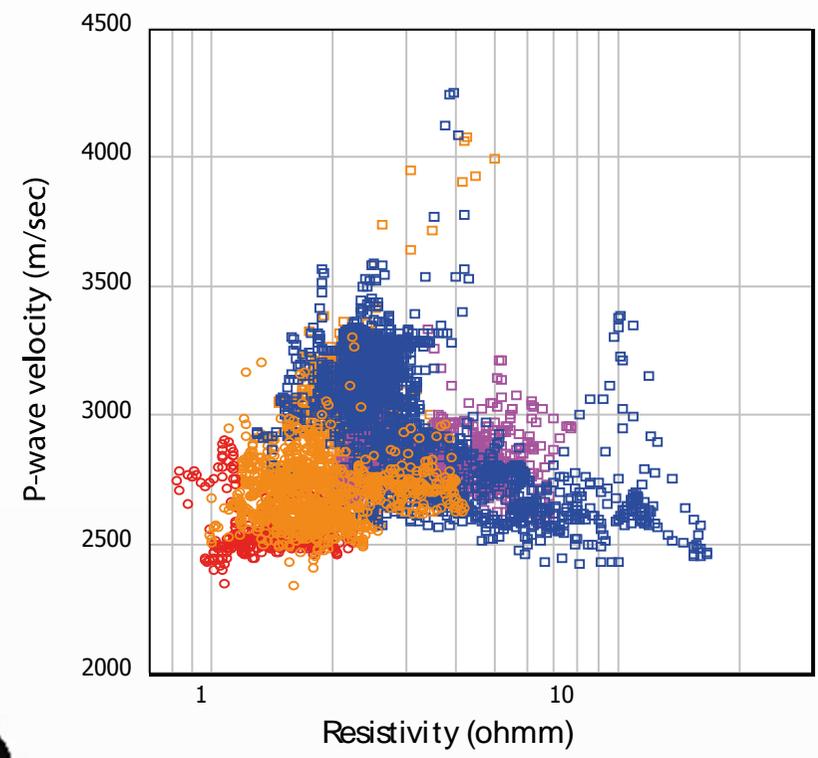


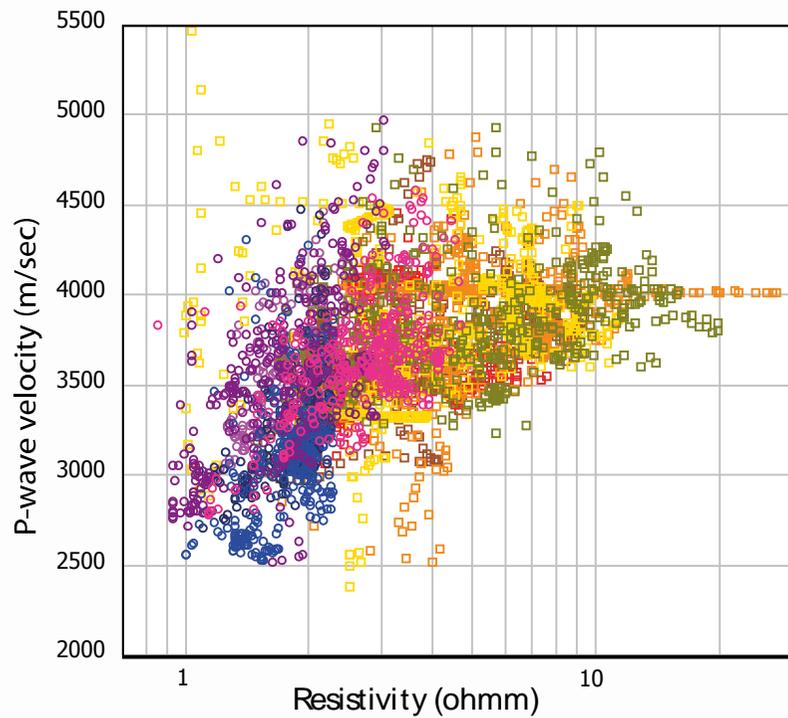


- Well**
- 9/3-2
 - 9/2-2
 - 9/2-1
 - 9/2-3
 - 9/2-5
 - 9/4-1
 - 9/4-2
 - 9/4-3
 - 9/4-4
 - 9/4-5

- Samples from the Egersund Basin
- Samples from the Norwegian-Danish Bas

Tau Formation

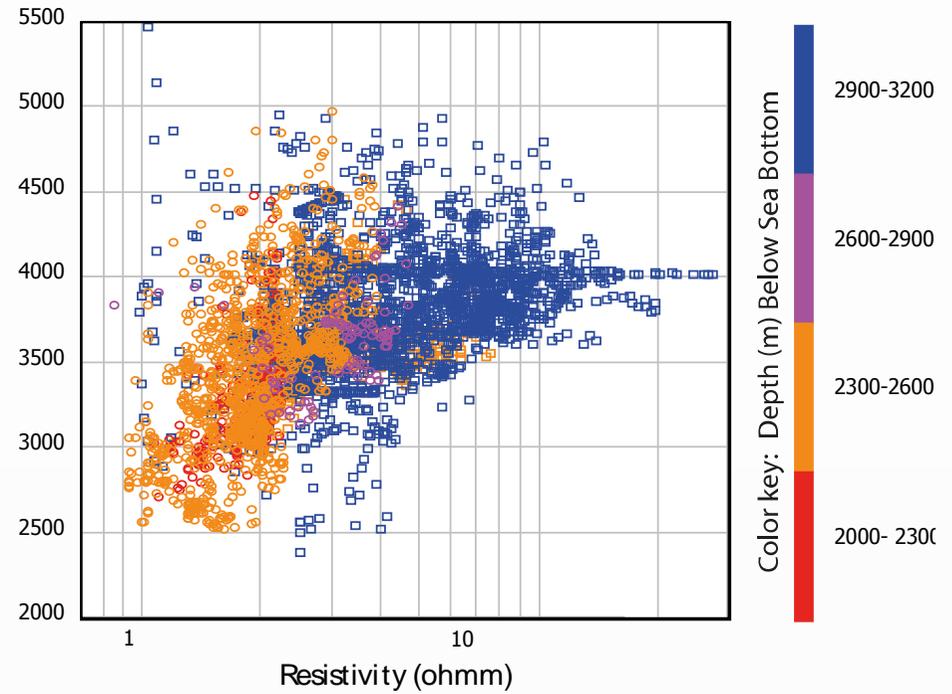


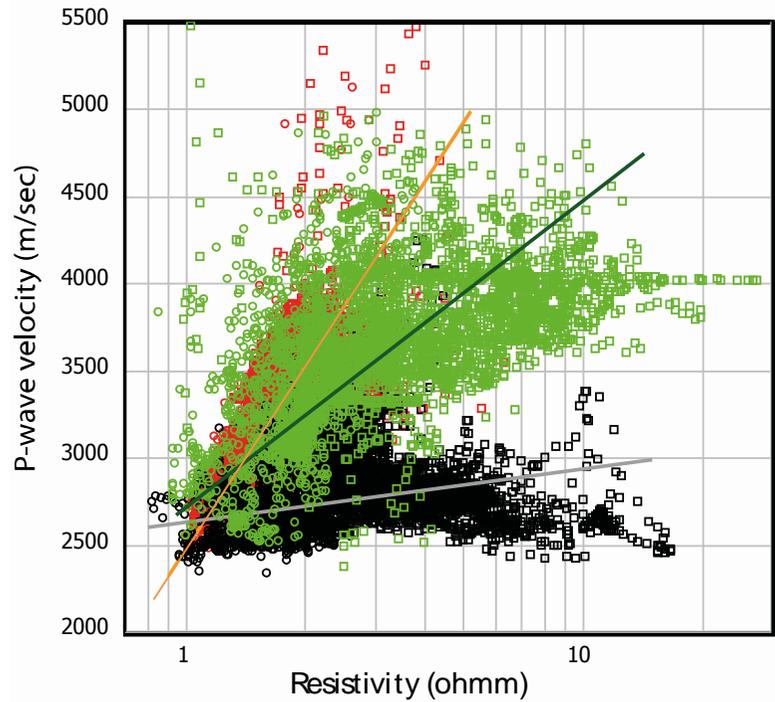


Egersund Formation

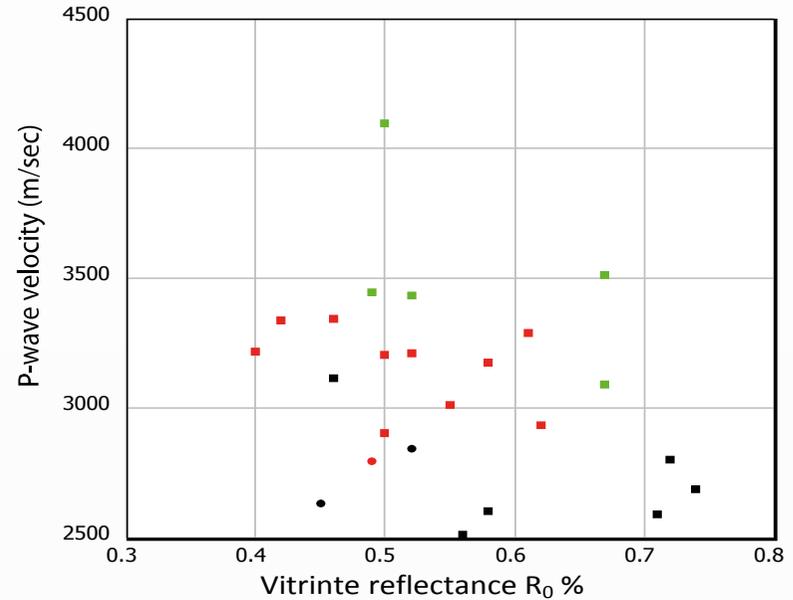
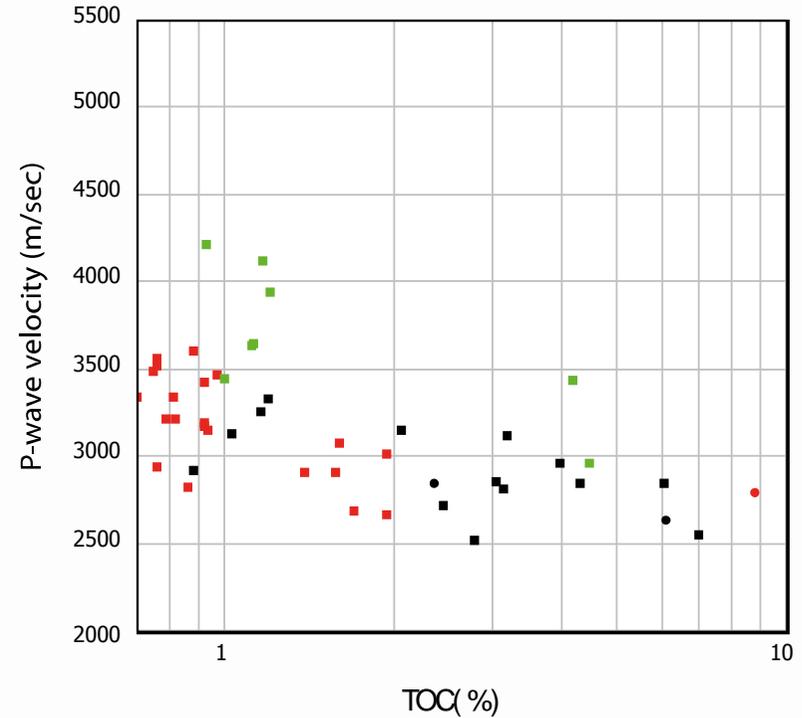
- Well
- 9/3-2
 - 9/2-2
 - 9/2-1
 - 9/2-3
 - 9/2-5
 - 9/4-1
 - 9/4-2
 - 9/4-3
 - 9/4-4
 - 9/4-5

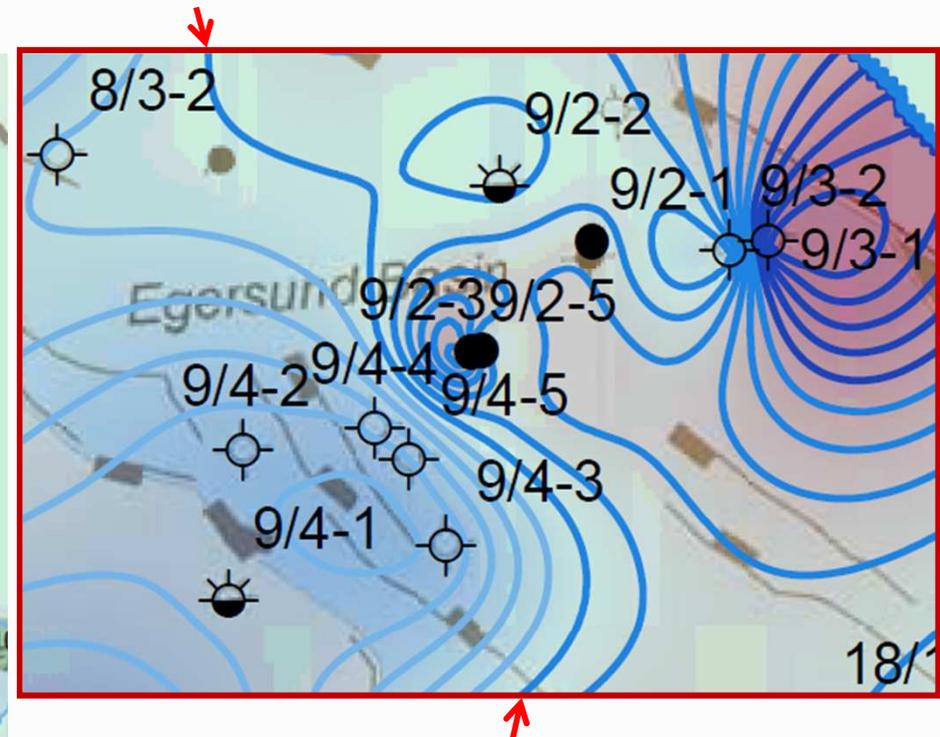
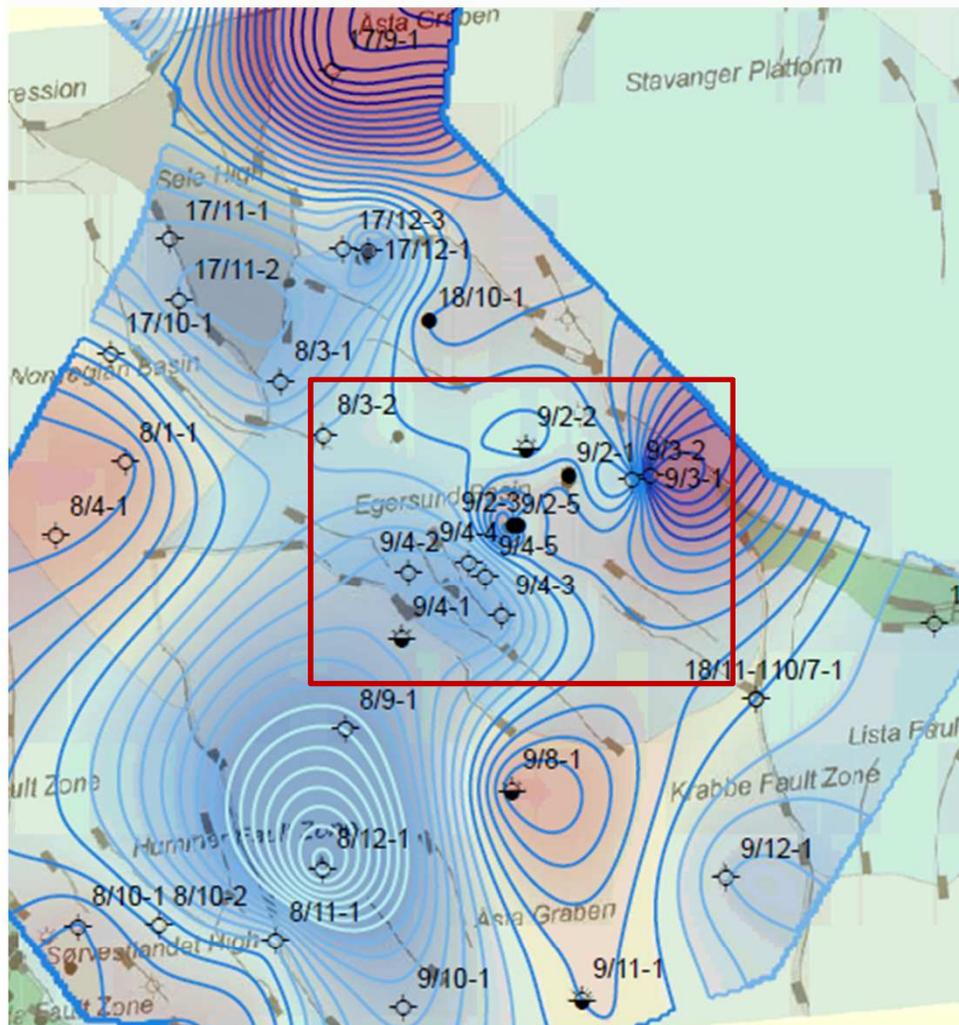
- Samples from the Egersund Basin
- Samples from the Norwegian-Danish Bas



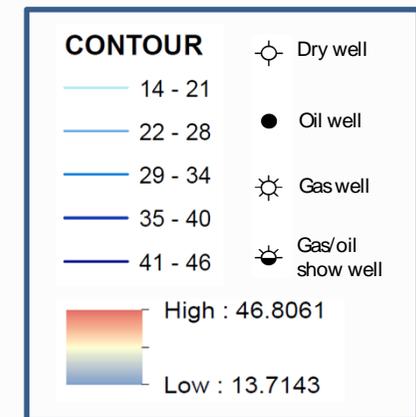


- Sauda Formation
- Tau Formation
- Egersund Formation
- Samples from the Egersund Basin
- Samples from the Norwegian-Danish Basin





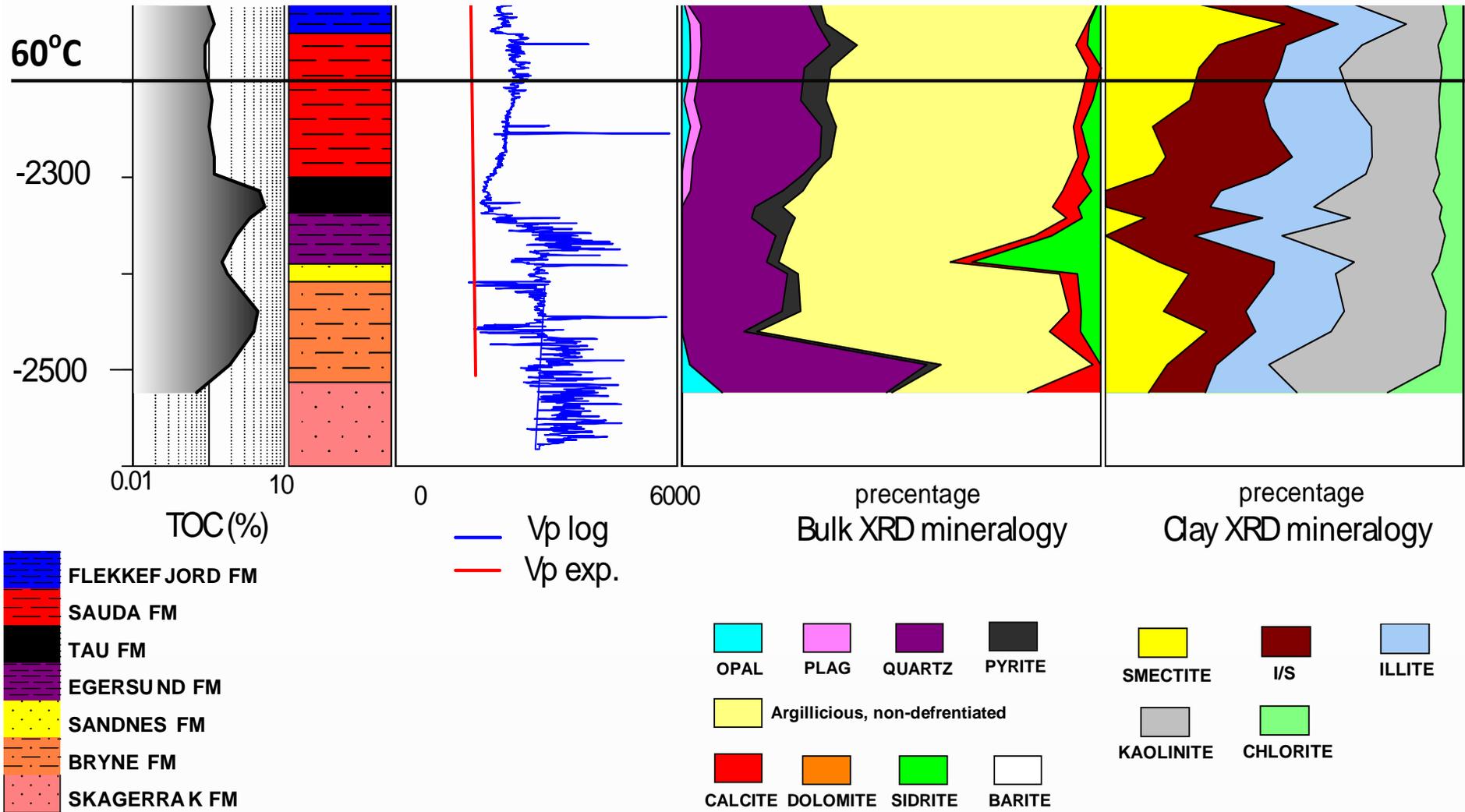
Differences in geothermal gradients/uplift between wells



Bottom hole temperature-based geothermal distribution map (data adapted from <http://factpages.npd.no/factpage>)



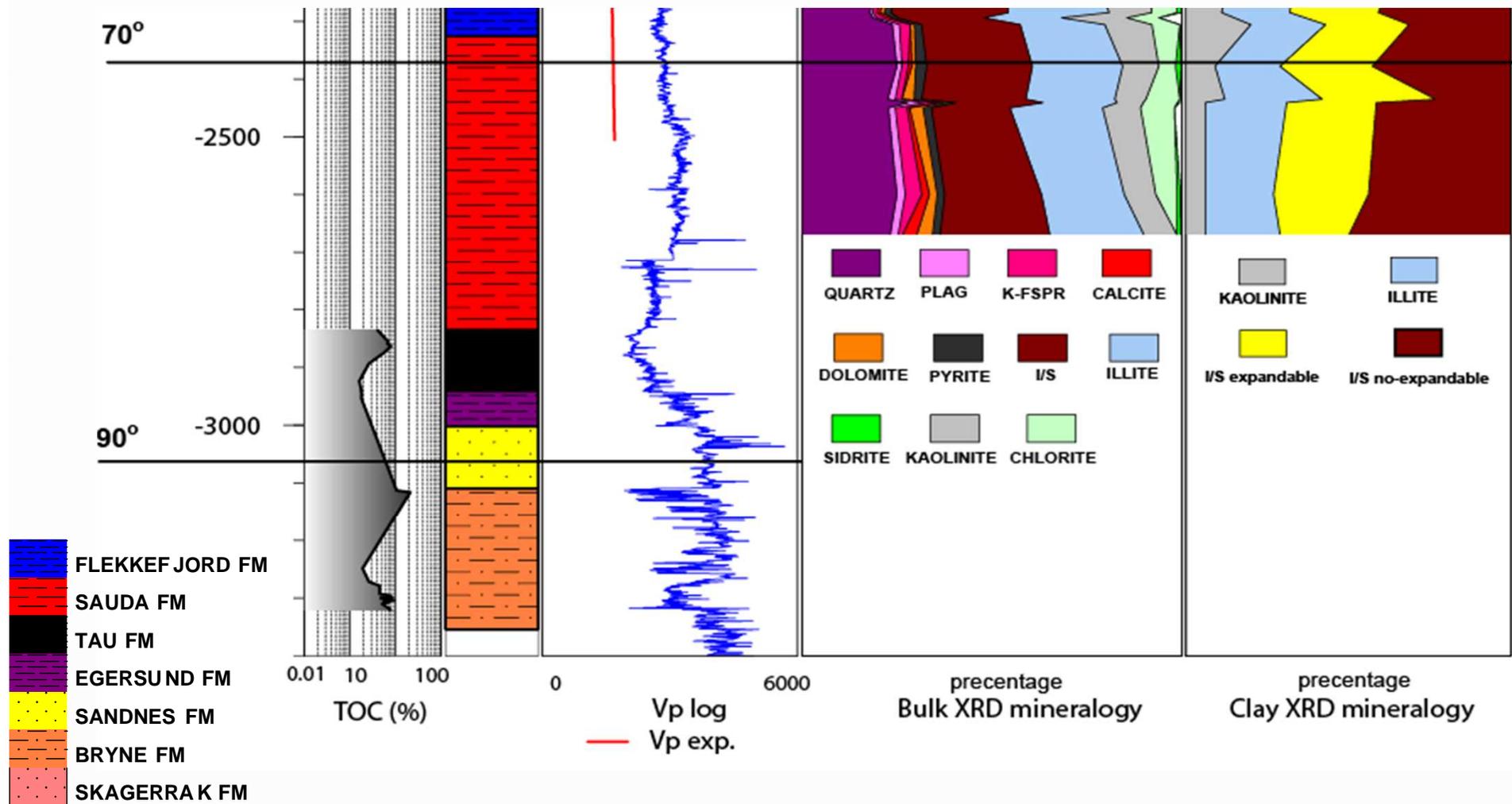
Mineralogy, well 9/4-3



<http://factpages.npd.no/factpage>



Mineralogy, well 9/2-2

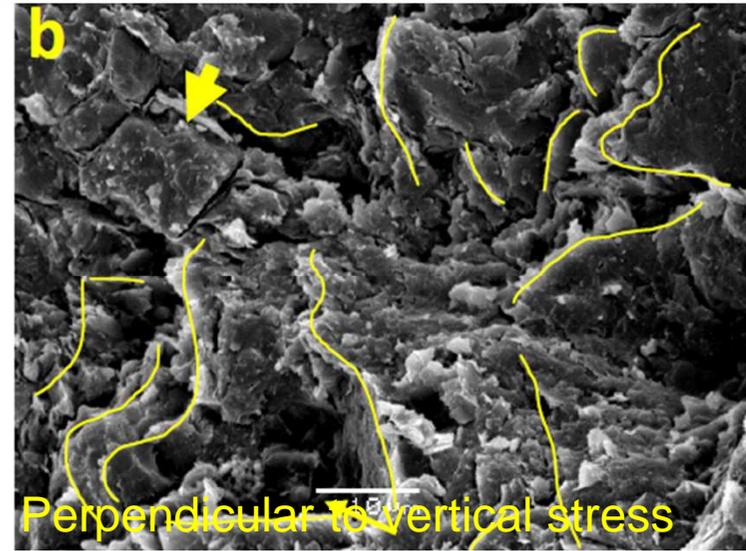
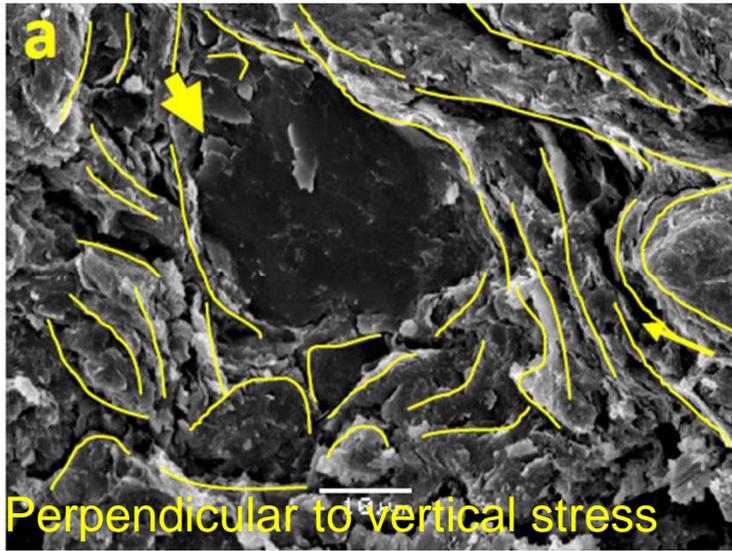


XRD mineralogy data after Nadeau et al. (2002)

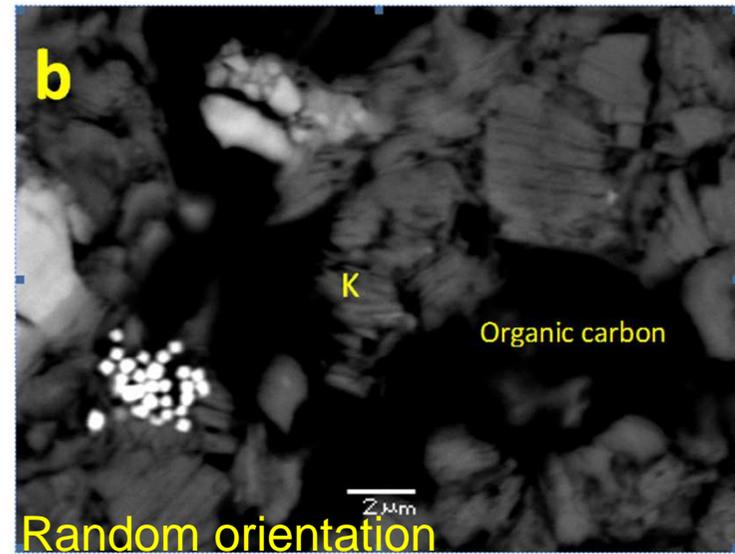
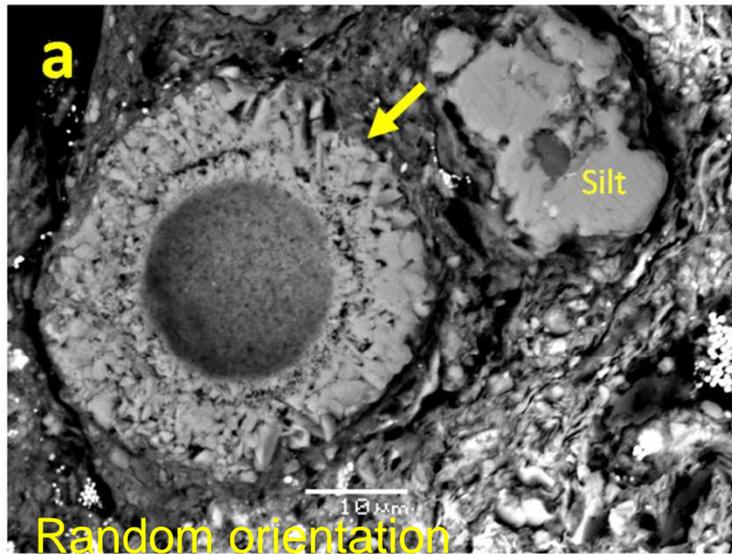


SEM Microscopy

Sauda Formation



Tau Formation



Conclusions

- P-wave velocity (V_p) changes with depth suggest major differences to the published velocities of experimental mechanical compaction, which can be interpreted as the onset of the mechanical to chemical compaction transition.
- The transition is found at different levels in different wells. This indicates differences in geothermal gradients and/or uplift between wells. This coincides with bottom-hole temperature based geothermal changes across the study area.



Conclusions

- Reverse Vp trend in the Tau and the lower part of the Egersund formations is coincident with an increase in the TOC content and vitrinite reflectance. This may suggest that the kerogen and/or residual oil content can play a role in the Vp reverse trend.



Acknowledgments

The work is carried out as part of the **CO2Seal** project
– funded by CLIMIT and Statoil

The logo for CLIMIT, featuring the word "CLIMIT" in a bold, blue, sans-serif font.