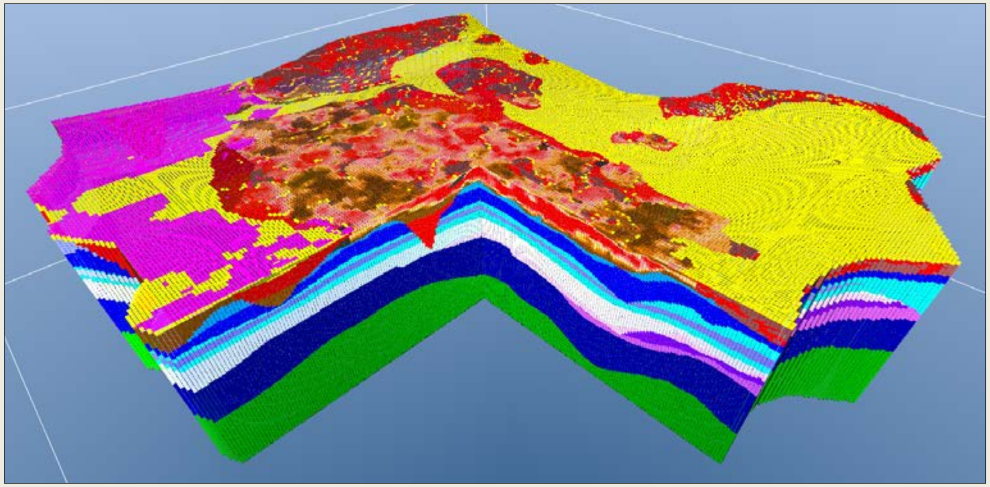
GEUS



Examples of hydrogeological and geological modelling from geophysical data

Flemming Jørgensen

Geological Survey of Denmark and Greenland

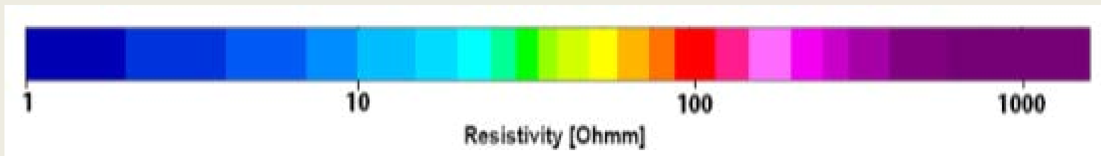
Translating resistivity to geology or hydrogeology – limitations:

- The degree of saturation
- The ion content of the pore water
- Clay content
- Clay type

- Vertical resolution capability
- Horizontal resolution capability
- Weak resolution of resistive layers
- Spatial variations in property

- Depth of penetration, DOI
- Coupled and noise-infected soundings
- Model equivalency, model uncertainty
- The type of model used – blocky or smooth model

Data interpretation

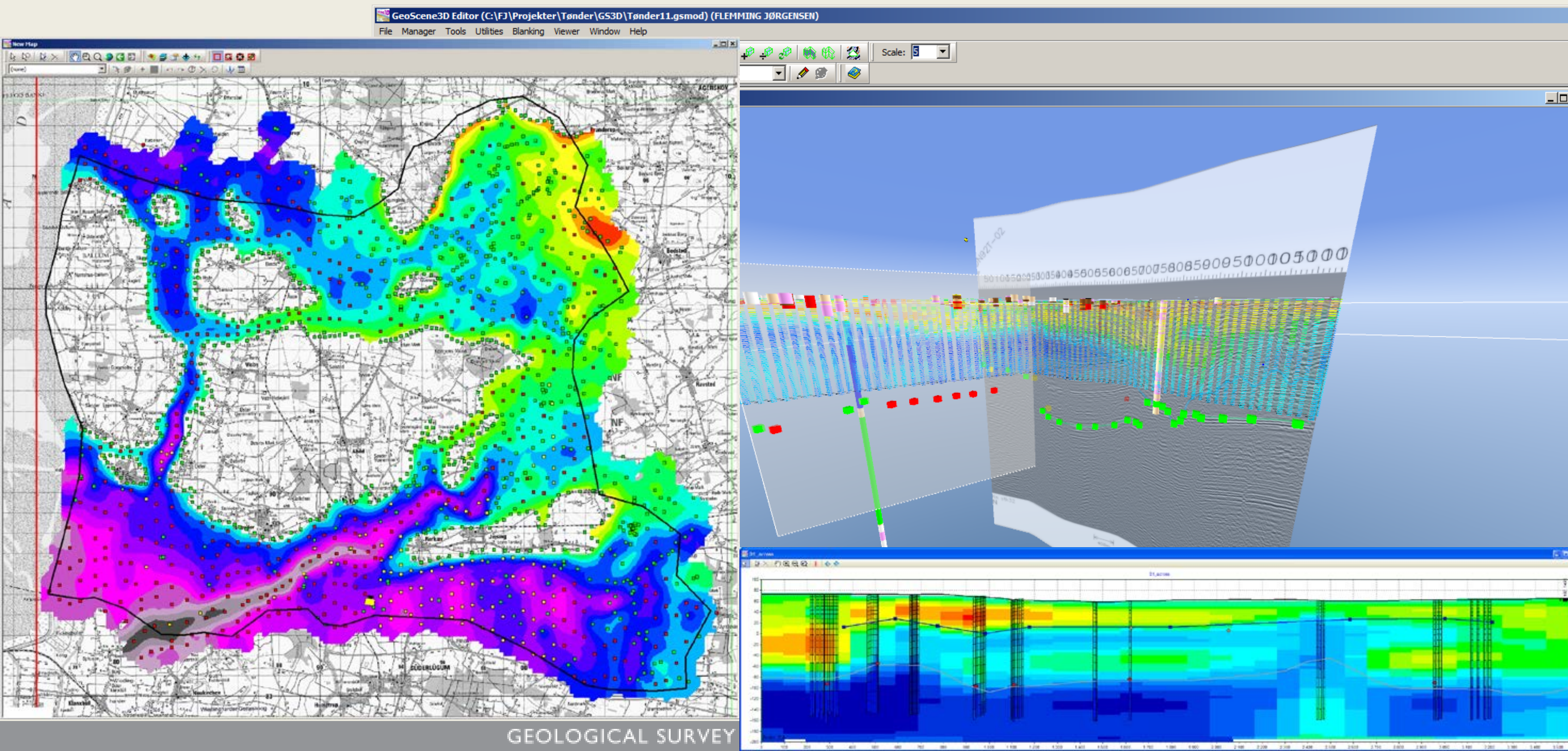


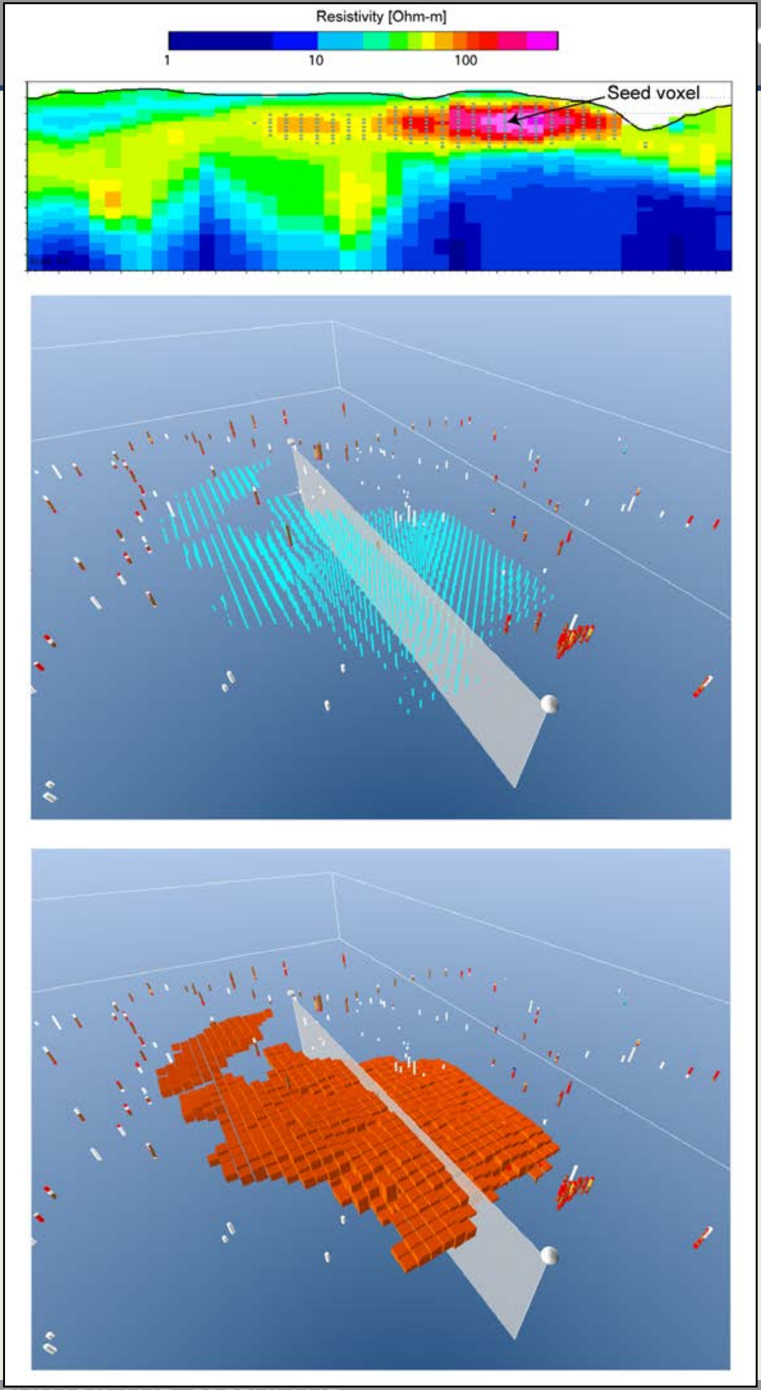
Some Danish sediments:

Sediments	Resistivity (Ω m)
Meltwater sand and gravel	>60
Clay till	25–50
Glacio-lacustrine clay	10–40
Neogene mica silt/sand: Miocene	>40
Neogene mica clay: Miocene	10–40
Paleogene clay: Eocene–Oligocene	5–12
Paleogene clay: Paleocene–Eocene	1–7
Danian limestone	>80

Layer-based modelling

Basic digitalisation of interpretation points on maps, profiles and directly in 3D space



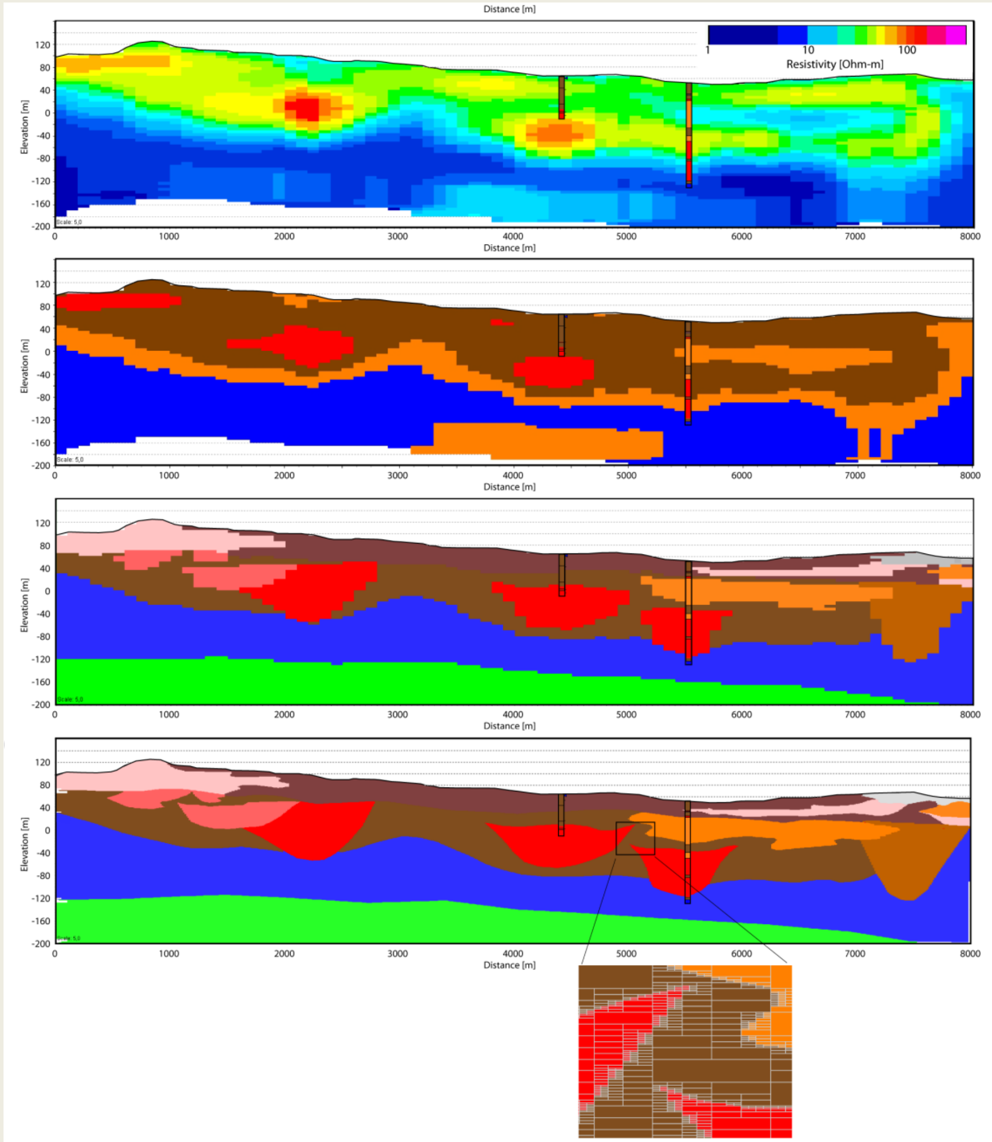


Voxel modelling tools

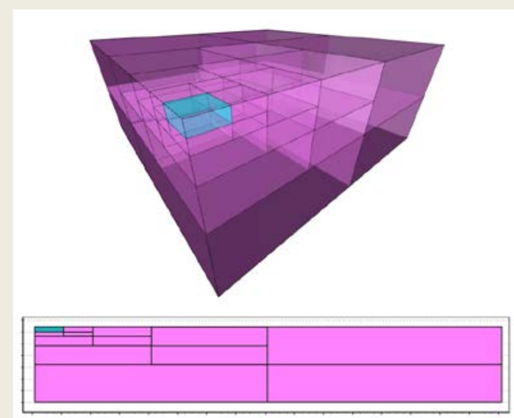
- Region grow selection

Jørgensen, F., Møller, R.R., Nebel, L., Jensen, N.-P., Christiansen A.V. and Sandersen, P.B.E 2013: A method for cognitive 3D geological voxel modelling of AEM data. Bulletin of Engineering Geology and the Environment.

Cognitive, manual voxel modelling, octree discretization



- Voxels can be divided into 8 equally-sized in order to increase the level of detail



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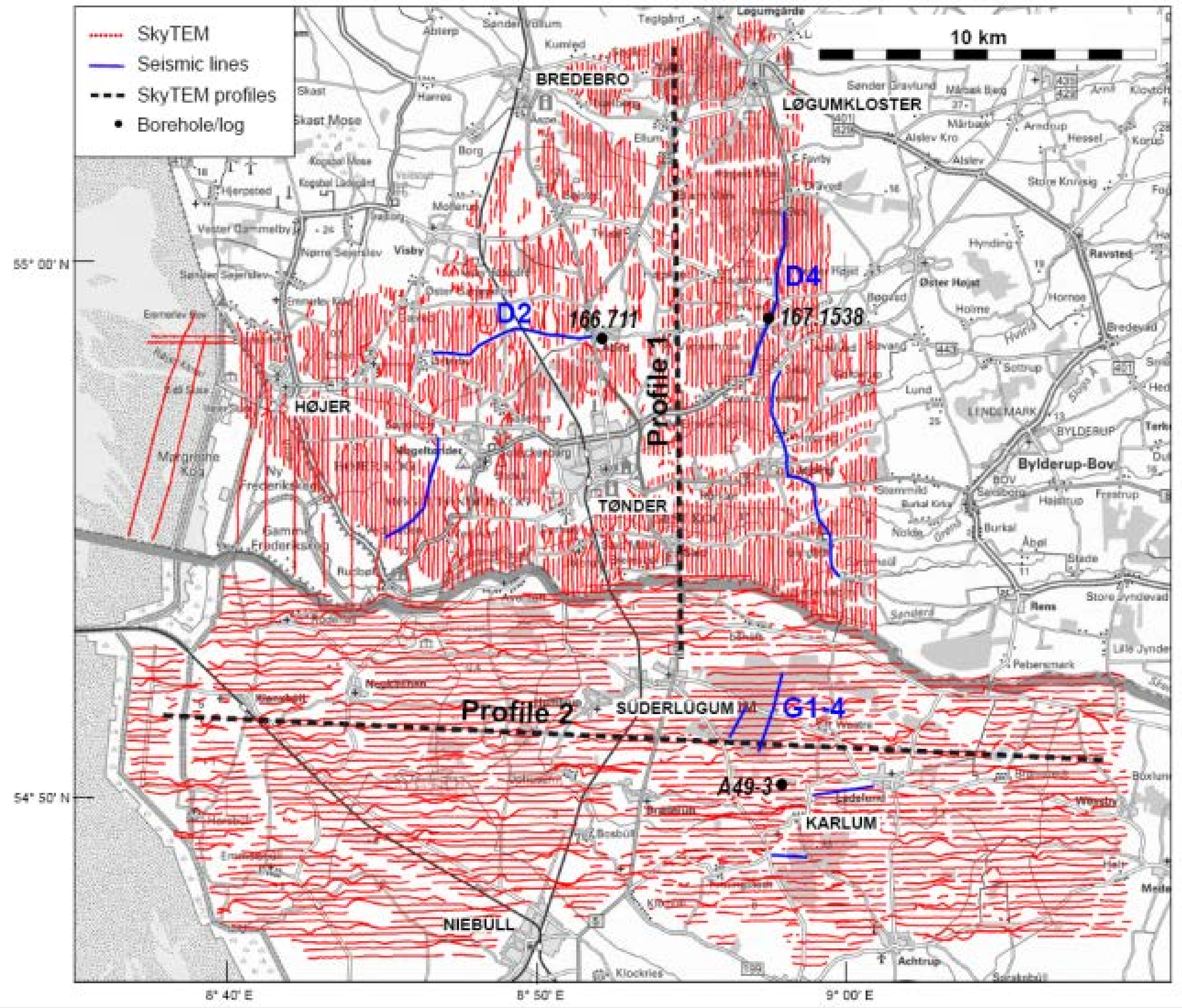
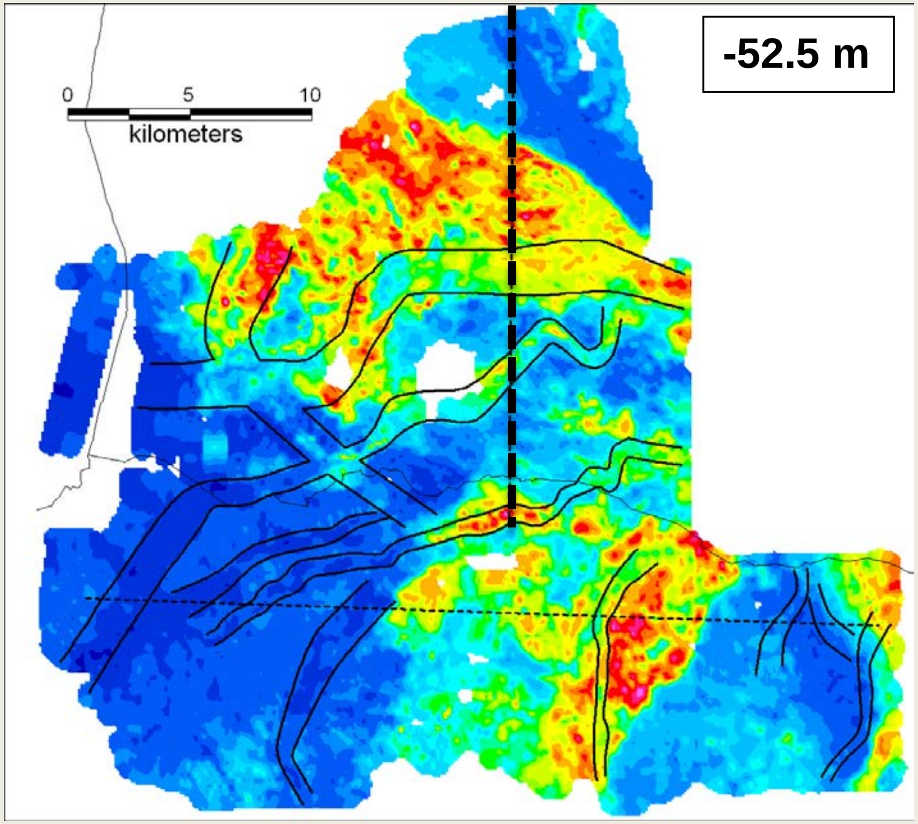
The Tønder-Leck survey

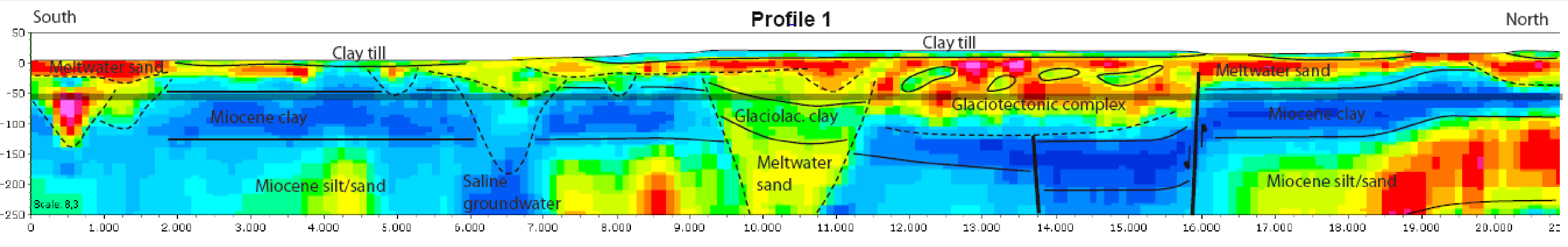
- 3230 line km
- 166 and 250 m spacing
- 721 km^2



Jørgensen, F. et al. 2012: Transboundary geo-physical mapping of geological elements and salinity distribution critical for the assessment of future sea water intrusion in response to sea level rise. Hydrology and Earth System Sciences, 1845-1862.

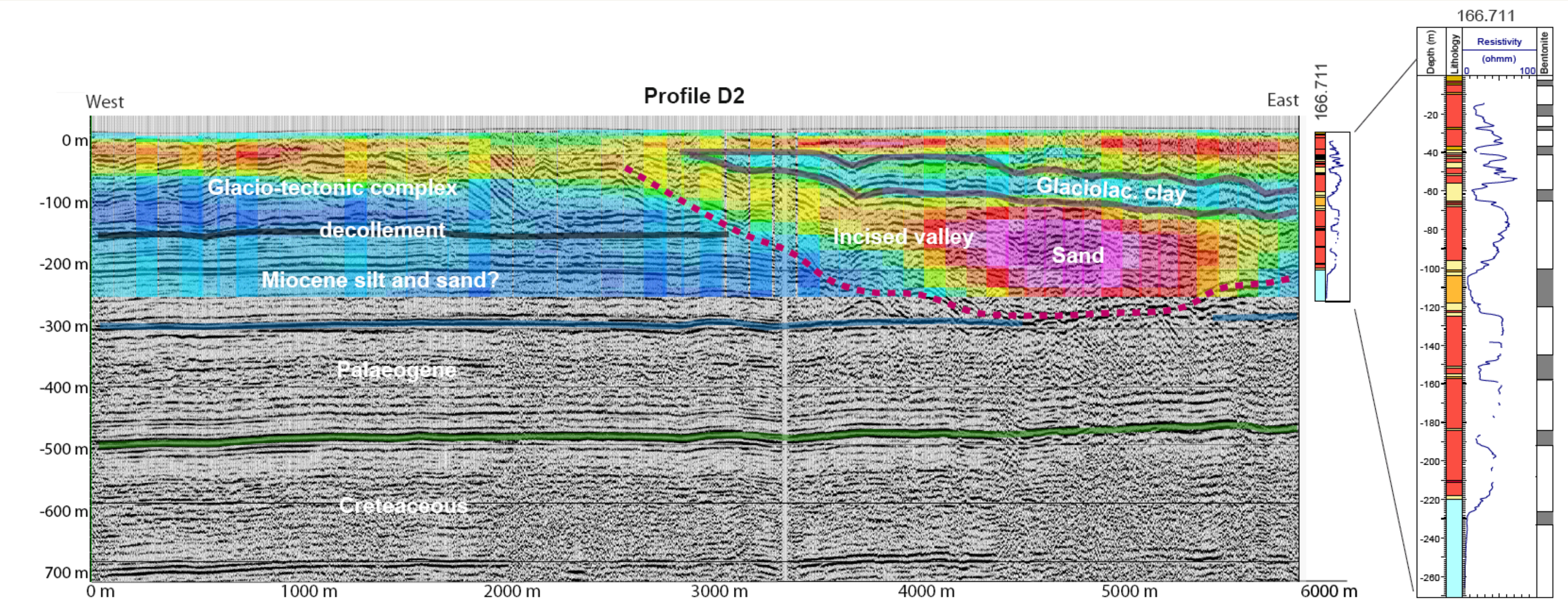
Geological interpretations

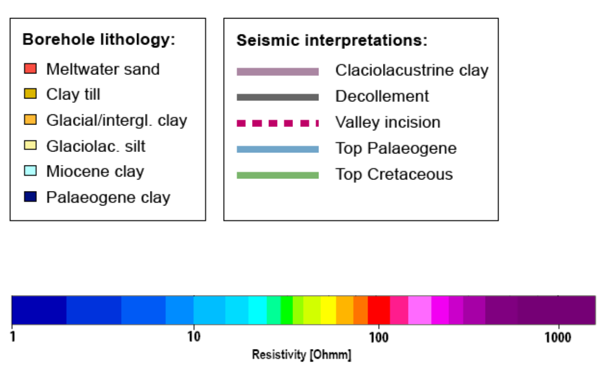




Jørgensen et al. 2012

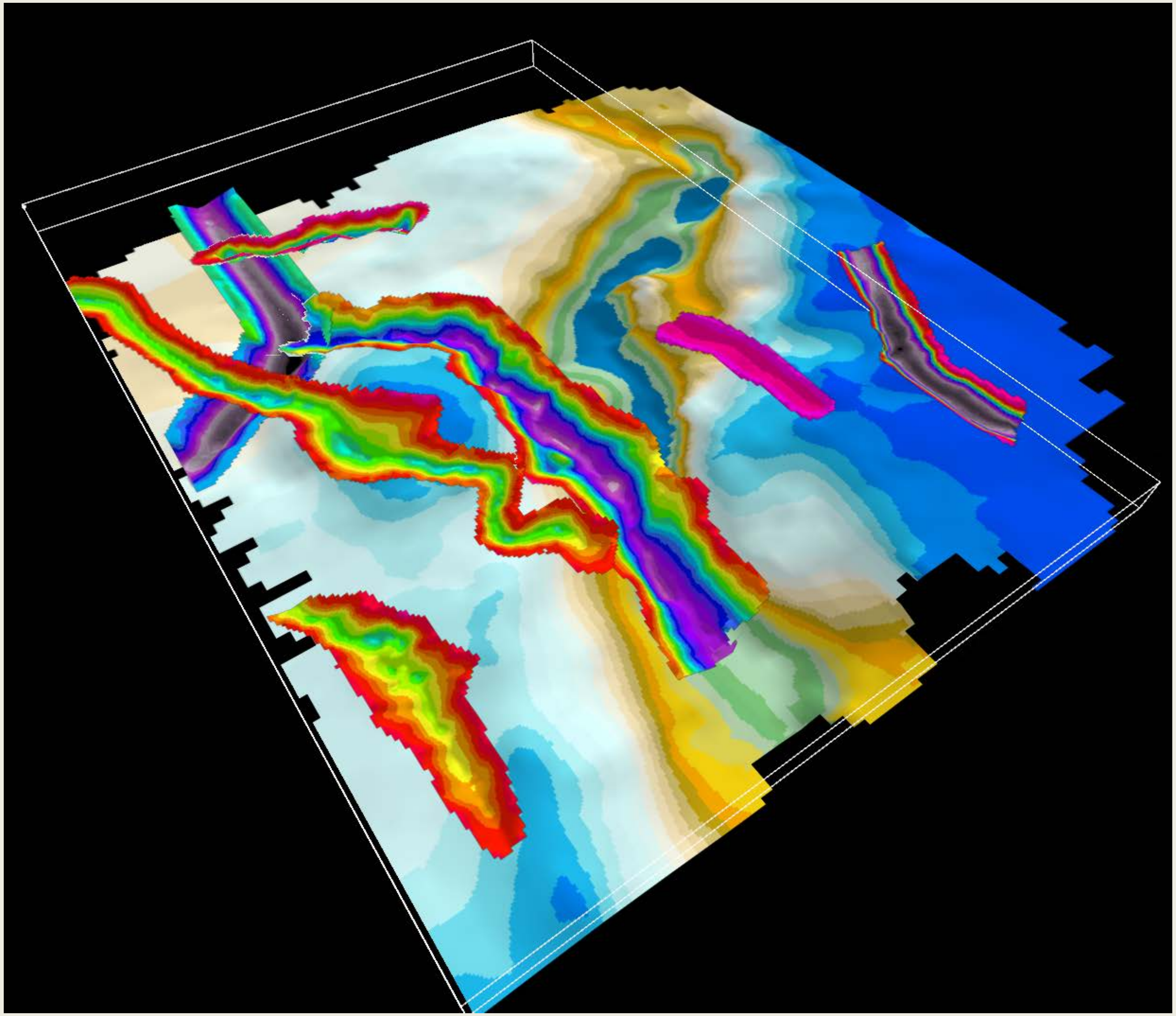
Geological interpretations



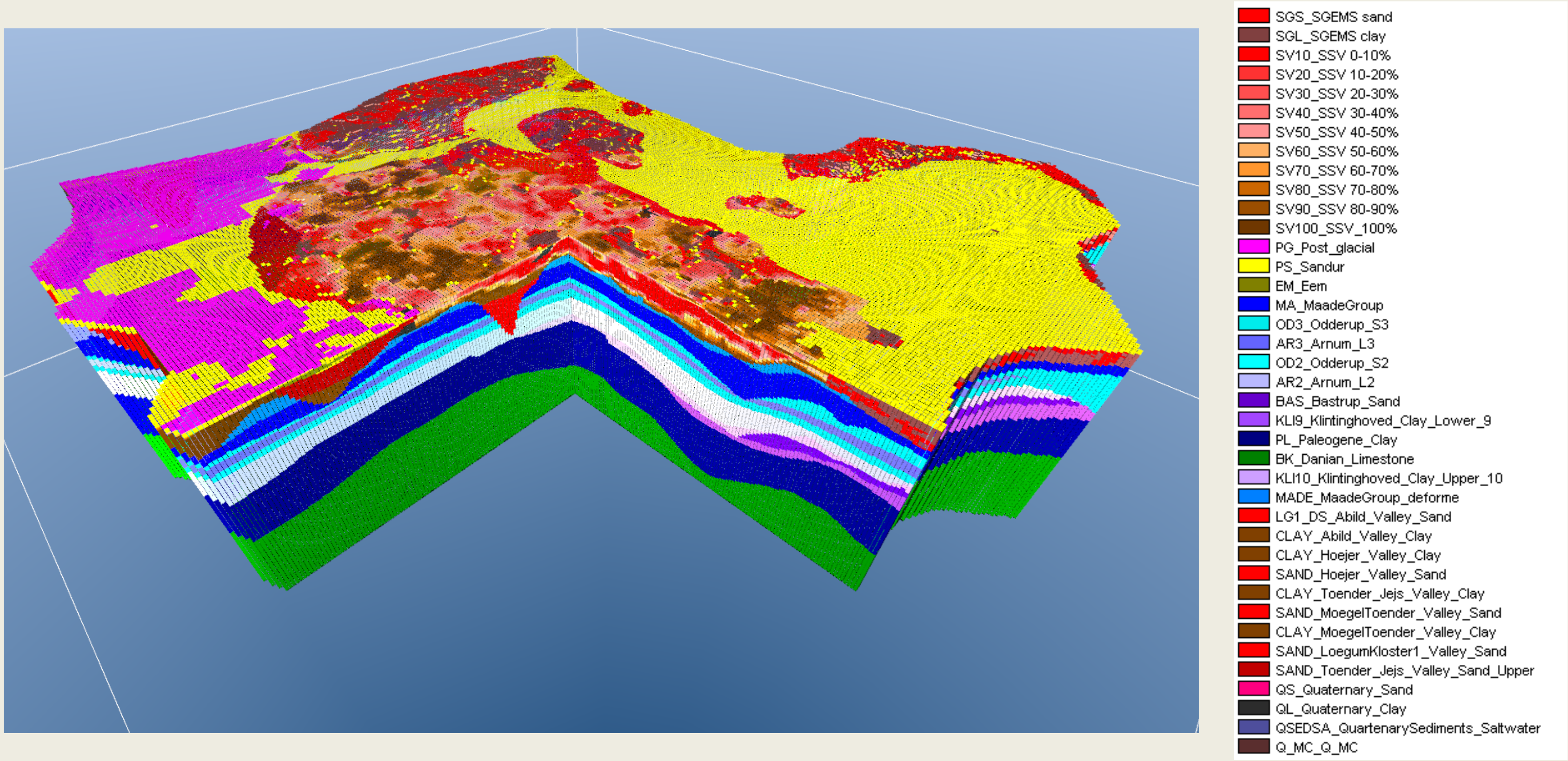


Jørgensen, F. et al. 2012: Transboundary geophysical mapping of geological elements and salinity distribution critical for the assessment of future sea water intrusion in response to sea level rise. Hydrology and Earth System Sciences, 1845-1862.

Buried valleys



Final voxel model



Voxel model, valley surface