

«Bruk av nye metoder for å få bedre forståelse av grunnforhold. Oppbygging av en geologisk modell for Orkladeltaet ved bruk av lettseismikk og programvare utviklet for oljeleting i sjøbunnen»

Dr E.I.H. Siggerud

Digital Geologi AS



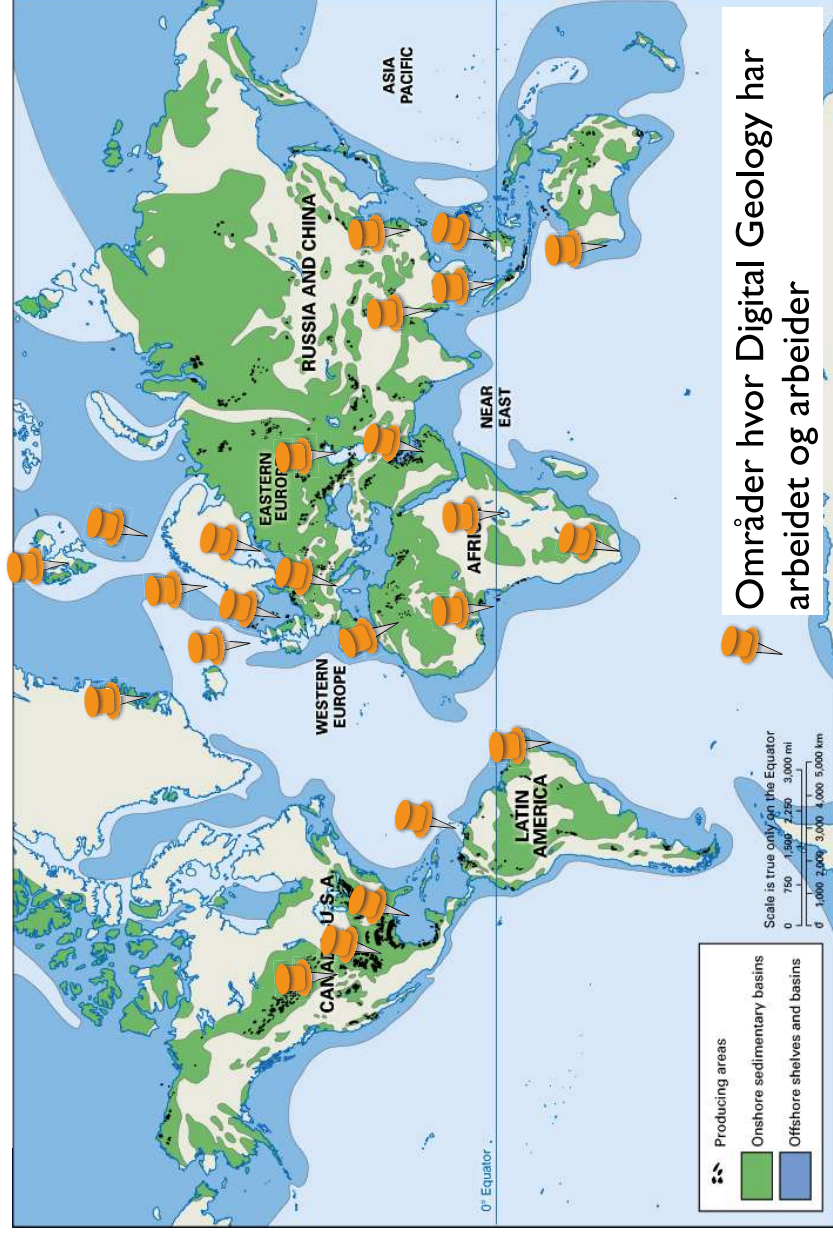
Topics of presentation

- Digital Geologi AS
- Methods and tools
- The Orkdal Delta 4D geomodel - preliminary
- Integrating shallow marine seismic and GPR data (land)
- Properties modeling integration with physical measurements
- Going forward



Digital Geologi AS

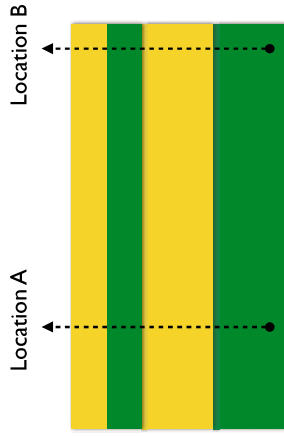
- 1) Digital Geology AS was founded in summer of 2014 by three professionals from the HC industry with more than 80 years combined experience from working across the world
- 2) The company is the first to bring the detailed knowledge of 4D geomodelling to bear onshore Norway
- 3) Digital Geologi AS have offices in Trondheim and Oslo, and are currently engaged in several similar projects for clients across Norway



'the silent revolution ...'



'where were you in 1973..'



Geology until the late 1970 based on lithological correlations and static models confined to area of investigation



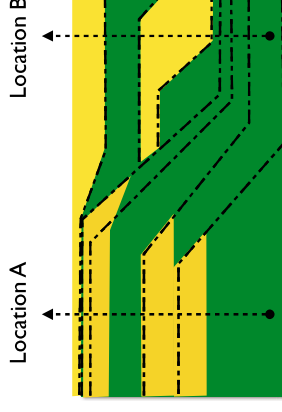
'..where were you (in 1982)?'



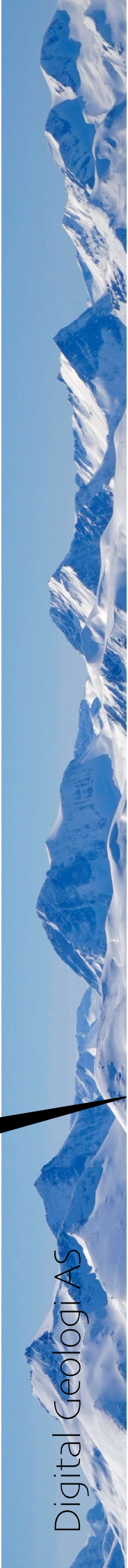
Working in the Gulf of Mexico using 2D seismic a new world in understanding emerged during the 1980s



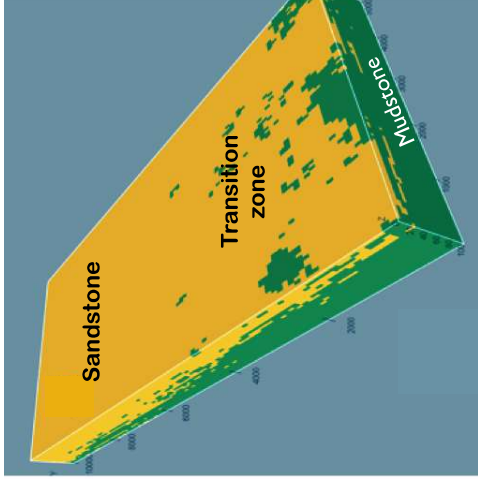
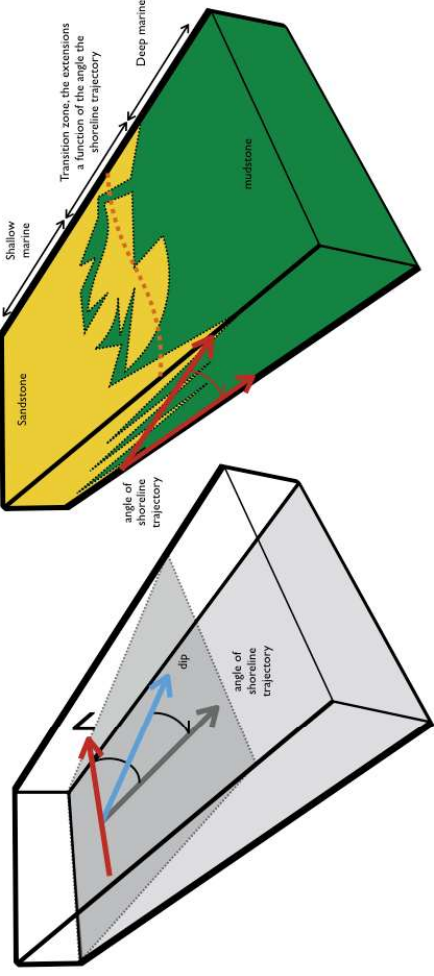
'..where were you (in 1991)?'



Early 1990s saw a silent revolution in understanding the dynamics of geological system and thus prediction of properties in time and space



From geological understanding to a proactive 4D geomodel



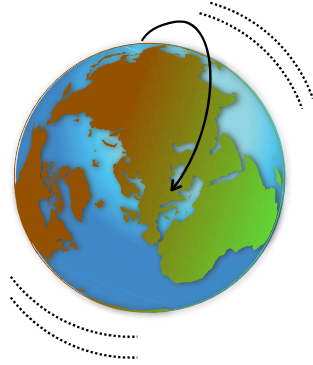
Truncated Gaussian Fields

Geological model

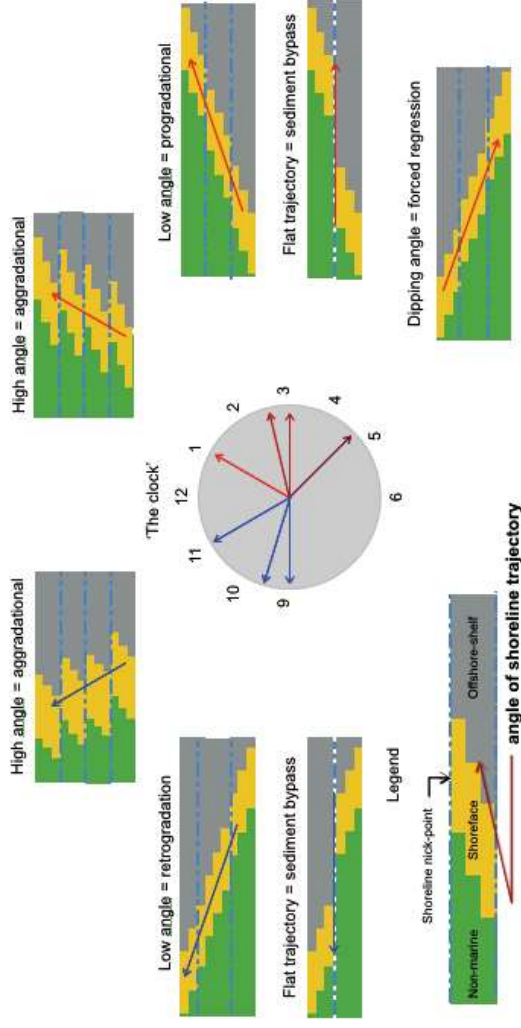
4D Geological computer model

- Fully specified probability distribution
- Prior defined by trend, truncation levels and variogram
- In a Bayesian setting conditional simulations will give an unbiased prediction of the posterior distribution

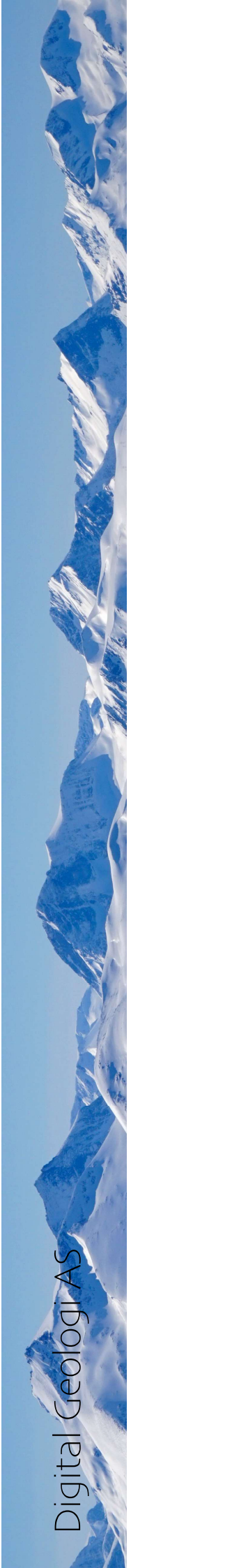
‘Post-revolution...’



‘... so while the rest of the world is spinning back-wards into the future...’



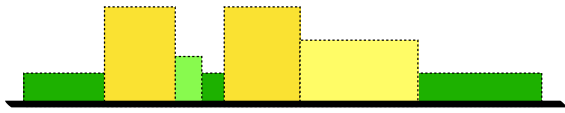
The realisation that understanding the dynamics of the geological system enable systematic prediction of sediment distribution (in time and space) thereby logically elucidating



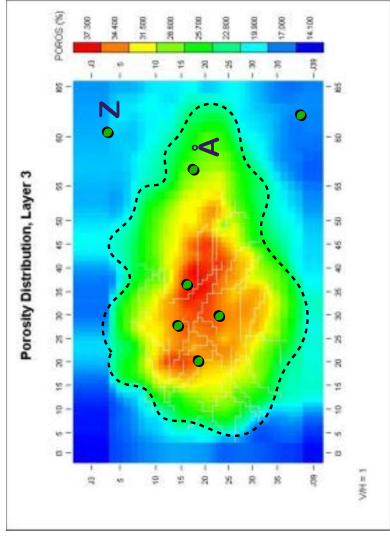
‘What do we mean by 4D?’

1D

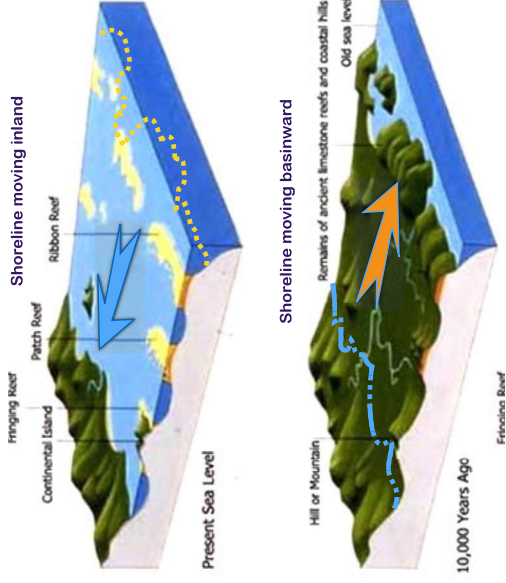
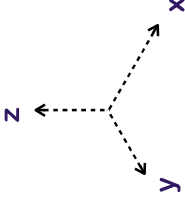
Well Z



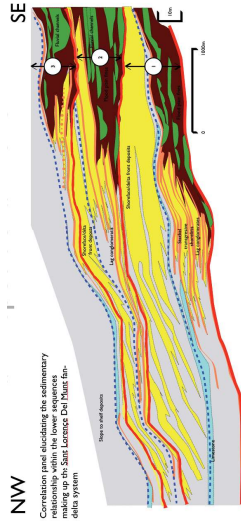
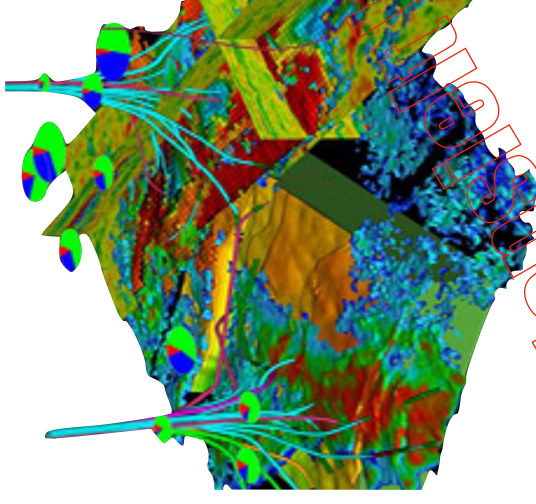
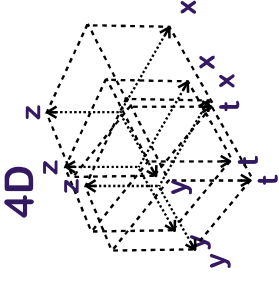
2D



3D

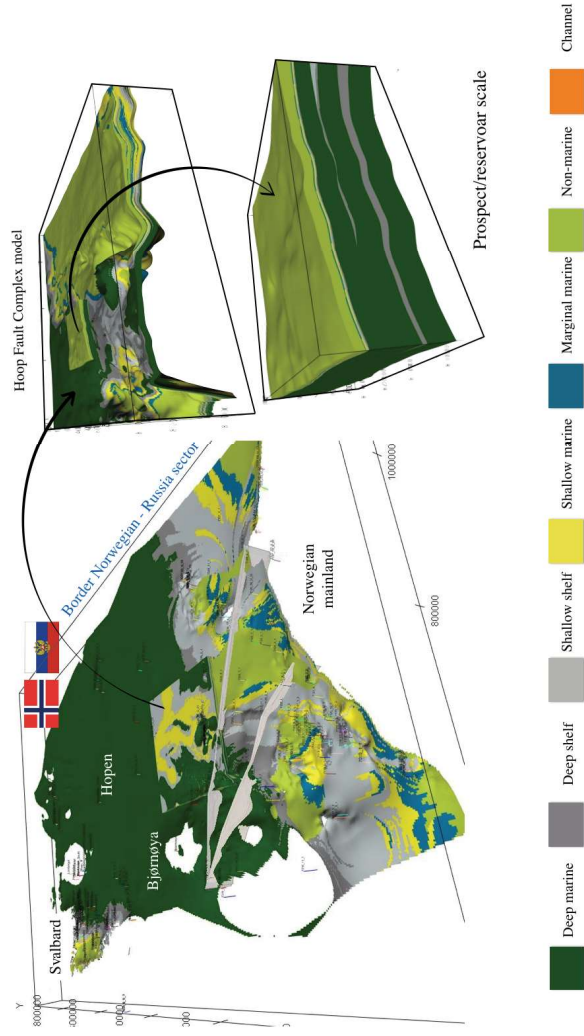
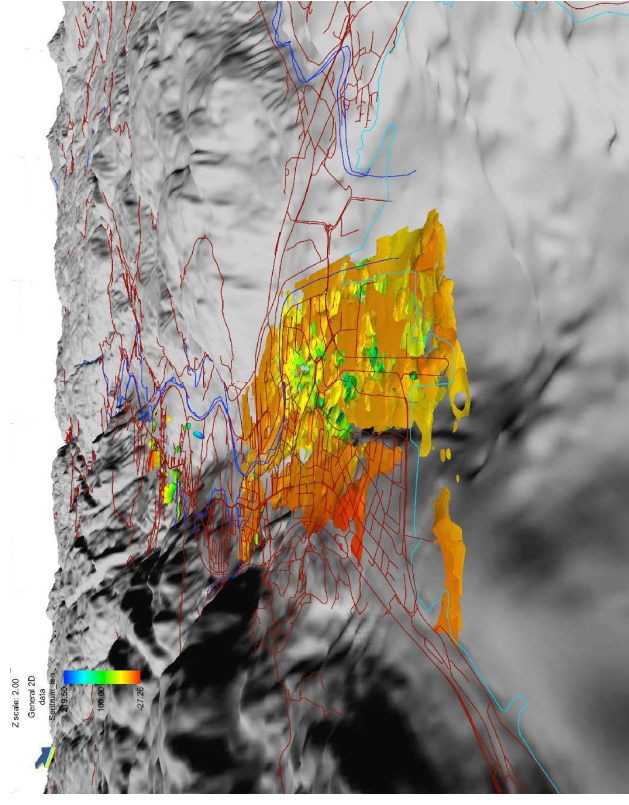


4D



KOMPAGNOR

Proactive geomodeling (scale independent)



Verdens største 4D geologiske modell; Norske del av Barentshavet 650,000km²

4D geo-kommune modell fra Orkdal som viser utbredelse av sannsynlighet for kvikkleire

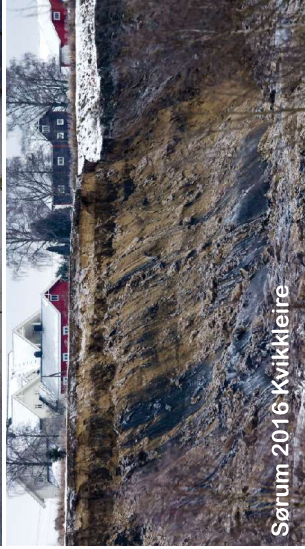
Norway a geological challenge



Mannen ras 2019?



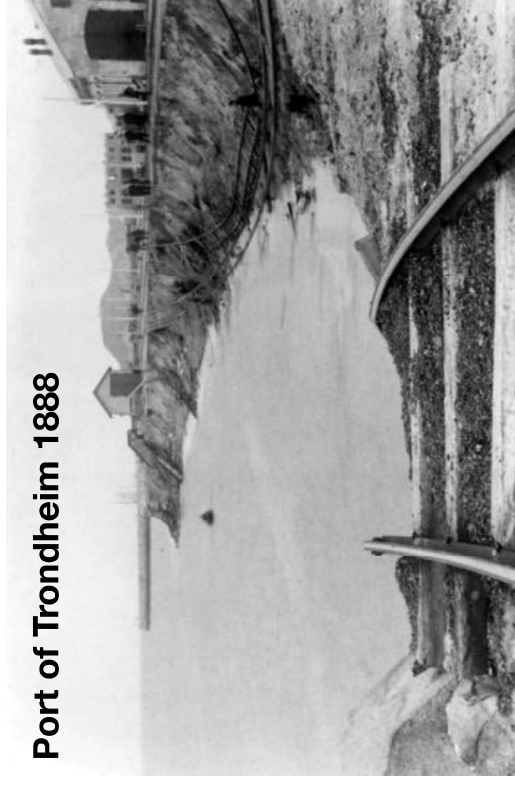
Glomdalen flom 2018



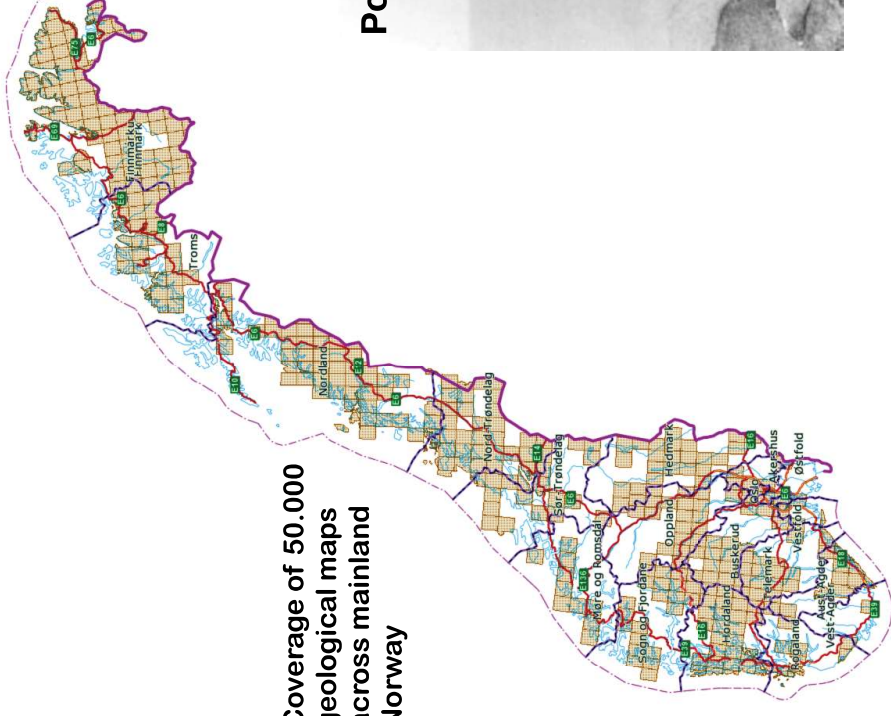
Sørum 2016 Kvikkleire



Sneskred

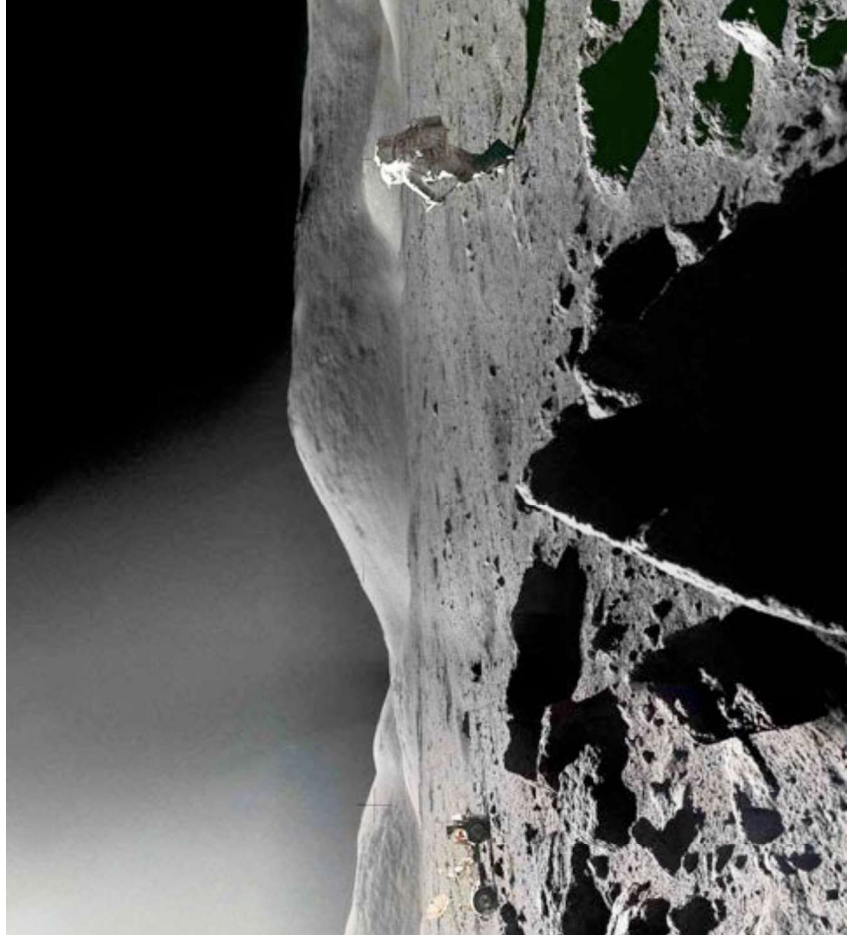


Port of Trondheim 1888



Coverage of 50.000 geological maps across mainland Norway

Applied geological knowledge



Geologist Harrison Schmidt during fieldwork on the Moon 1972



Sneskred



Ras problematikk



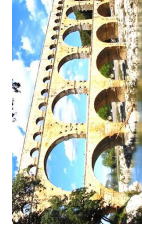
Flom og ødeleggelser



Kvikkleire

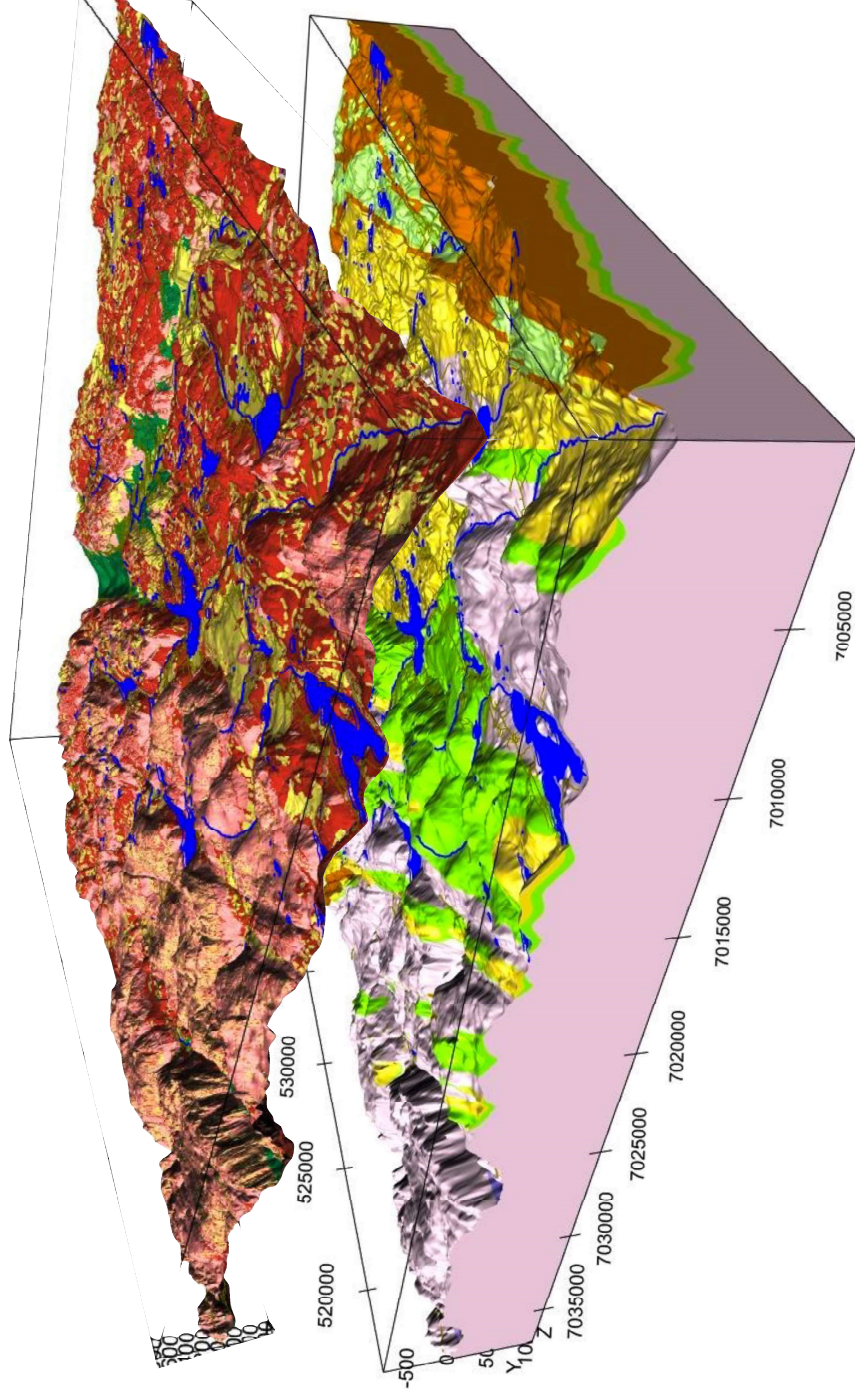


Vei standard

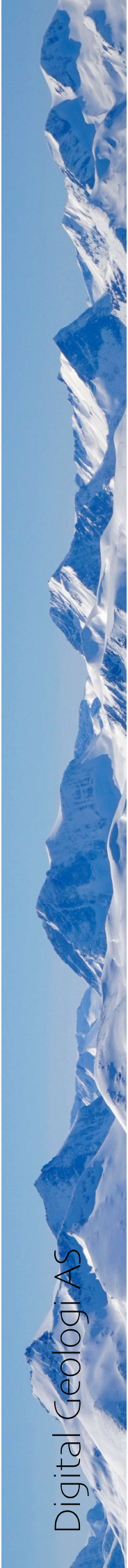
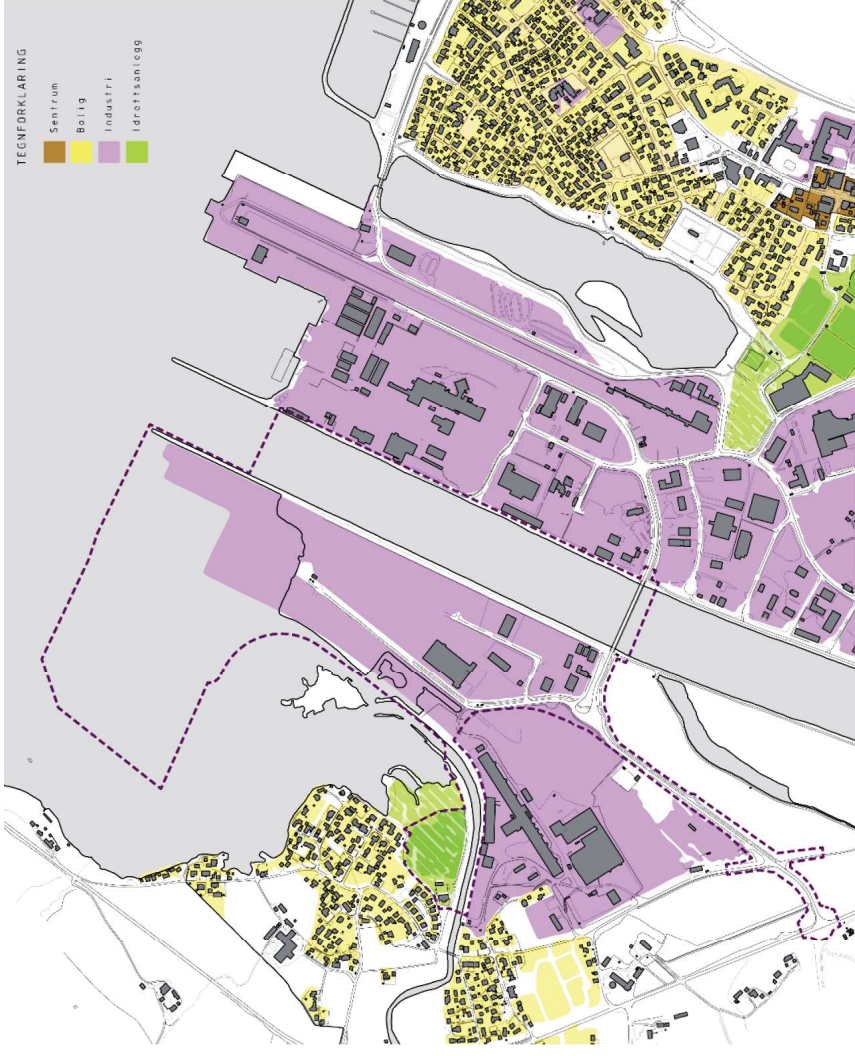


Helsetilstanden til broene

Orkdal kommune geomodel (2017-)



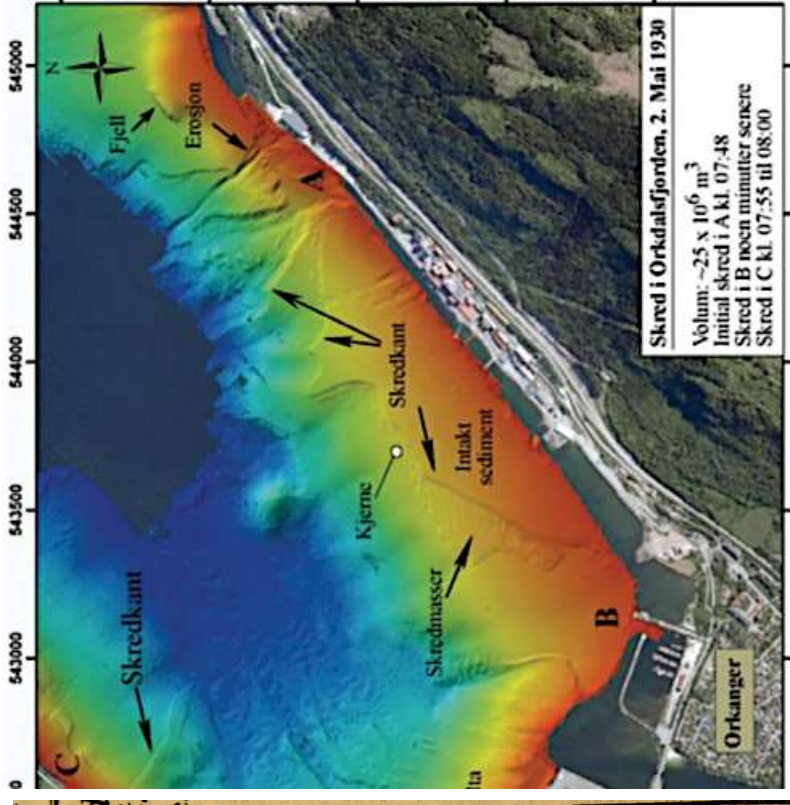
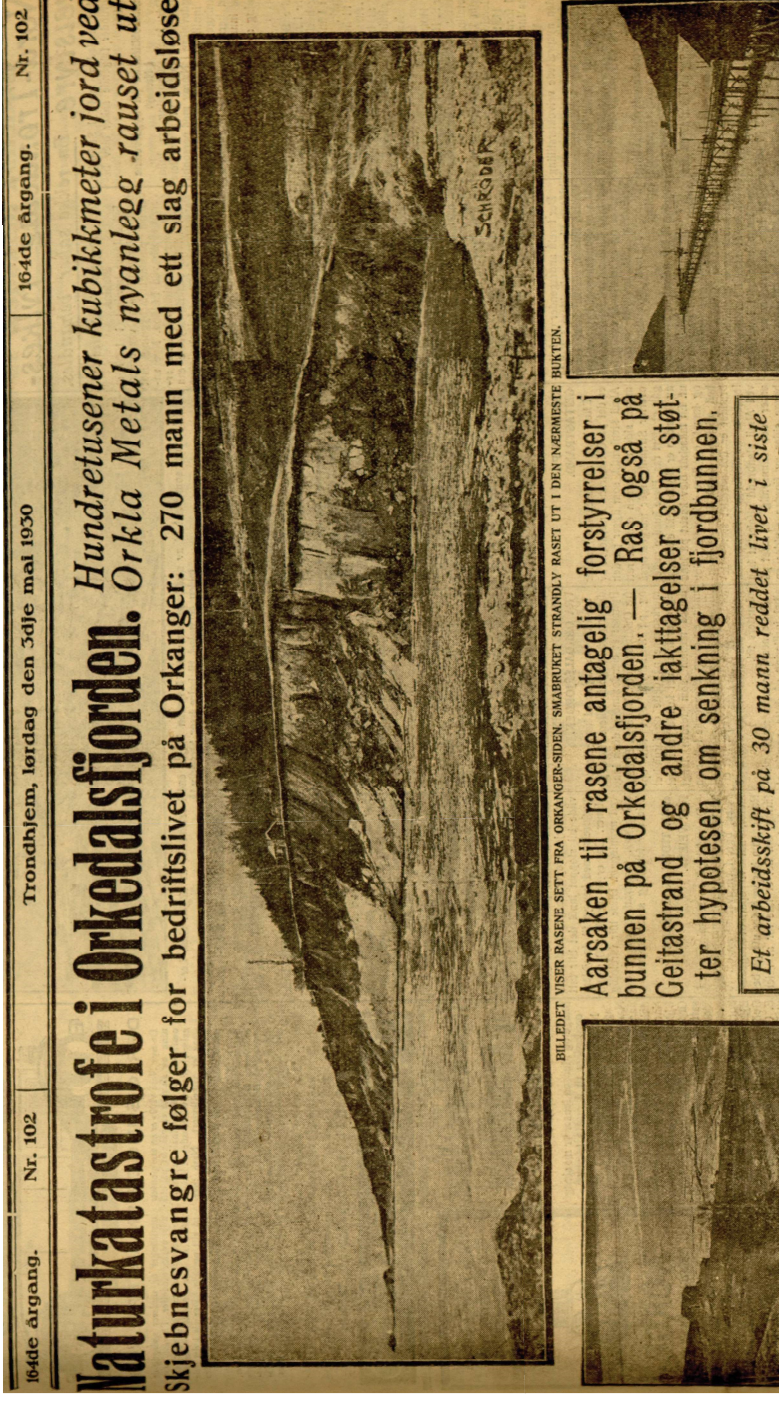
Proposed new port Orkdal Delta



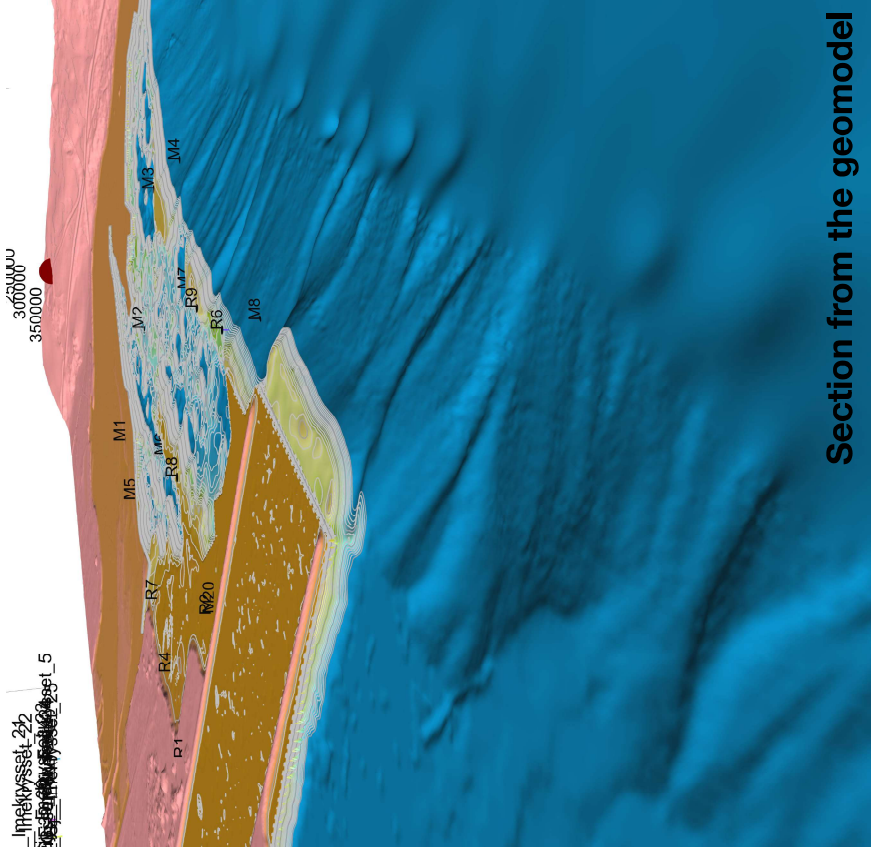
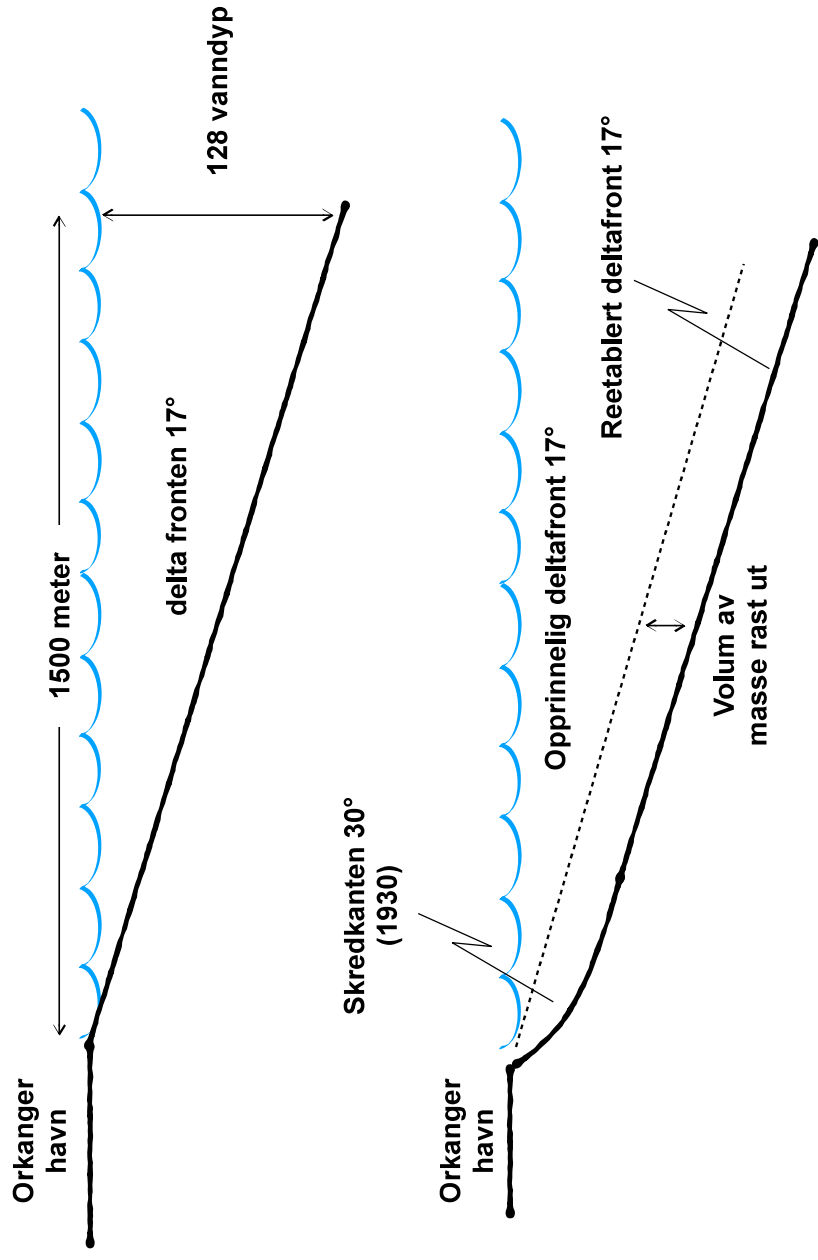
Orkla delta pre- and post 1973 development



Landslide and tsunami 2 May 1930

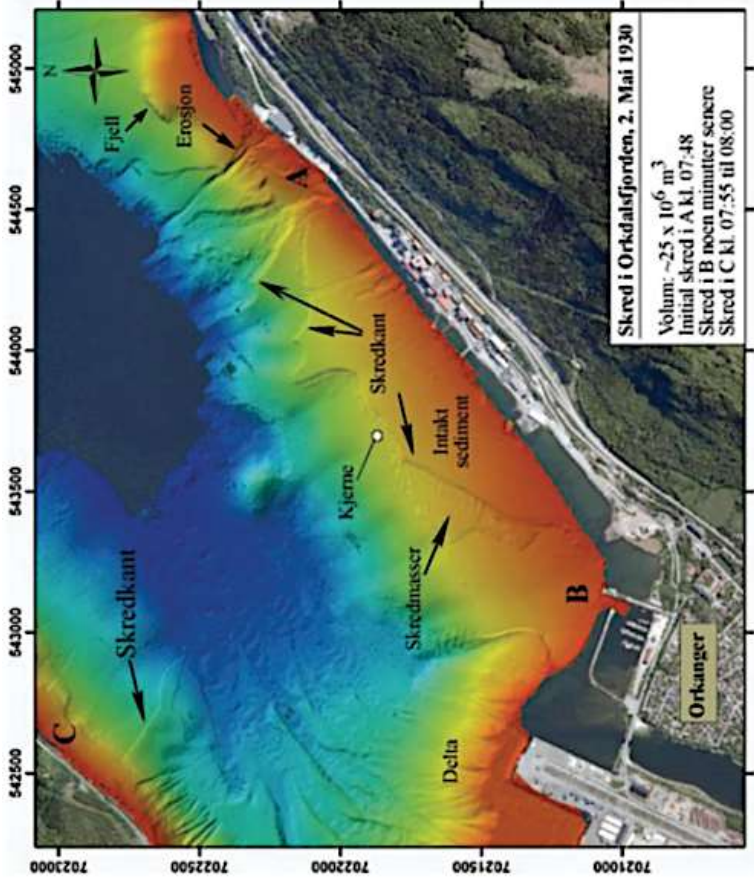
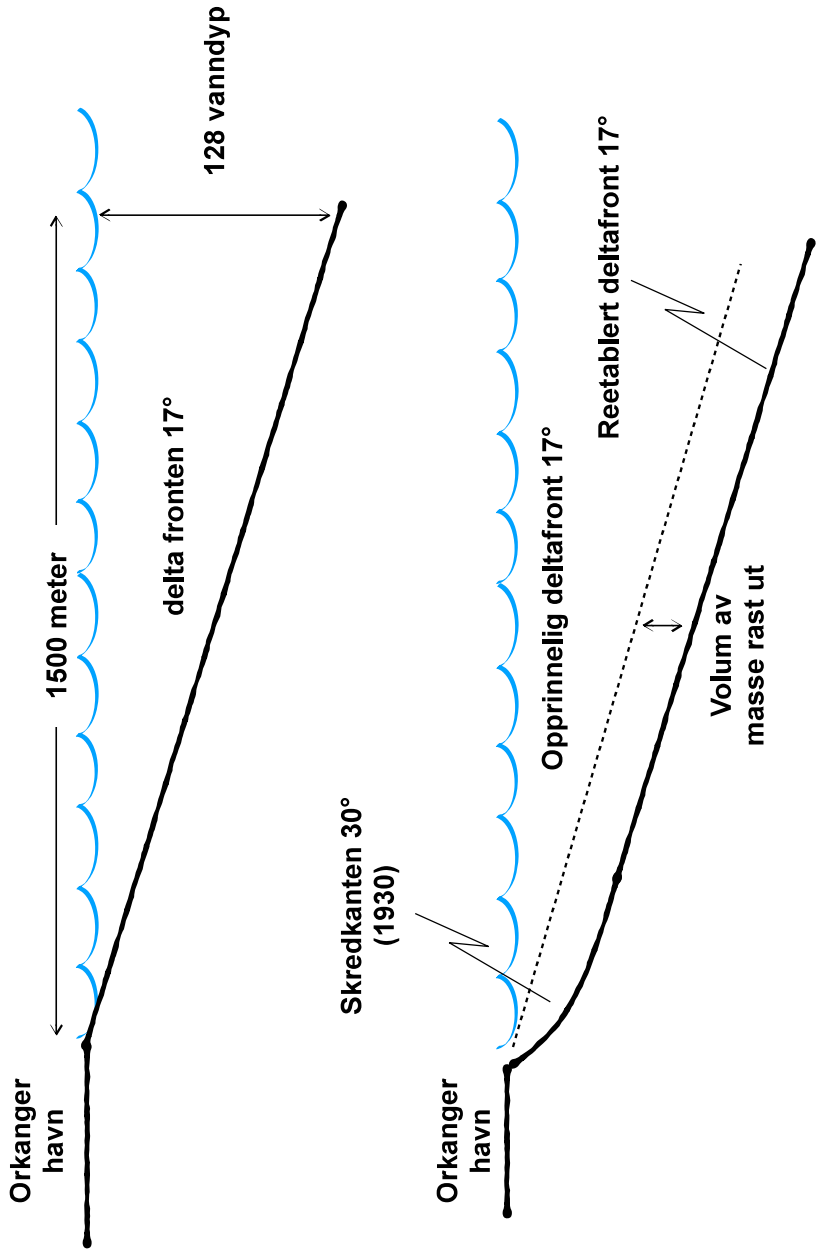


A consequence of the 1930 avalanche

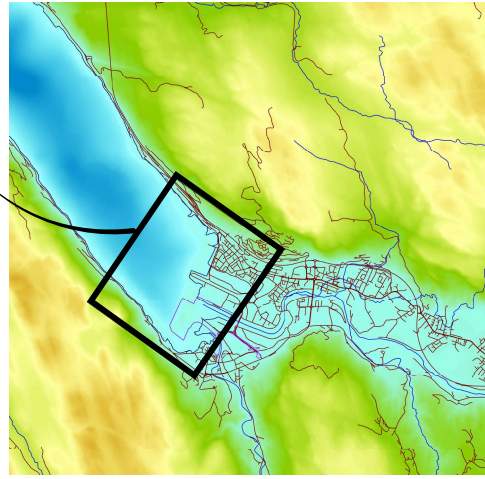
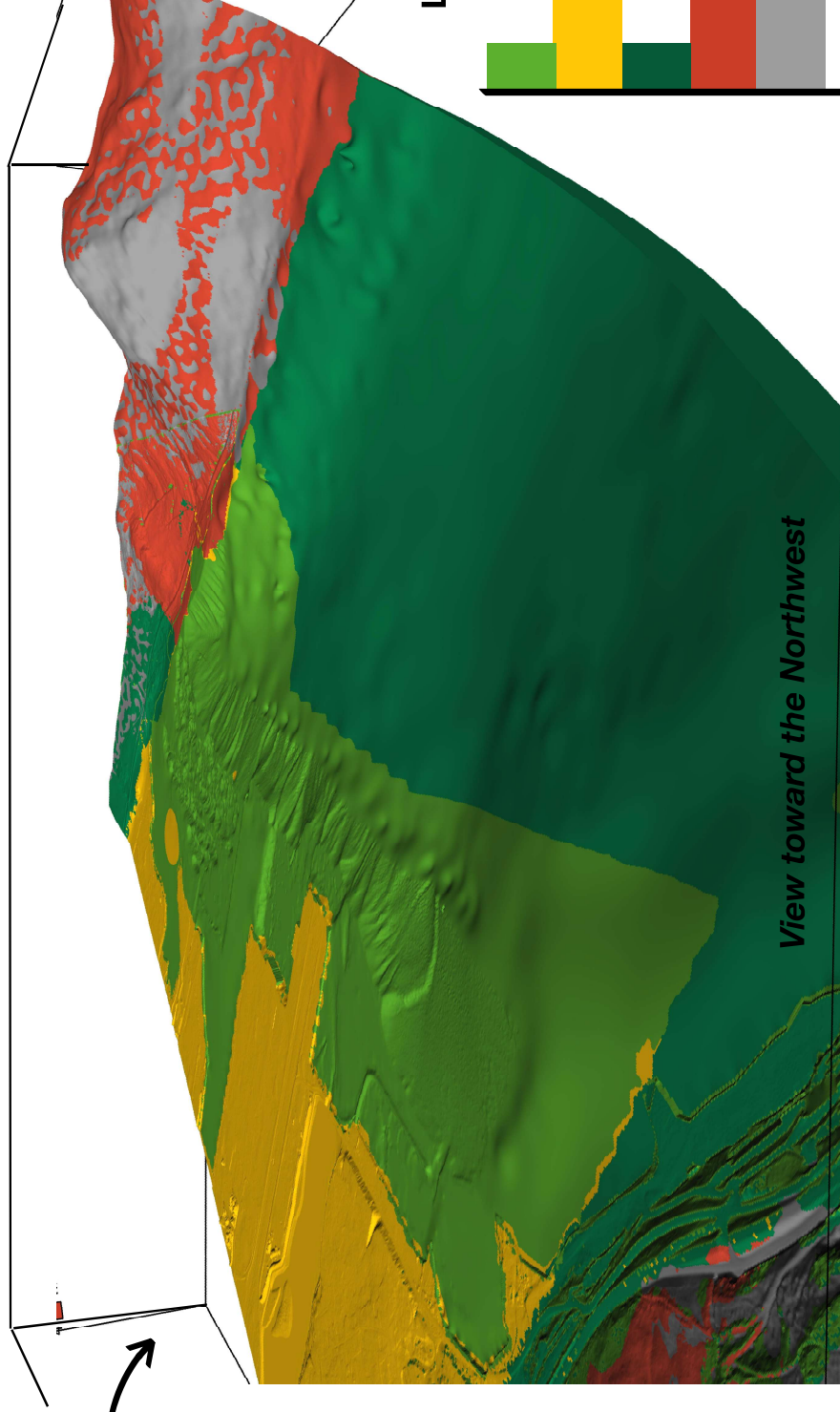


Section from the geomodel

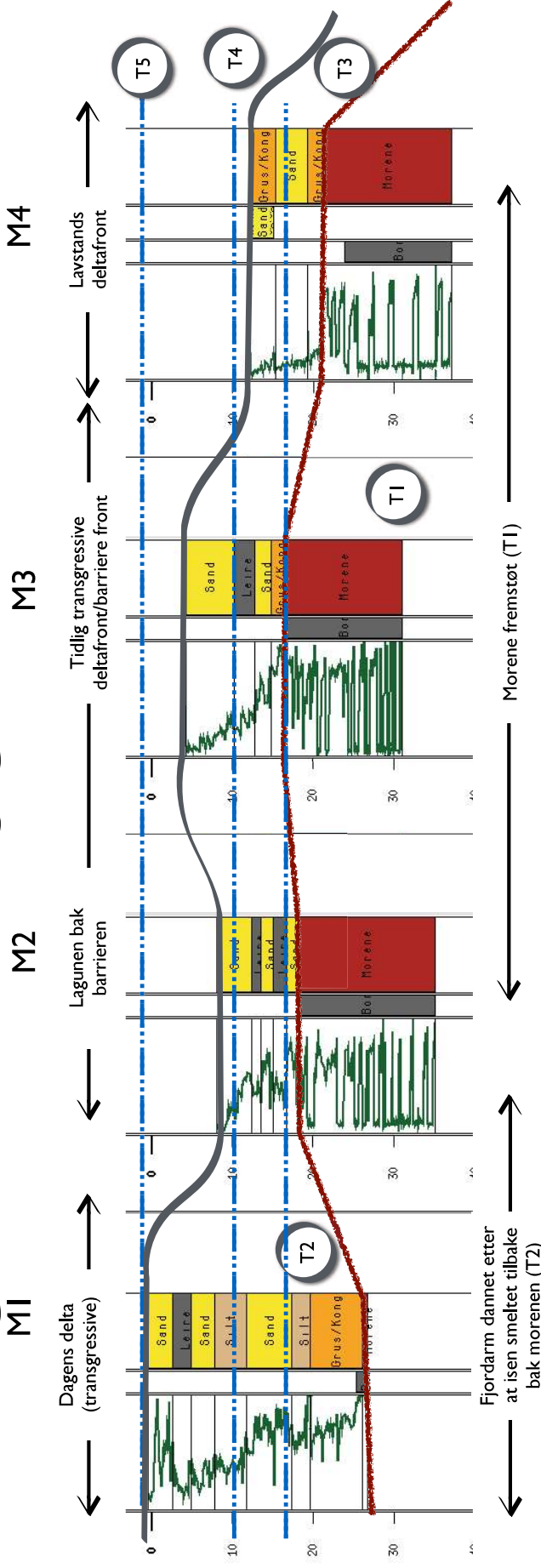
Konsekvensen av 1930 raset



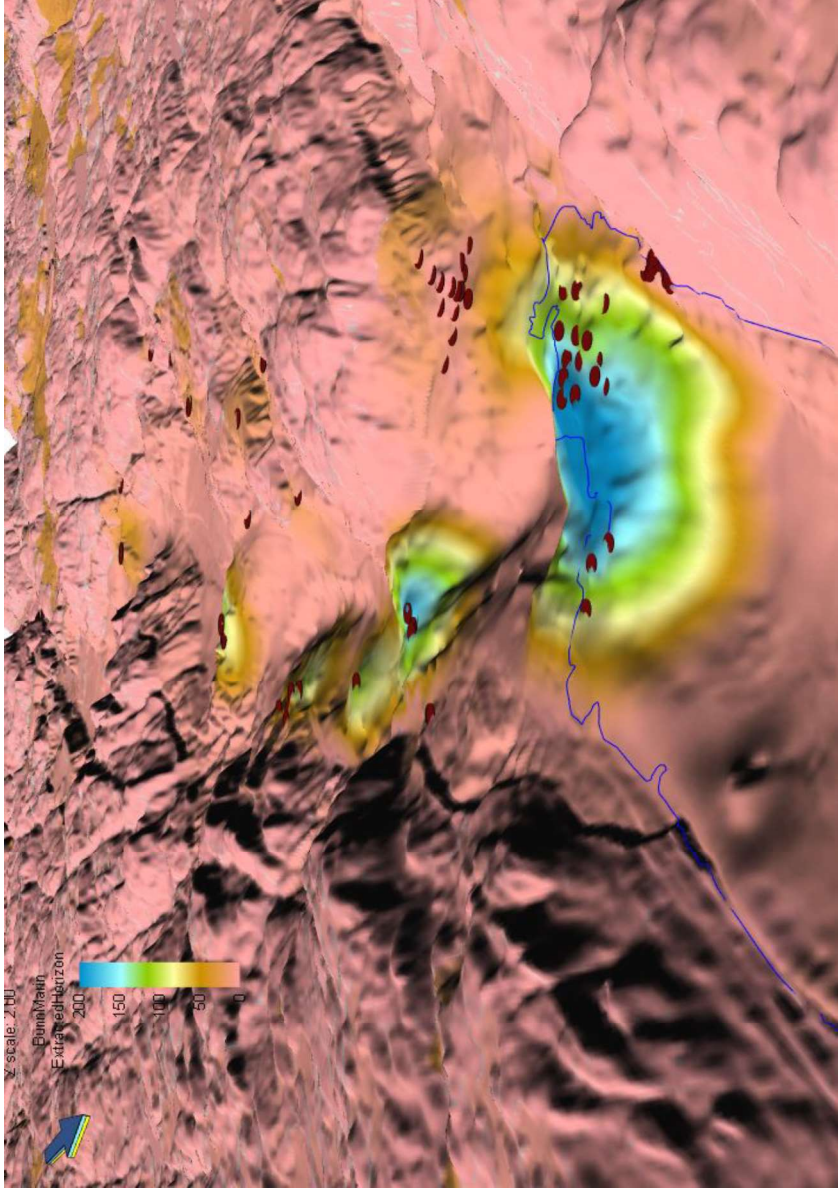
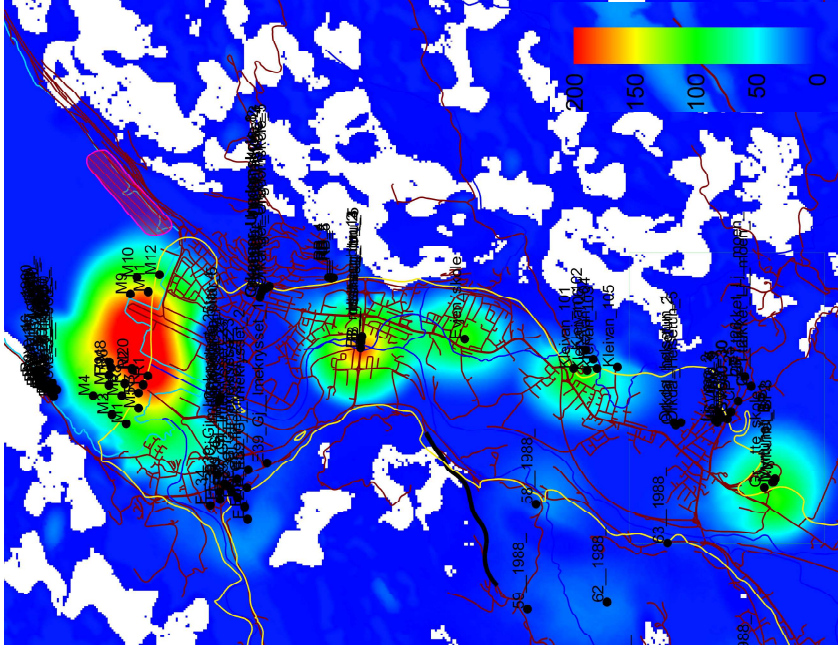
Pre-seismic Orkla Delta geomodel



Orkanger NV/Råbygda- Grønøra Vest

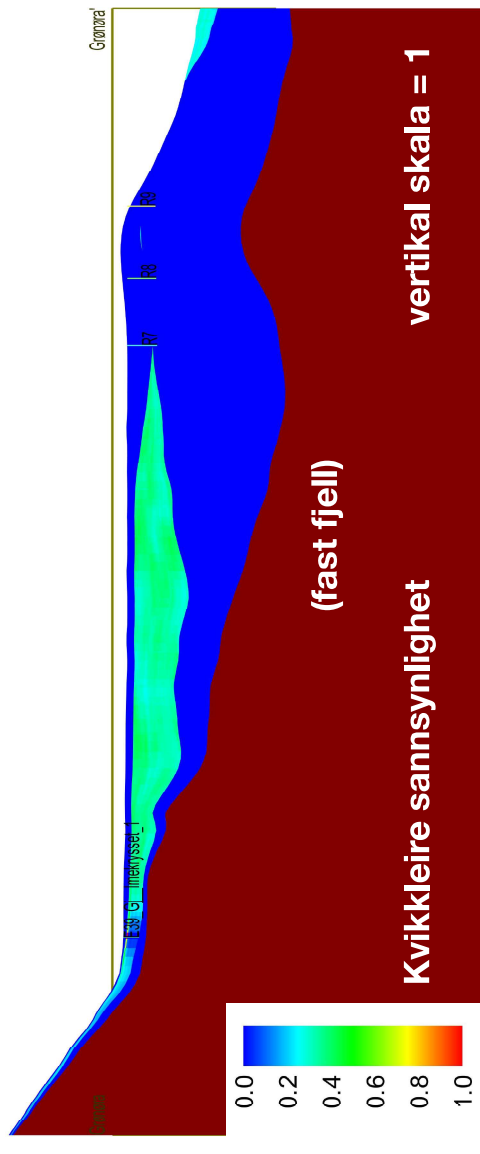
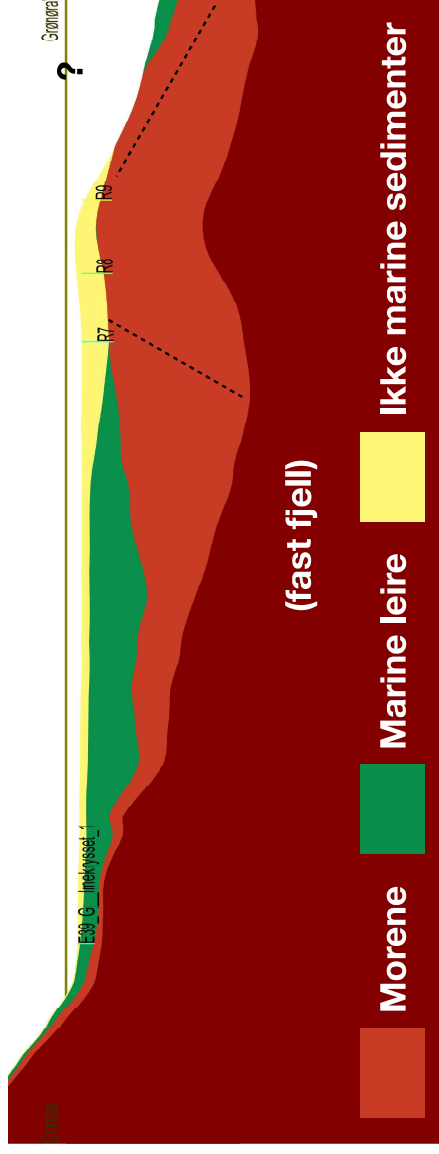
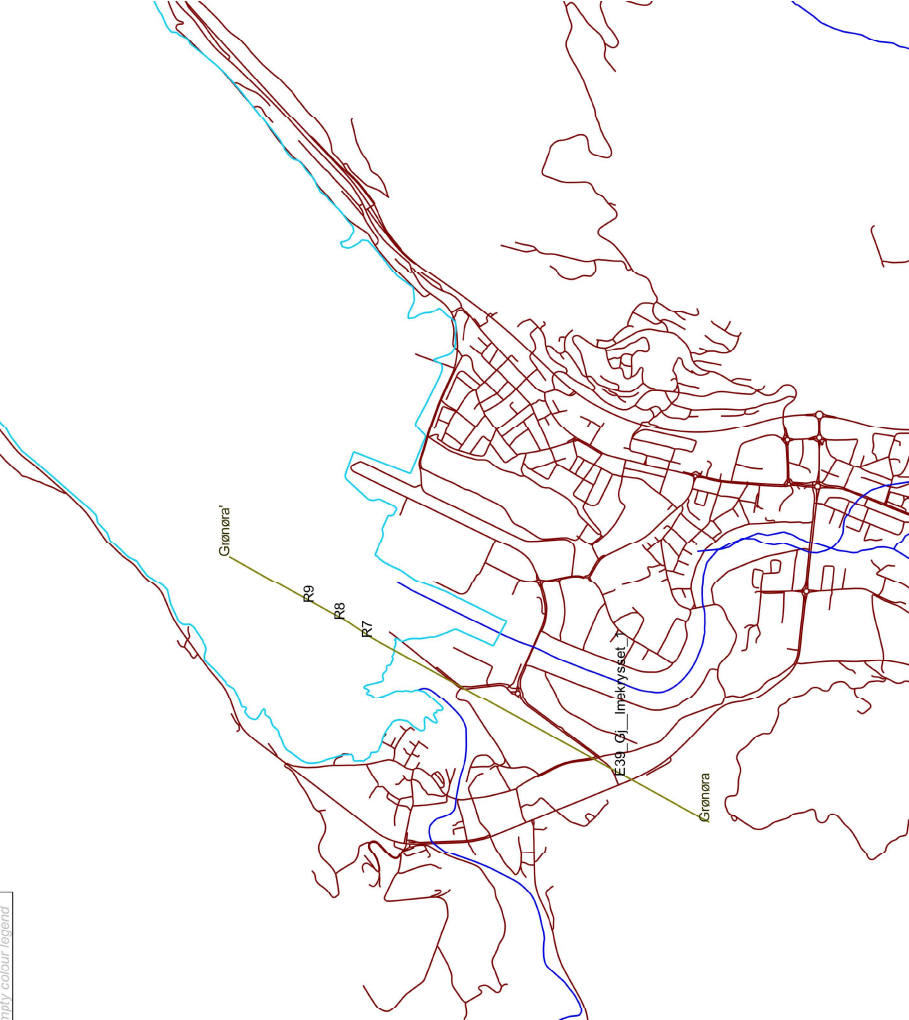


Pre-seismic geomodel of Orkla delta



Snitt gjennom modellen Grønøra Vest

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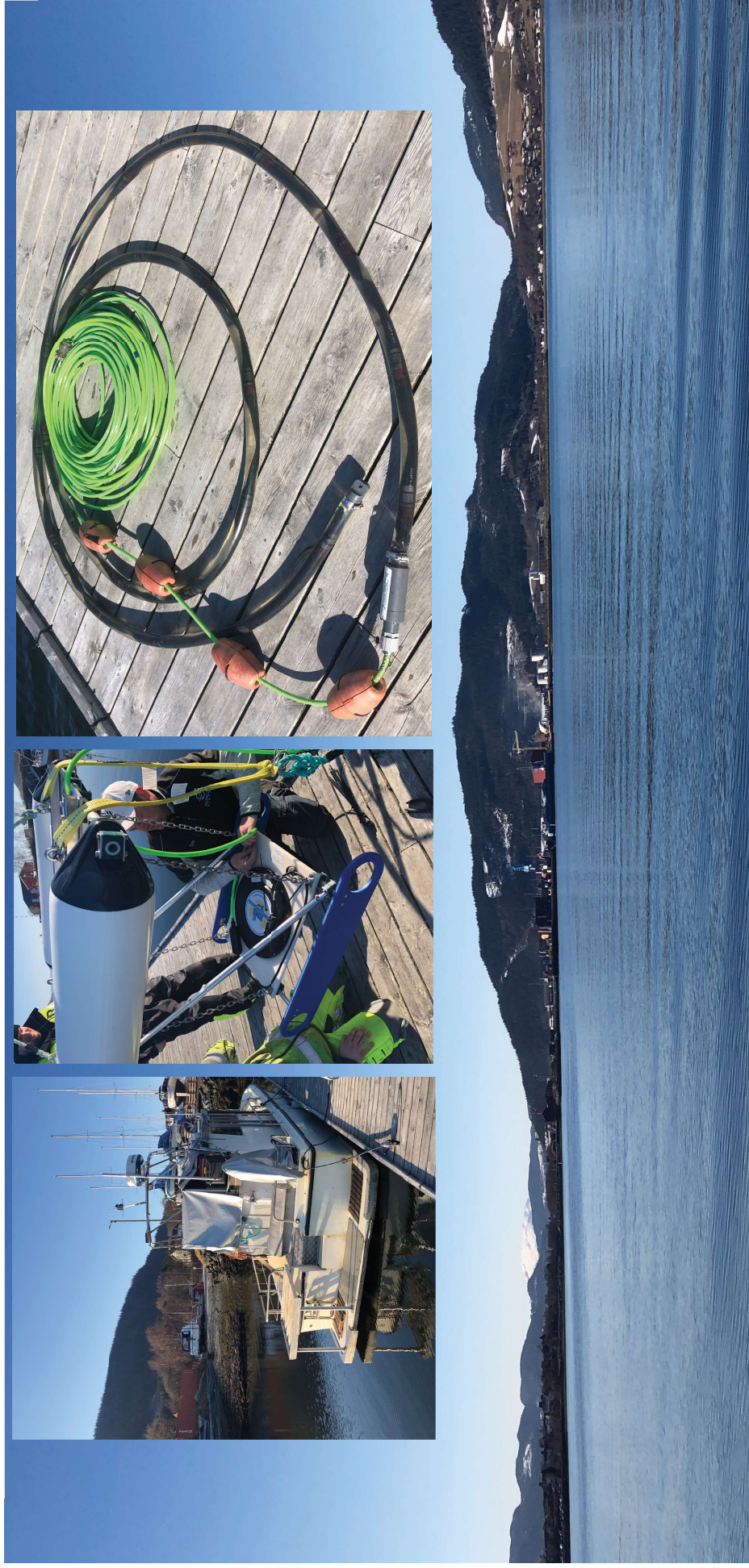
Seismic sea & land



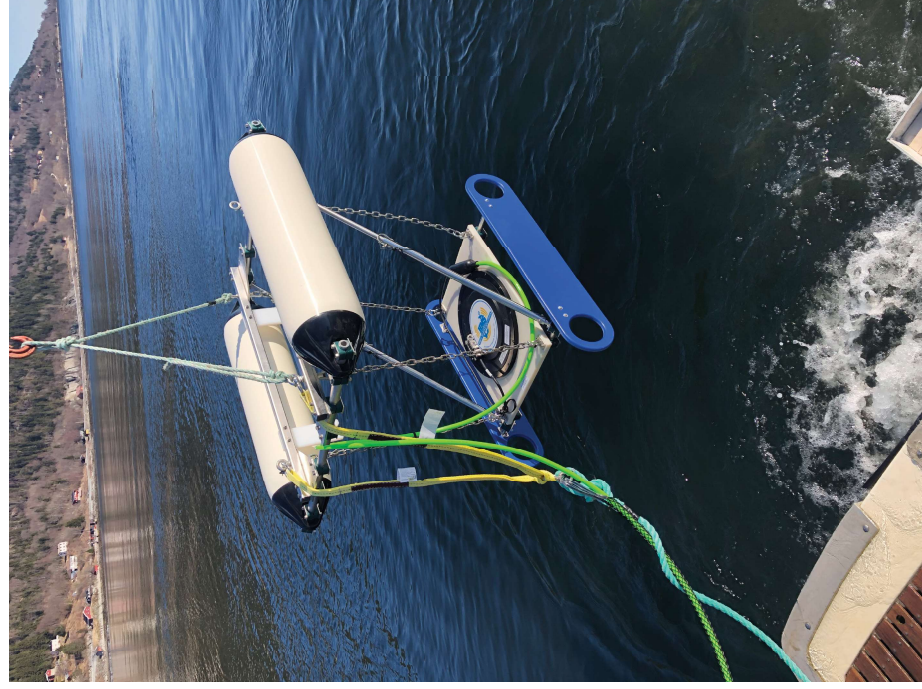
Digital Geologi AS



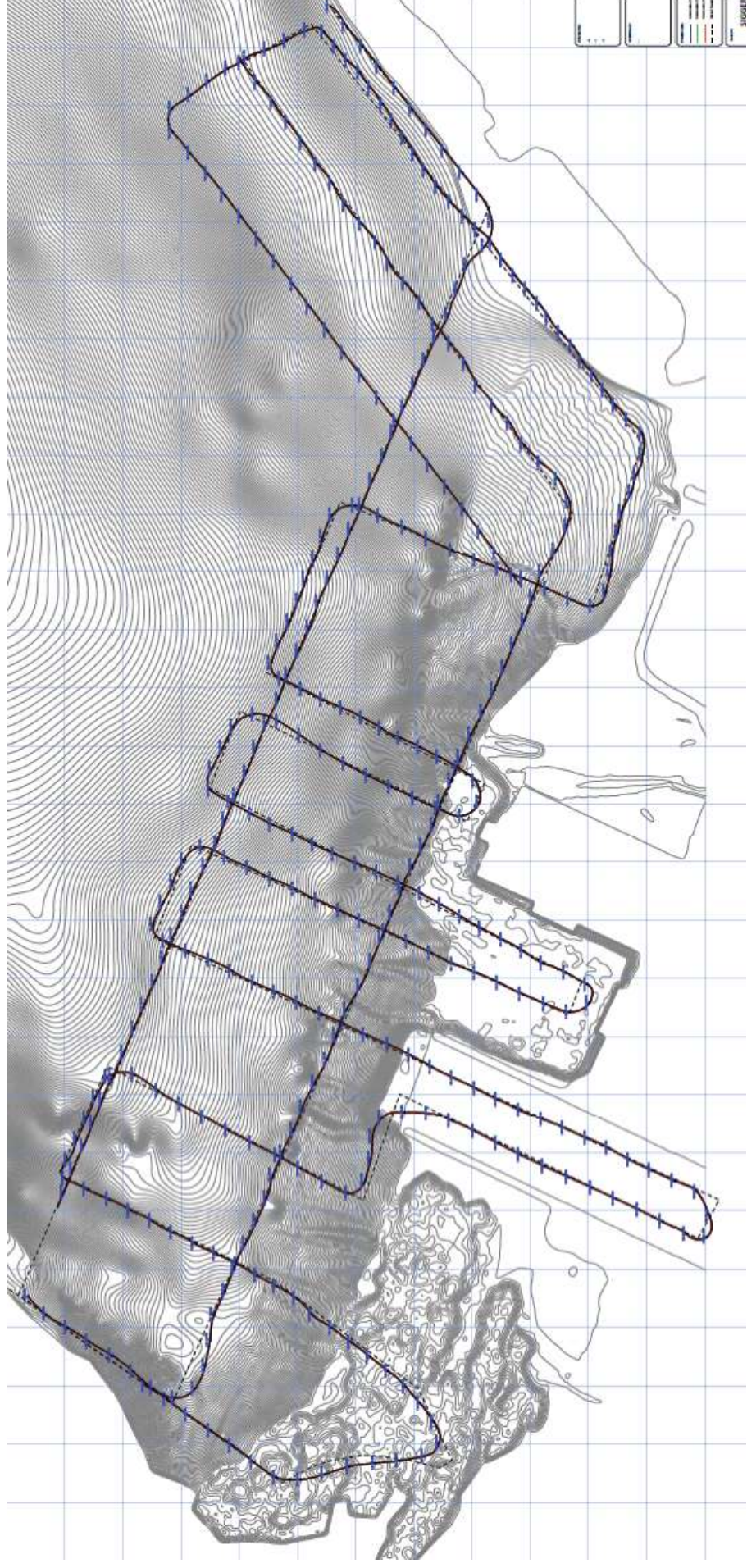
Seismic acquisition



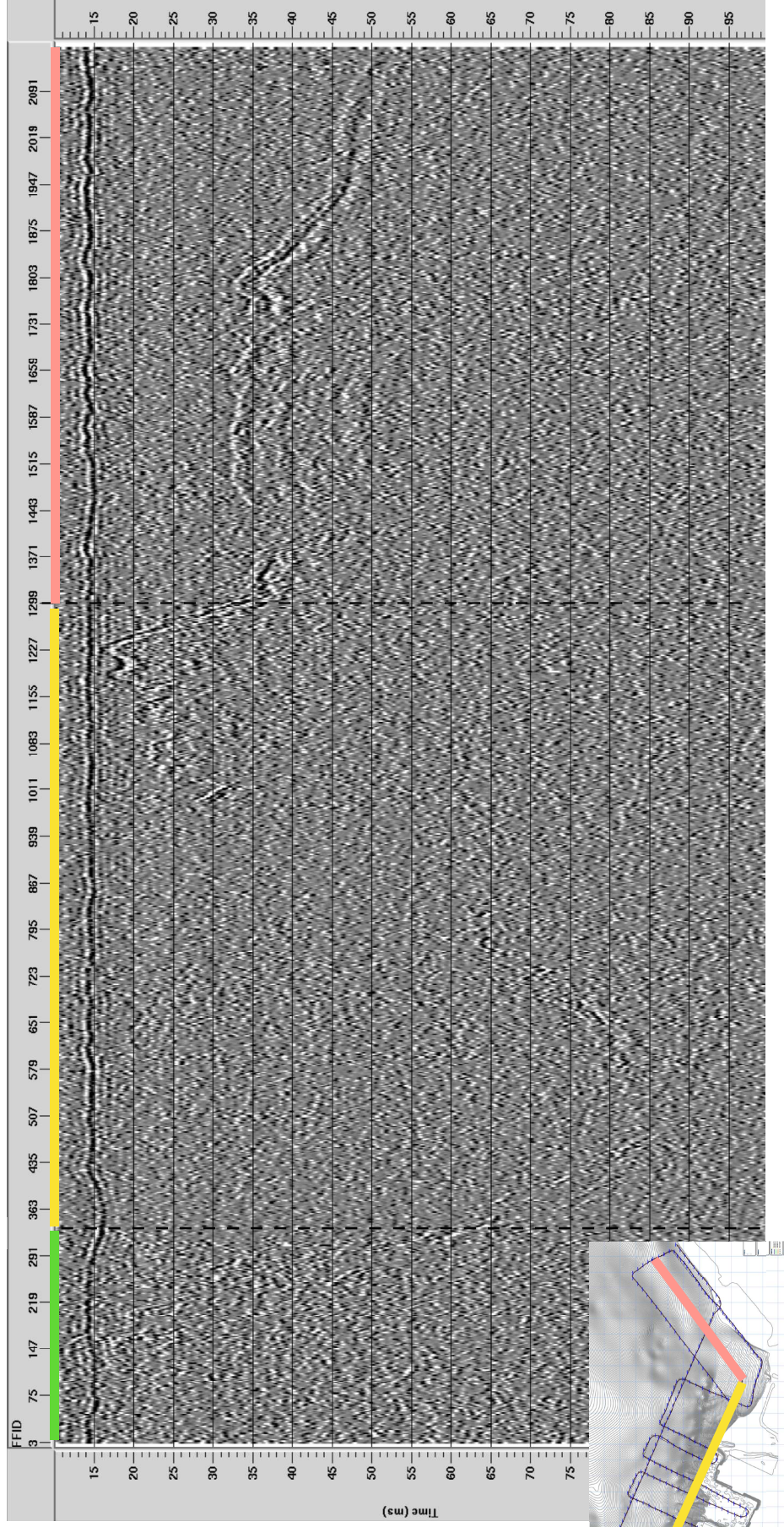
Seismic acquisition



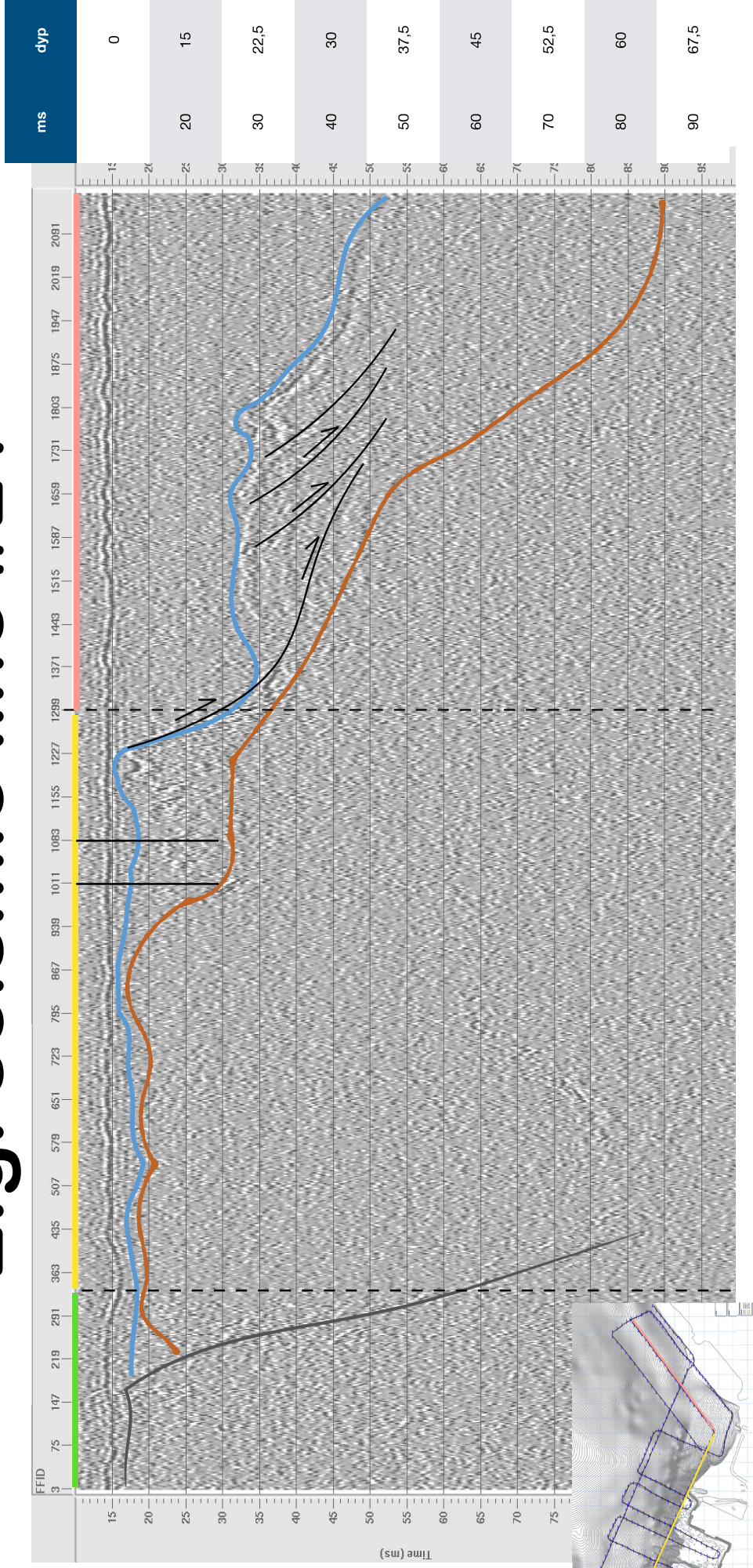
Plan seismic acquisition



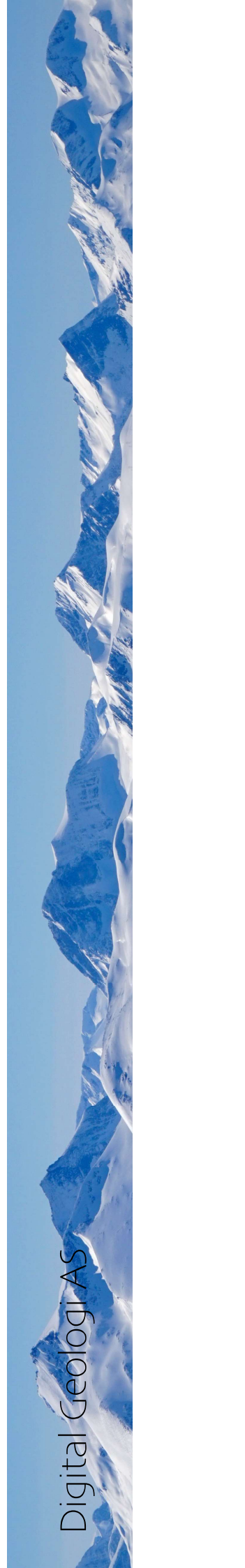
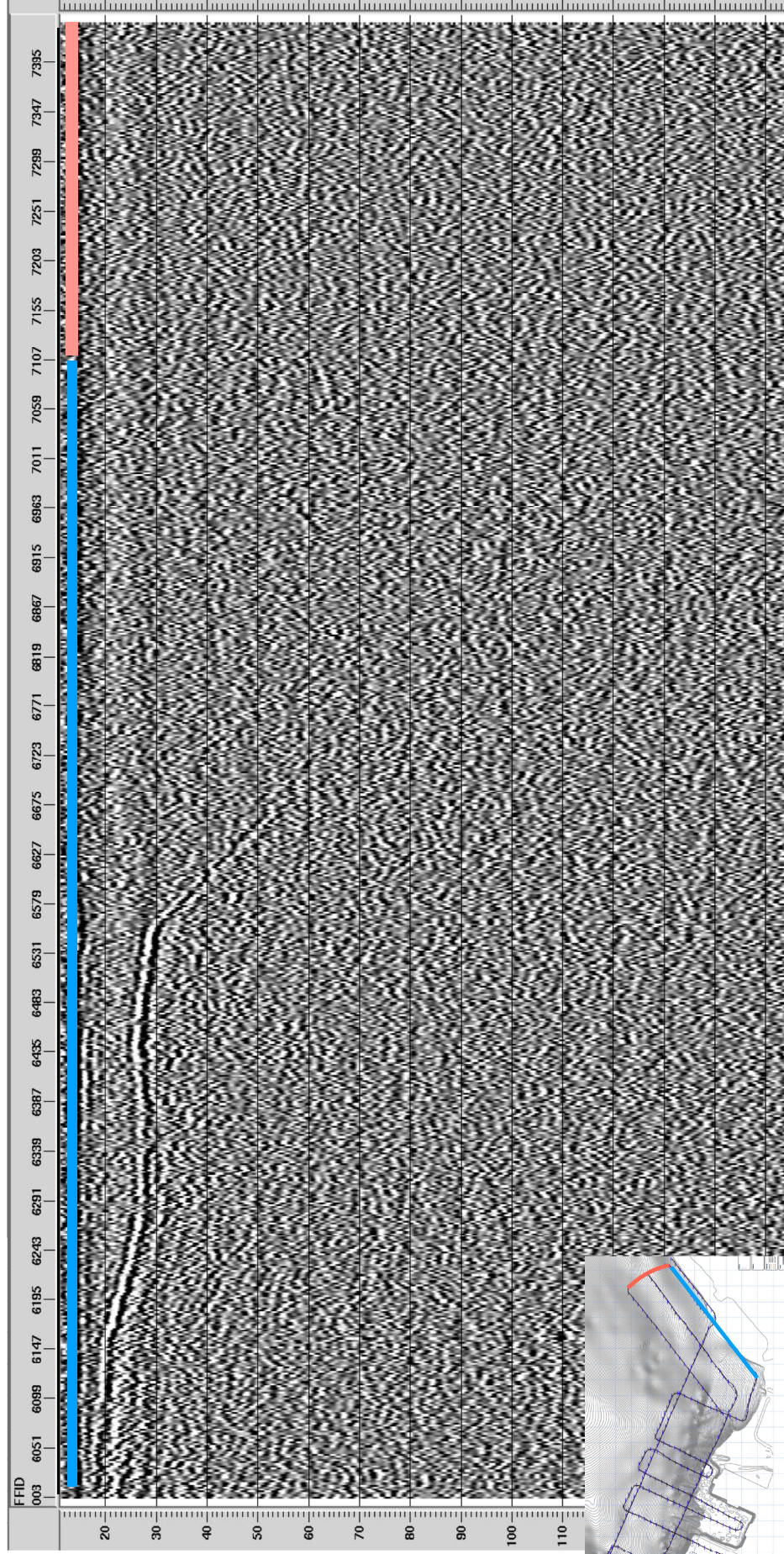
E.g. seismic line #21



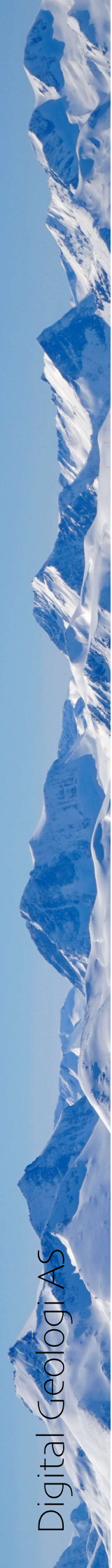
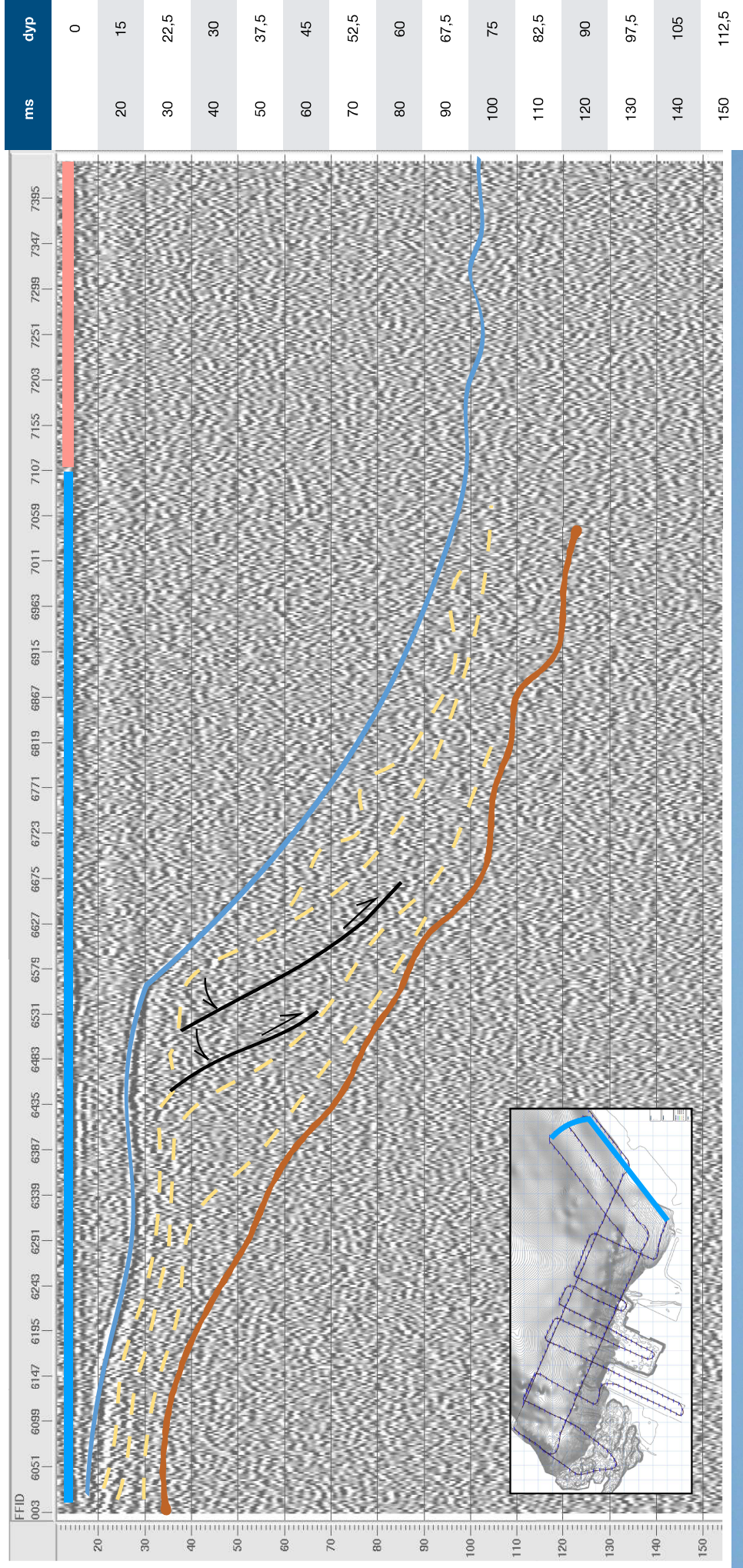
E.g. seismic line #21



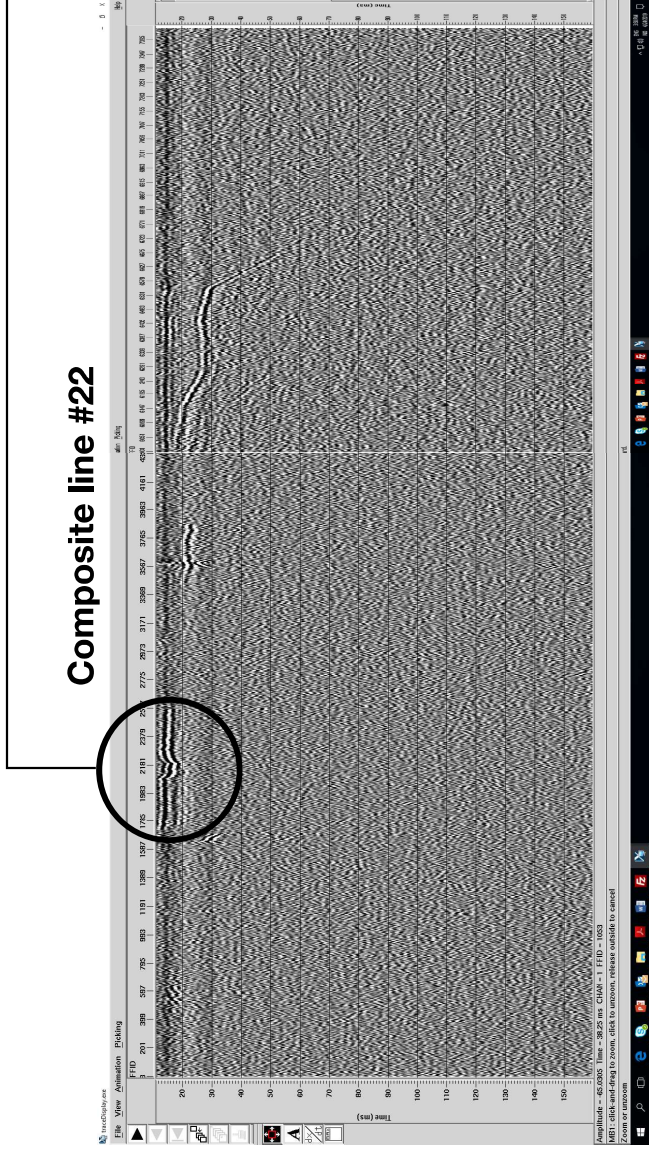
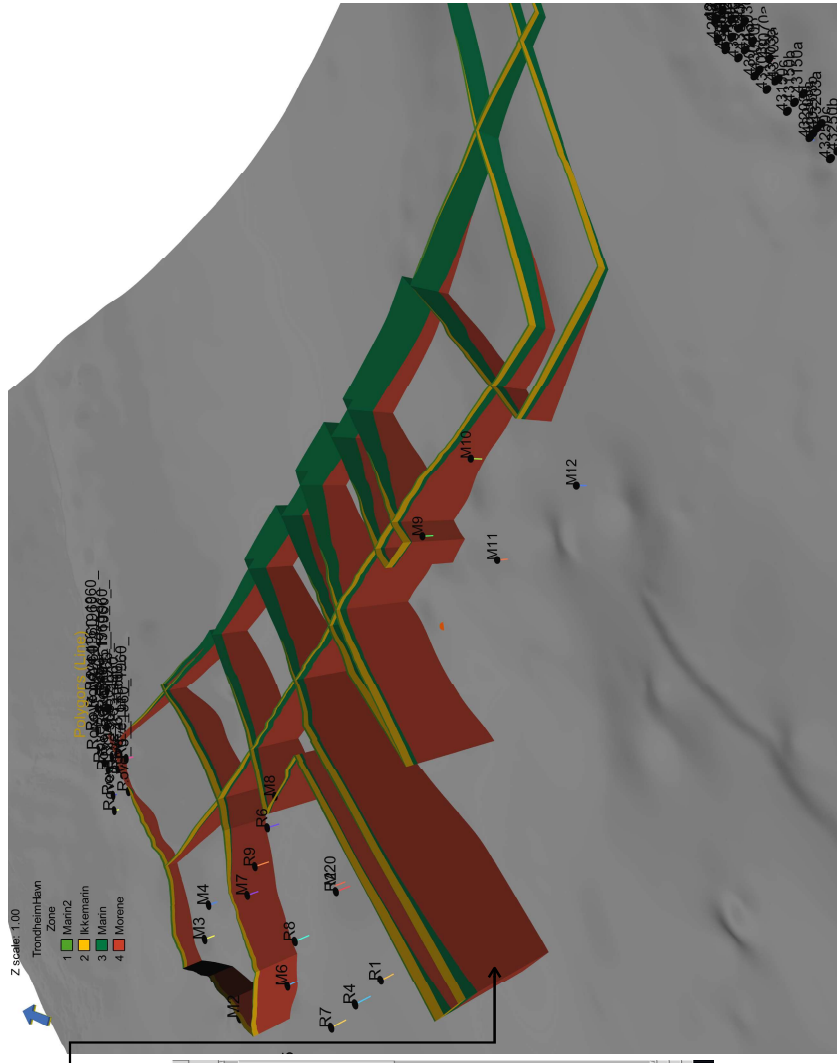
End of line #22



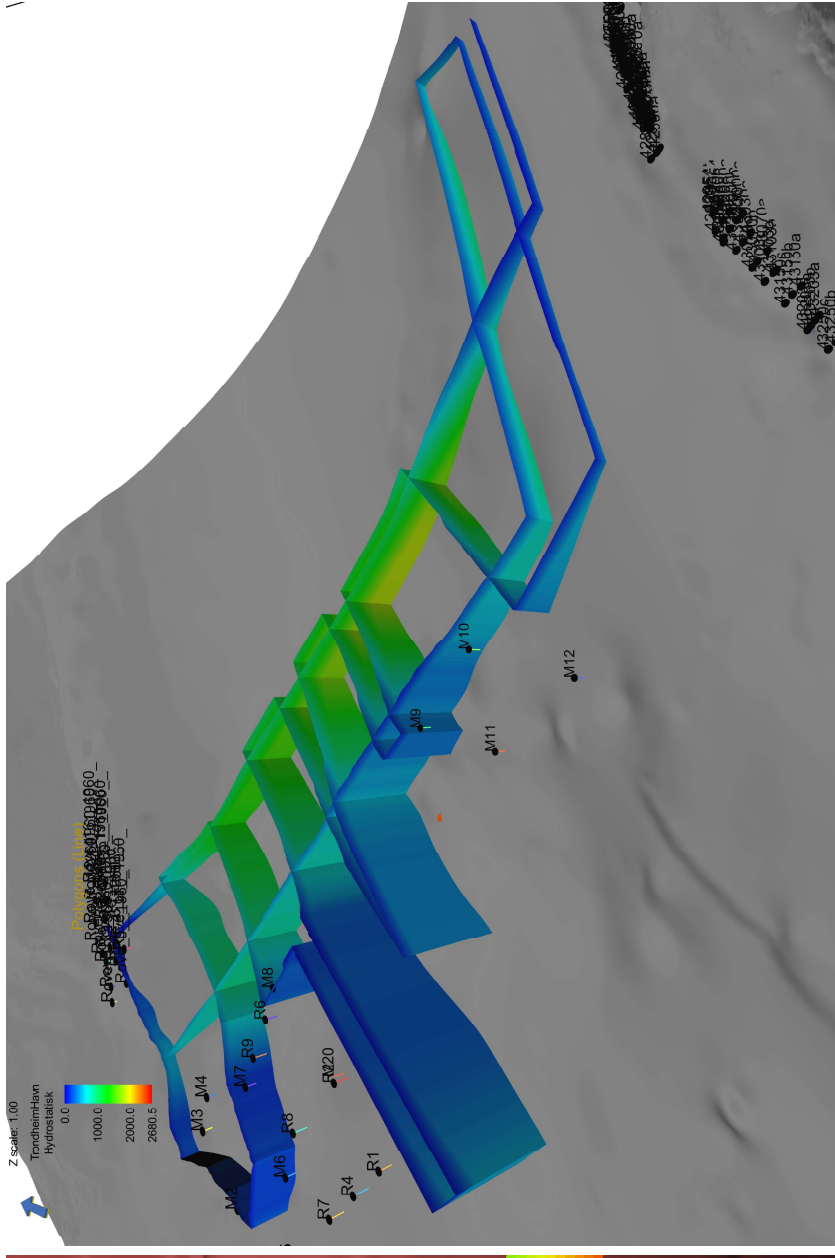
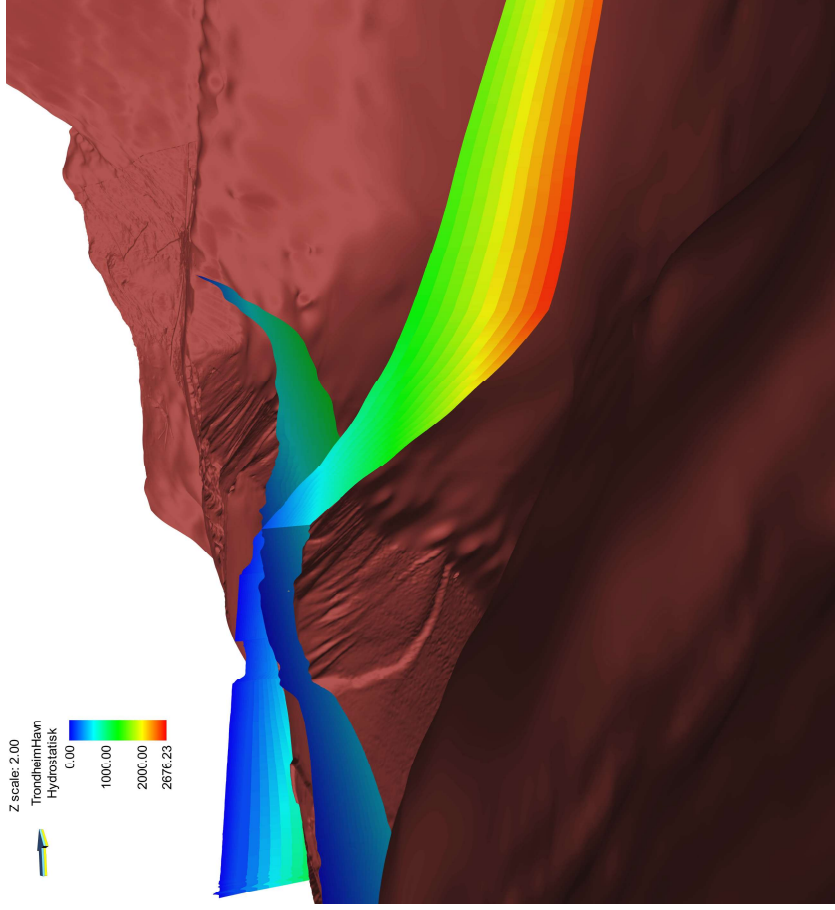
End of line #22



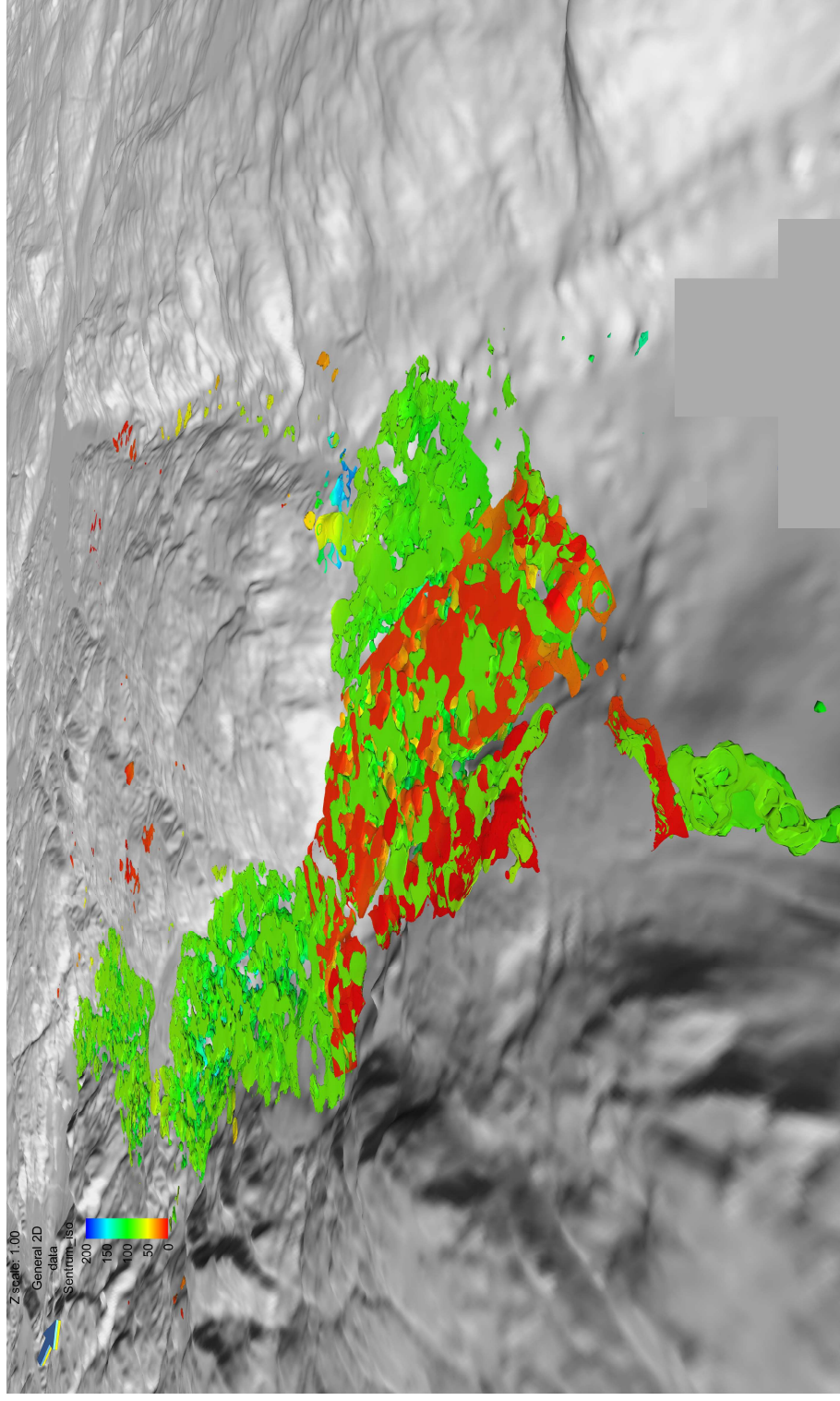
Example pre-processed data #22



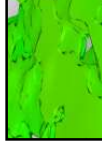
Pre & post seismic property model



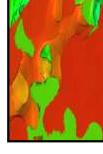
Orkdal land geomodel



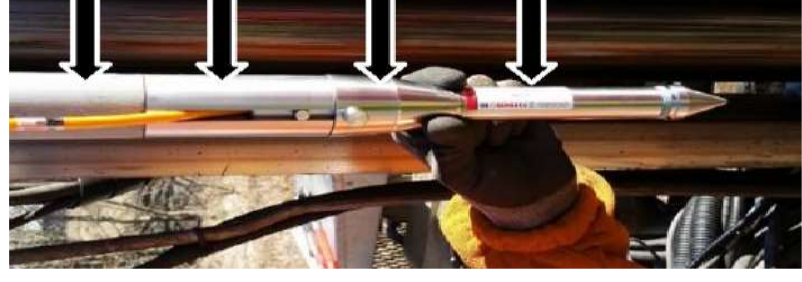
Volumer med sannsynlighet over 35% vist som isoflater (3D flater) i rommet fra hele kommune modellen



Volumer med sannsynlighet over 35% vist som isoflater (3D flater) i rommet fra detaljmodellen Orkanger sentrum



Epilouge



Borstål

Adapter – øvre del

Adapter – nedre del

Poretrykksmåler

