3D –modelling at the Geological Survey of Finland (GTK)

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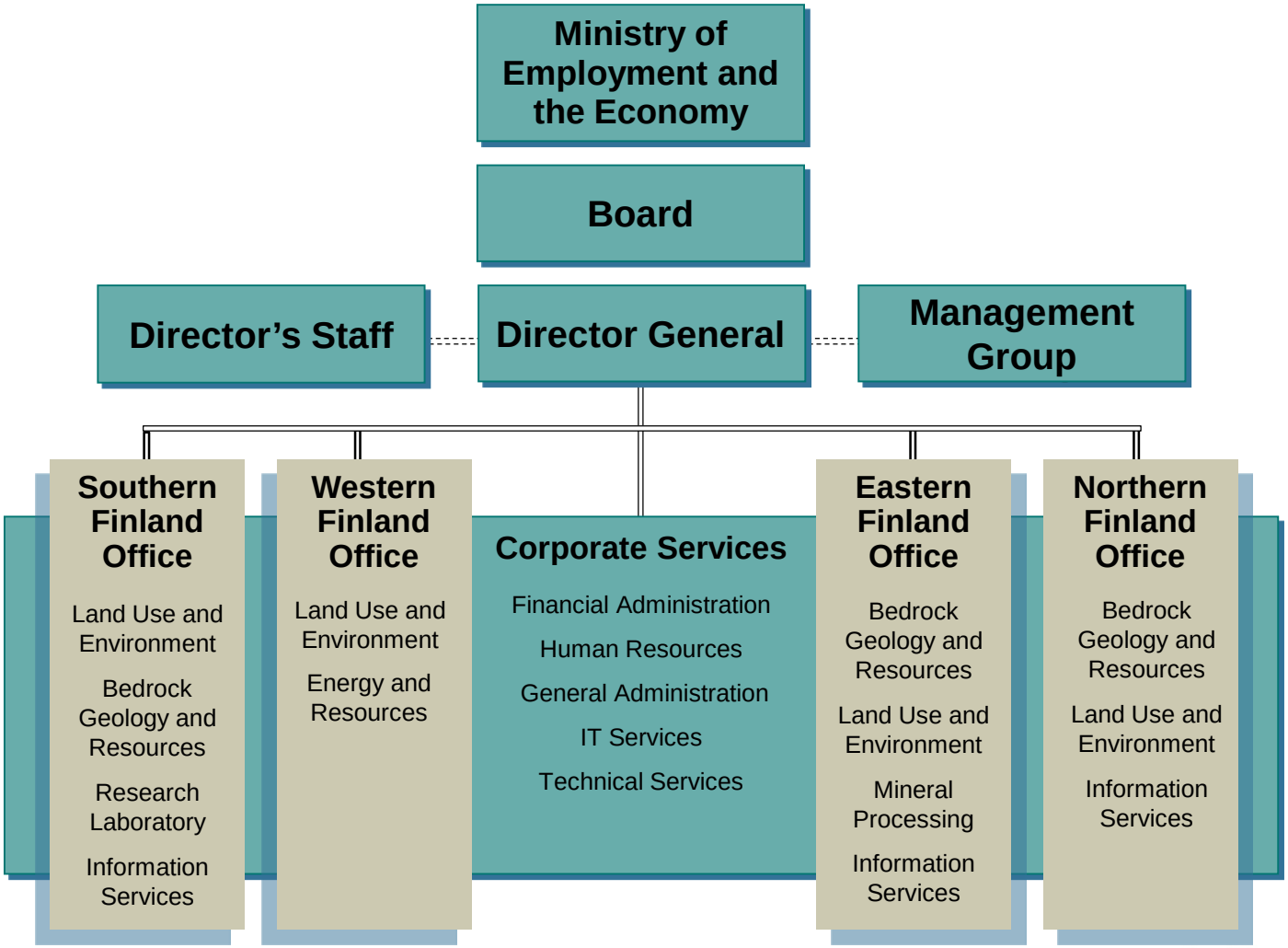
GTK's organisation 2014



GTK's staff on 1 January 2014

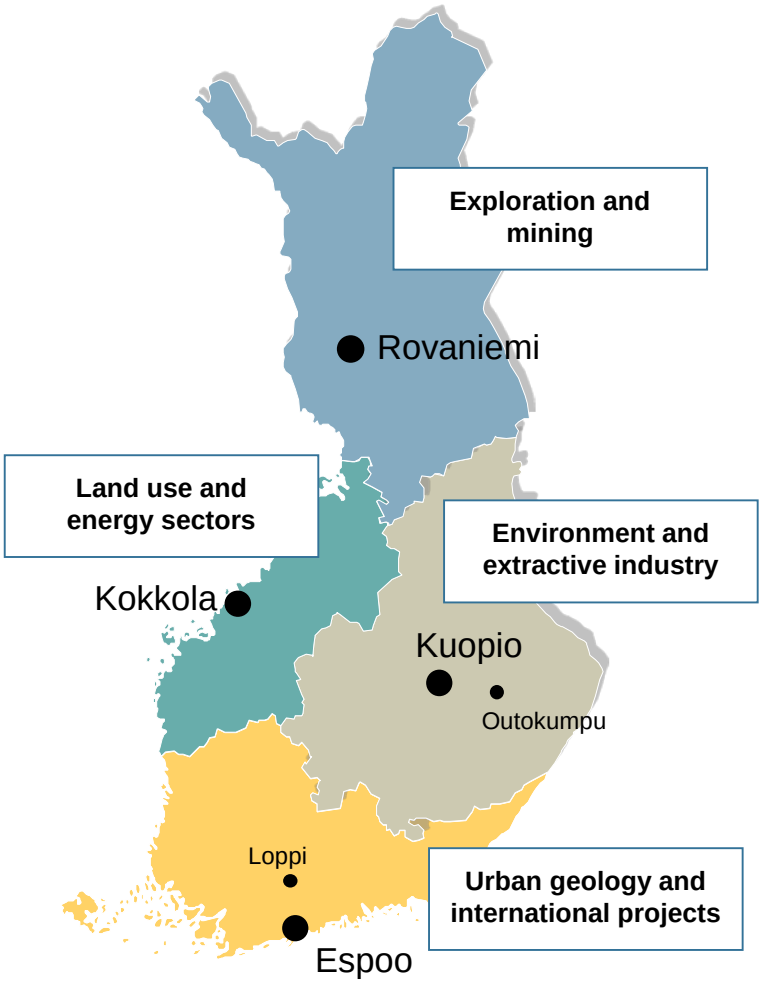
- Permanent staff
  - Southern Finland 237
  - Western Finland 35
  - Eastern Finland 189
  - Northern Finland 99

  560
- Temporary staff 24

  Total 584

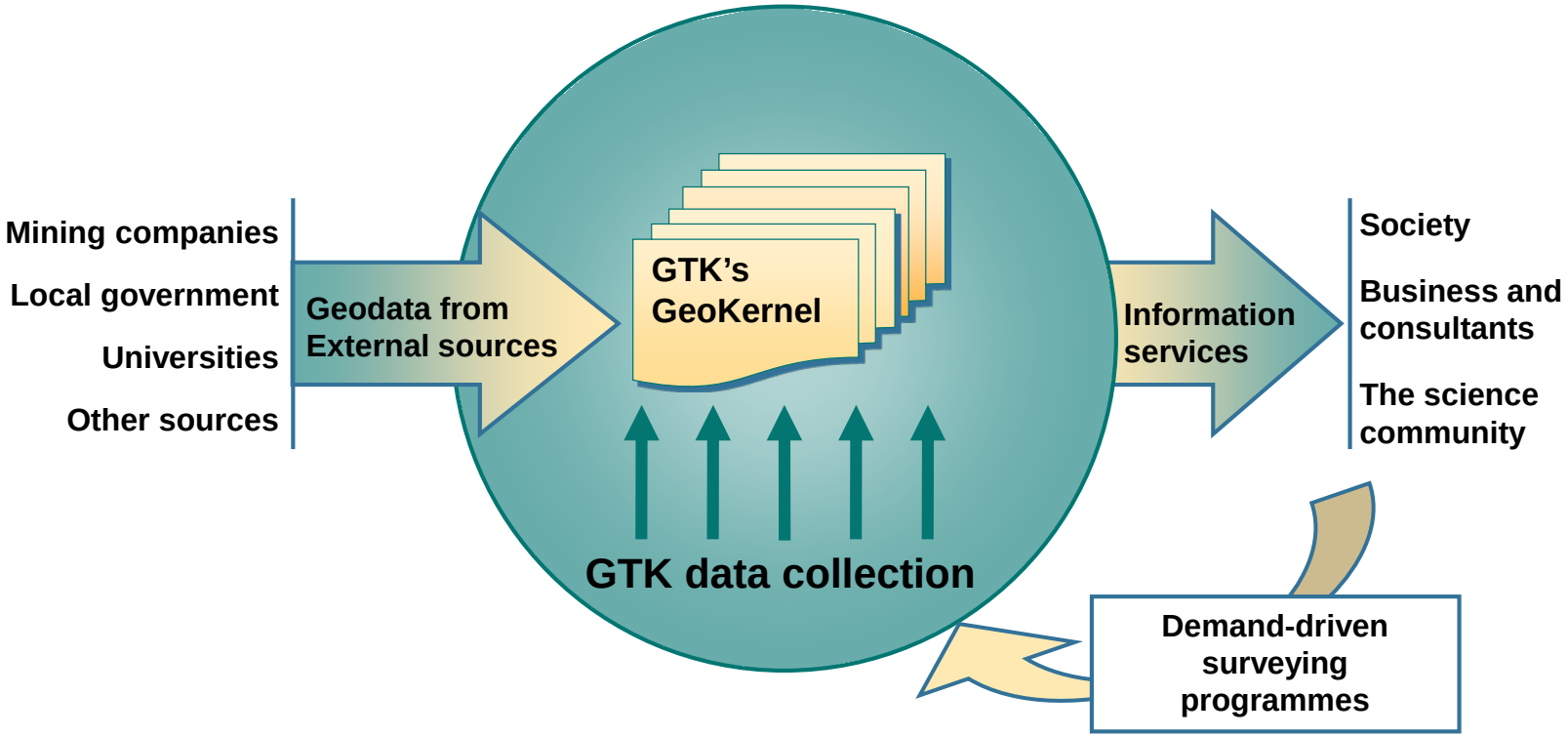
GTK's regional priorities and profiles

- Regional offices have close links to regional planning and the business sector.
- Research activities and services are defined on the basis of regional development plans and business priorities.
- Our major aims are to develop and maintain an internationally competitive business environment and to promote employment in regional counties.



GTK – national centre for geoscience data

Data acquisition - Information management - Web-based delivery

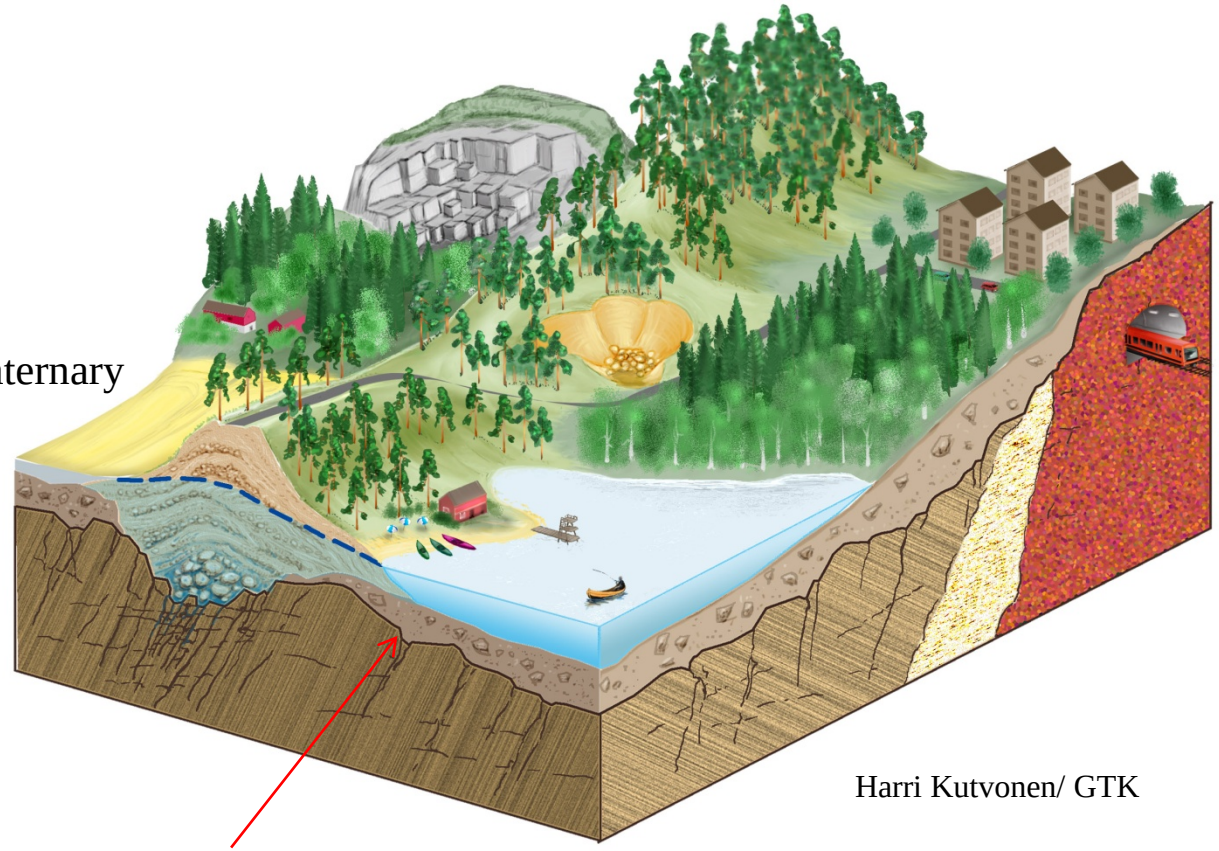


Introduction

- 3D-modelling in Finland has been traditionally related to ore modelling and evaluation
- New applications have been introduced in recent years
  - Eg. Regional, local and site scale 3D-models, Nuclear waste site models at Olkiluoto
- Computerized 3D ore modelling has been done since 1980.

Main geological units in Finland

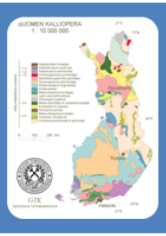
(Very) brief stratigraphy of Finland



Applications

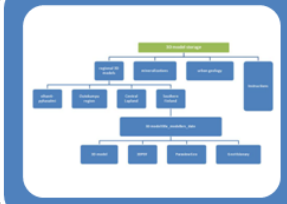
- Main research themes that use 3D-modelling in GTK are:
  - Ore exploration
  - Environmental investigations
    - Environmental studies in mining sites
  - Groundwater
    - Flow modelling and (reactive) transport modelling
  - Urban geology

3D geological model storage at GTK



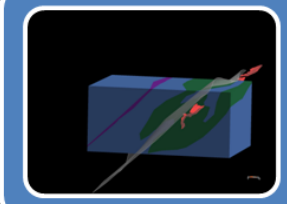
Geological map of Finland (bedrock and surficial deposits)

- locations of areas for 3D geological models
- a short description available
- a link to the 3D model storage
- planned for 2015



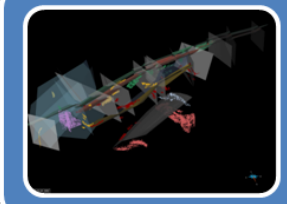
Presently, 3D models can be saved

- as projects of the specific modeling software
- with a short description
- as 3Dpdfs , Paraview projects, Geovisionary projects or software specific visualizations



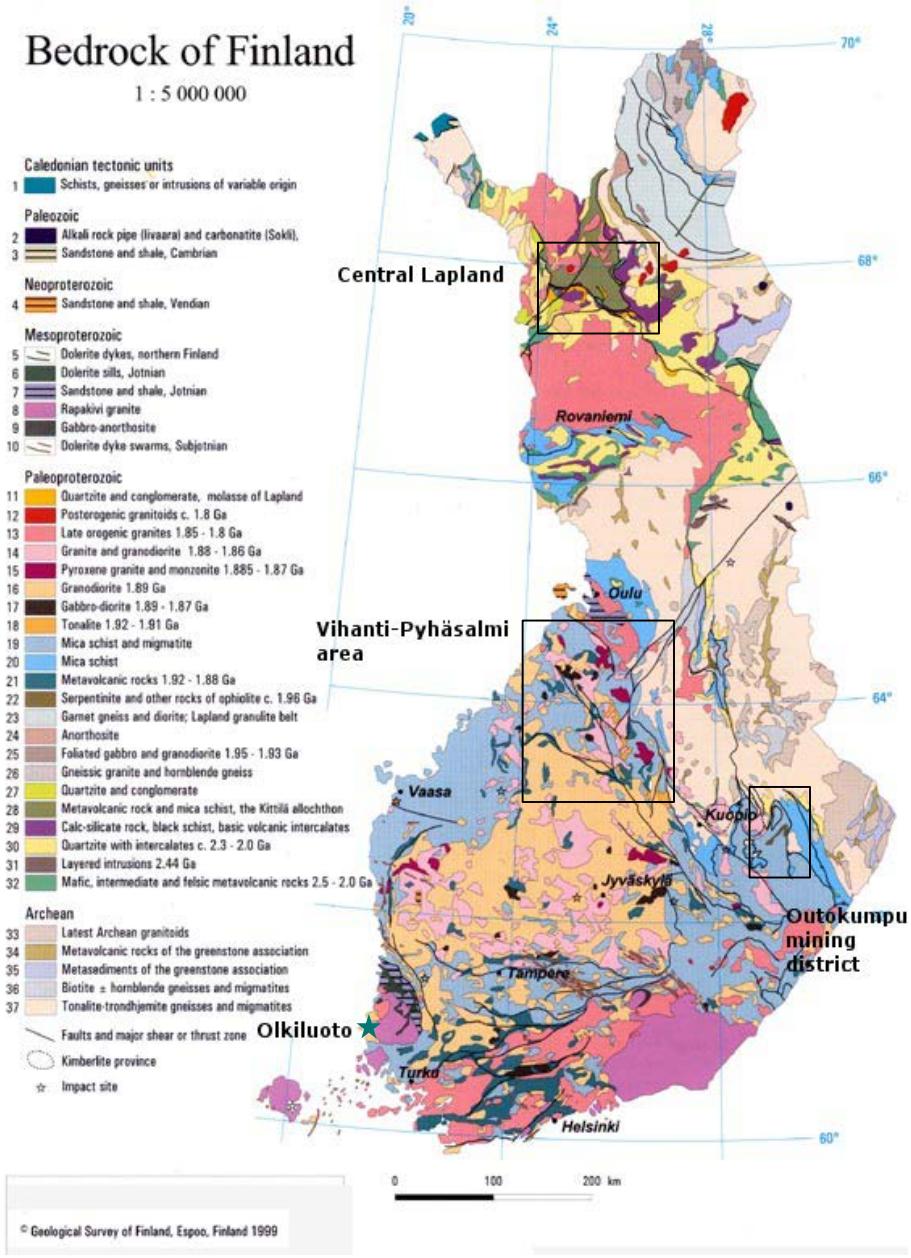
Public webpages of GTK (Geological Survey of Finland)

- geological maps of Finland showing the locations of selected 3D models
- 3Dpdfs of the selected 3D geological models
- planned for 2015



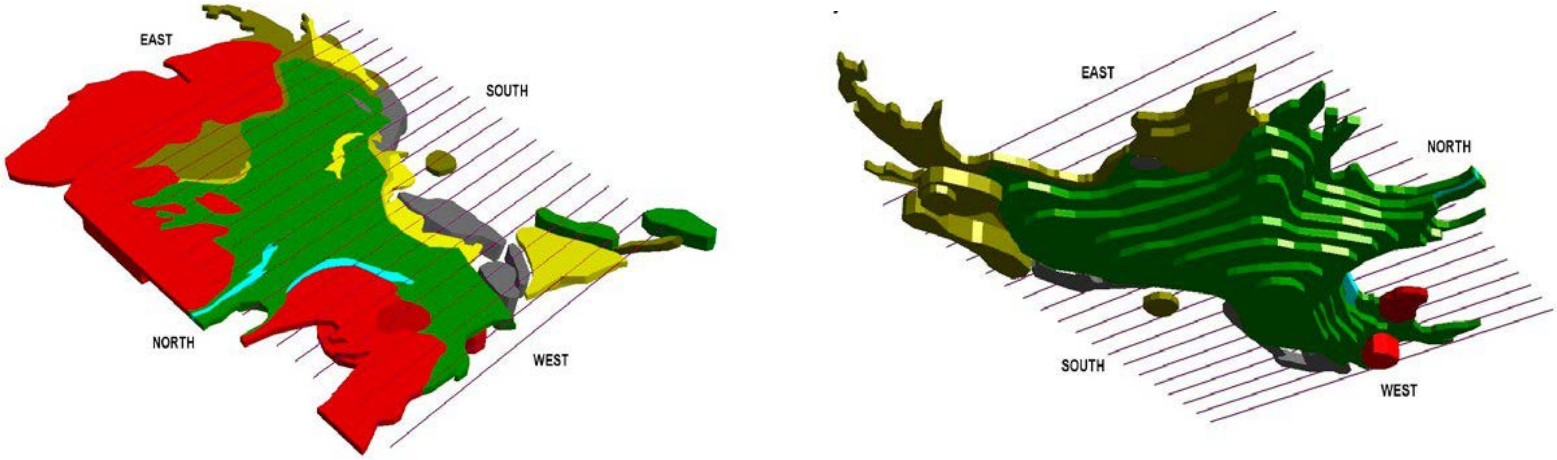
Possible future 3D database

- finalized regional 3D modeling projects, e.g. Lapland and Outokumpu area



Regional 3D modeling targets & Olkiluoto nuclear waste site (under construction)

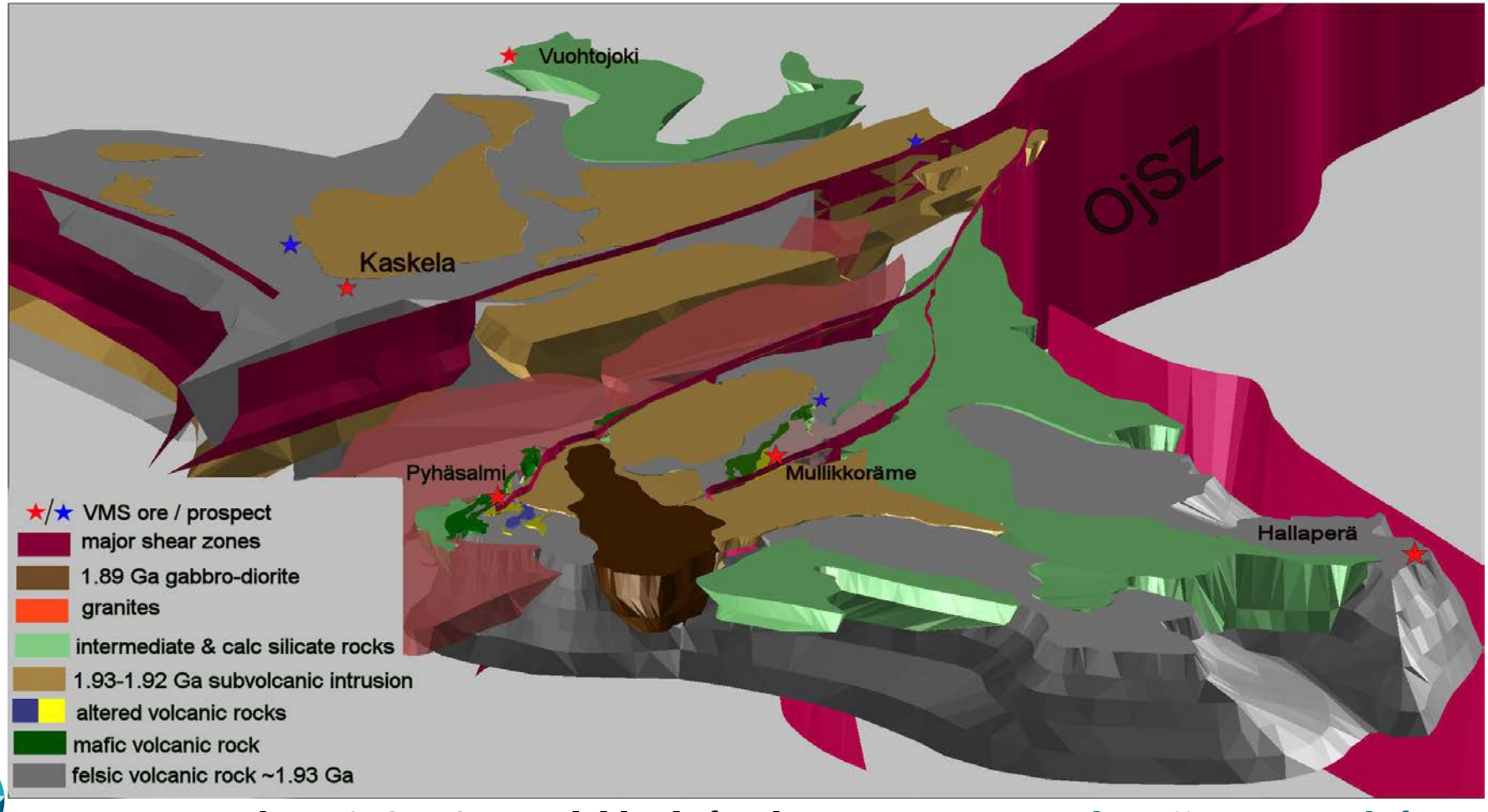
An example from central Lapland



3D model of the Kittilä terrane and surrounding geological blocks used in the modeling. View from the northwest and Kittilä terrane gravity model from the northeast. Modeling profiles are presented in both images.

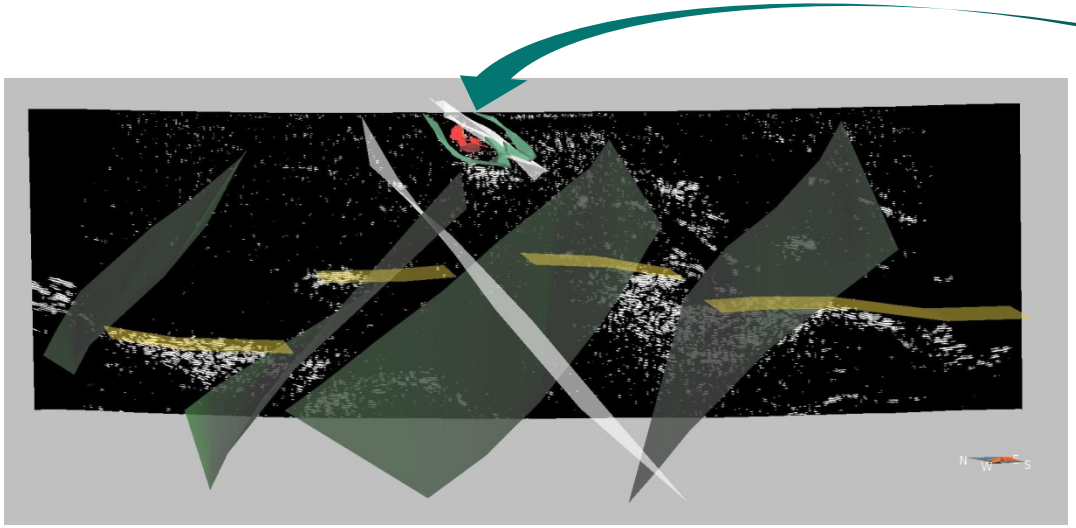
Tero Niiranen, Ilkka Lahti and Vesa Nykänen, 2014. 3D model of the Kittilä terrane and adjacent structures. In: 2014 Central Lapland Greenstone Belt 3D modeling project final report edited by Tero Niiranen, Ilkka Lahti, Vesa Nykänen and Tuomo Karinen. Geologian tutkimuskeskus, Tutkimusraportti 209 – Geological Survey of Finland, Report of Investigation 209.

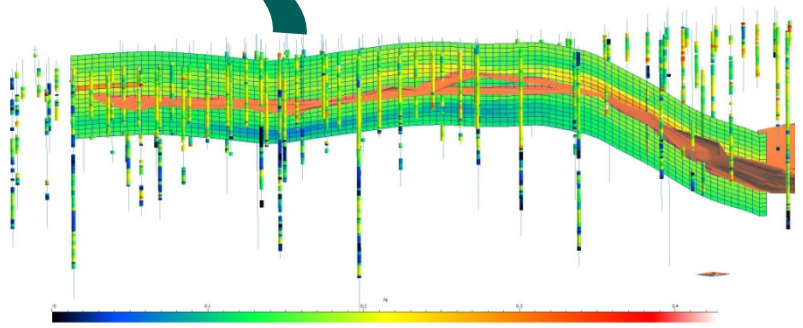
An example from Pyhäsalmi-Vihanti region



By Jouni Luukas 2013, a 3D model built for the ProMine project http://promine.gtk.fi

An example from the Outokumpu area



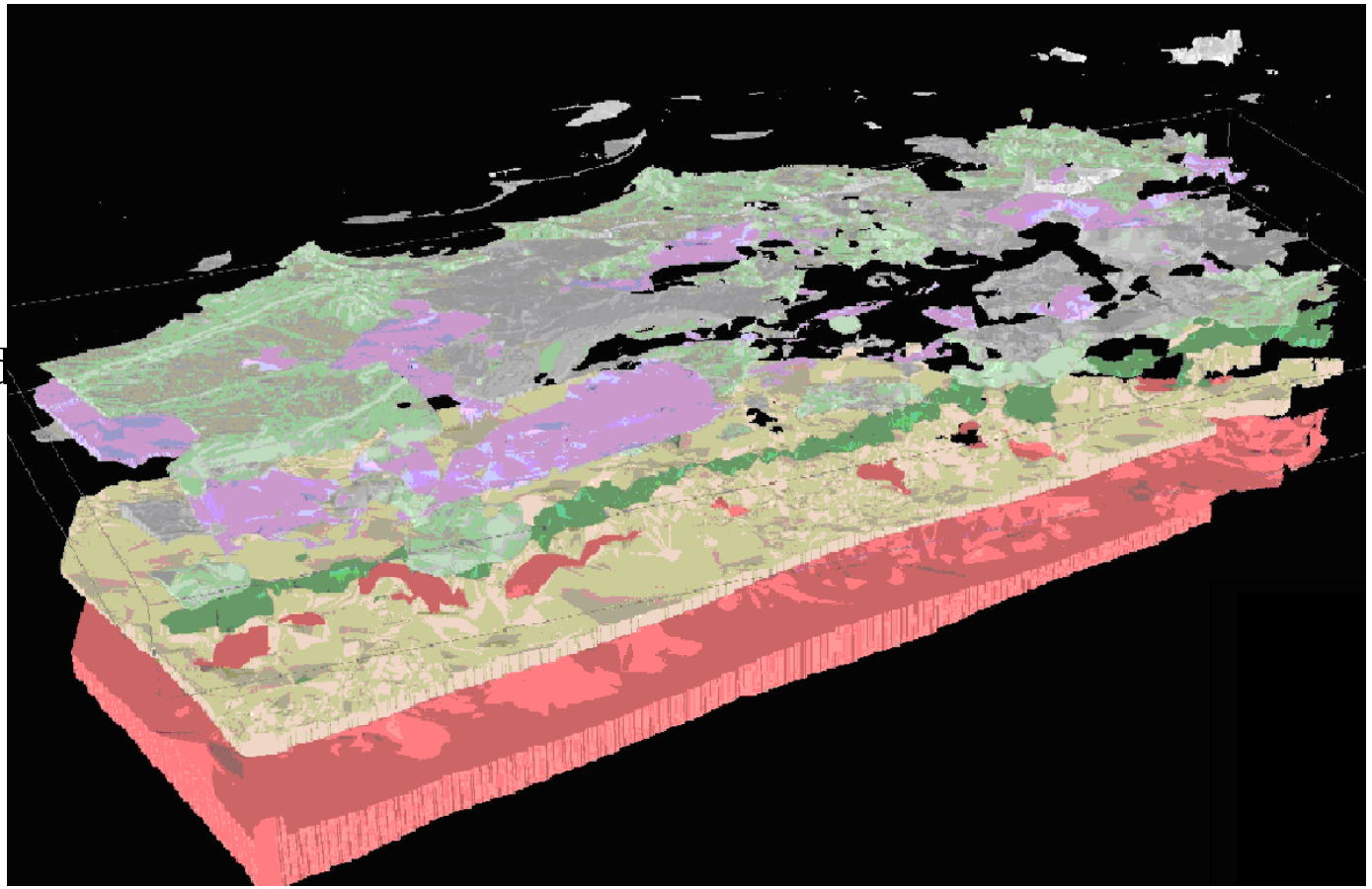


Laine, E. (ed.) 2012. 3D modeling of polydeformed and metamorphosed rocks: the old Outokumpu Cu-Co-Zn mine area as a case study. Geological Survey of Finland. Report of Investigation 195, 77 pages, 66 figures and 1 table

Applications

- Groundwater

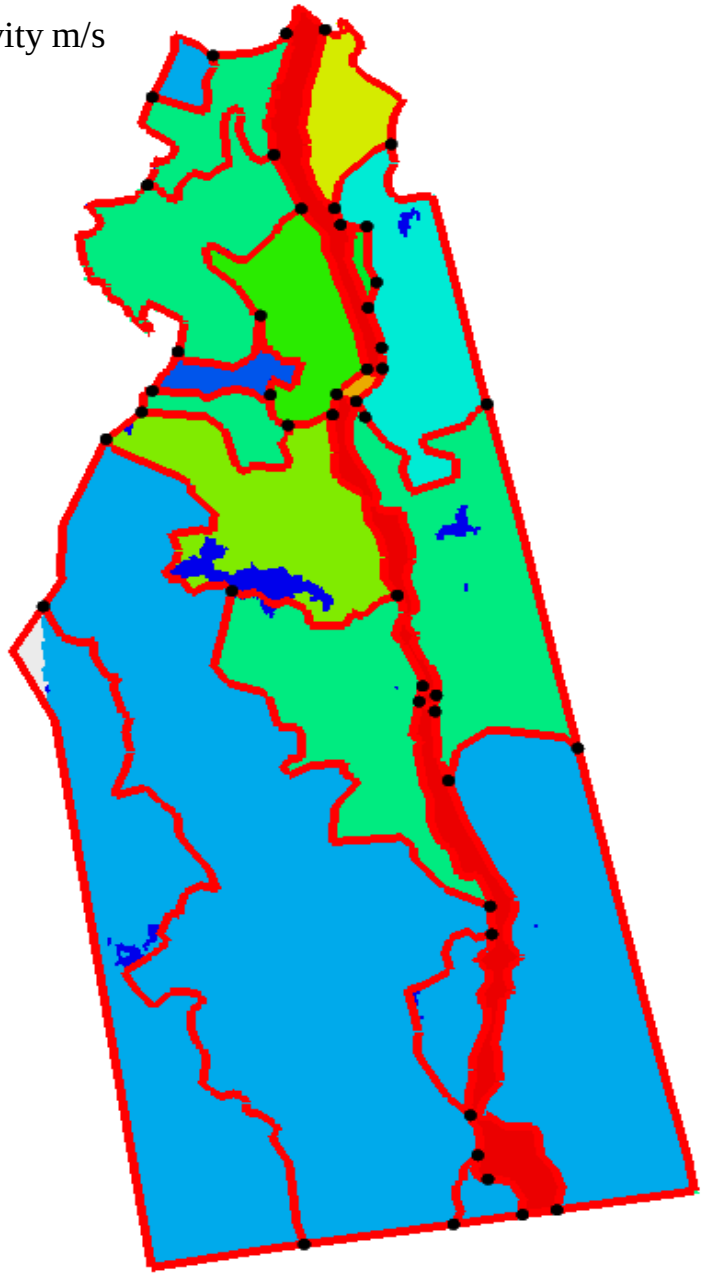
- Patamäki,
  Kokkola,
  Western Finland



The Patamäki 3D geological model of Patamäki groundwater area (red = bedrock, light brown = moraine, dark green = gravel, lila = silt, light green = sand, darker light green = fine sand) (Okkonen et al., 2011)

Applications

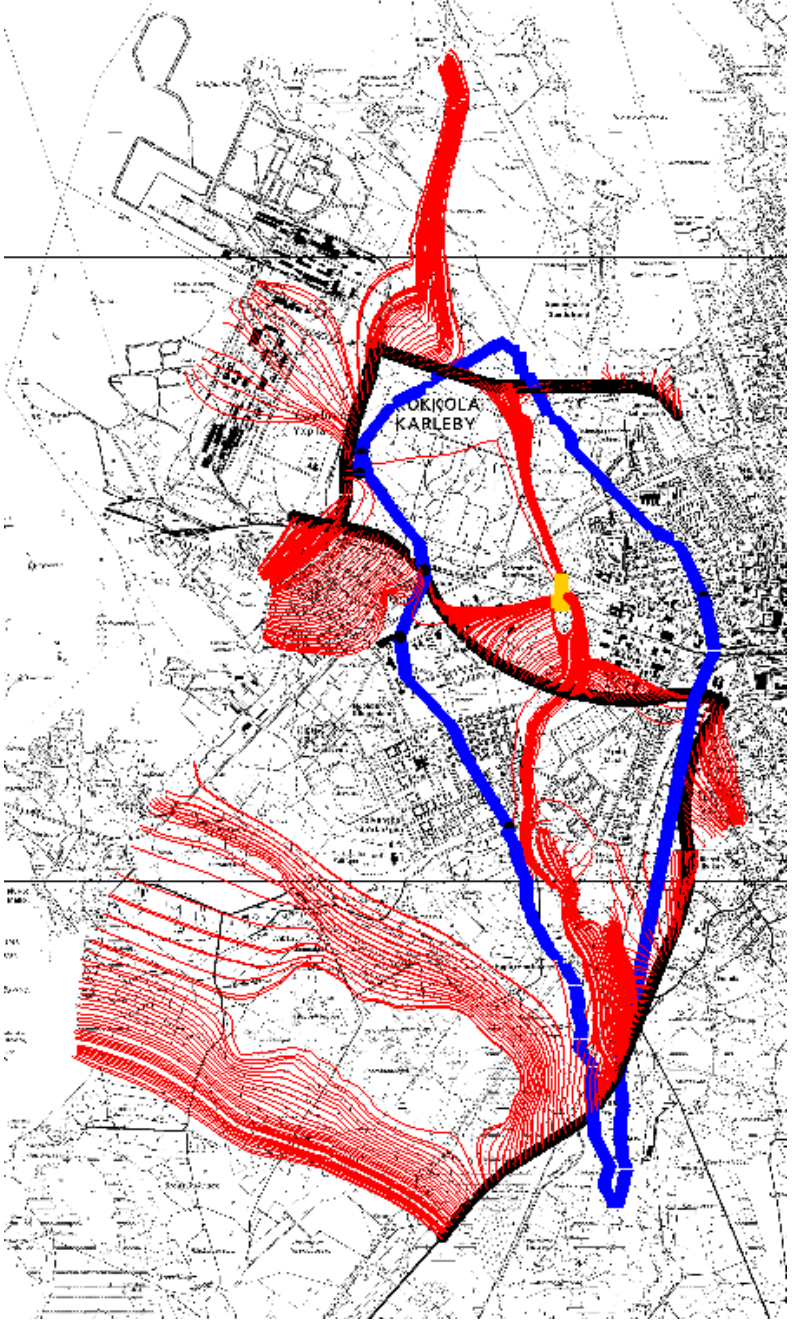
- Groundwater
- Patamäki: hydraulic conductivity



Hydraulic conductivity in the Patamäki area (Okkonen et al., 2011).

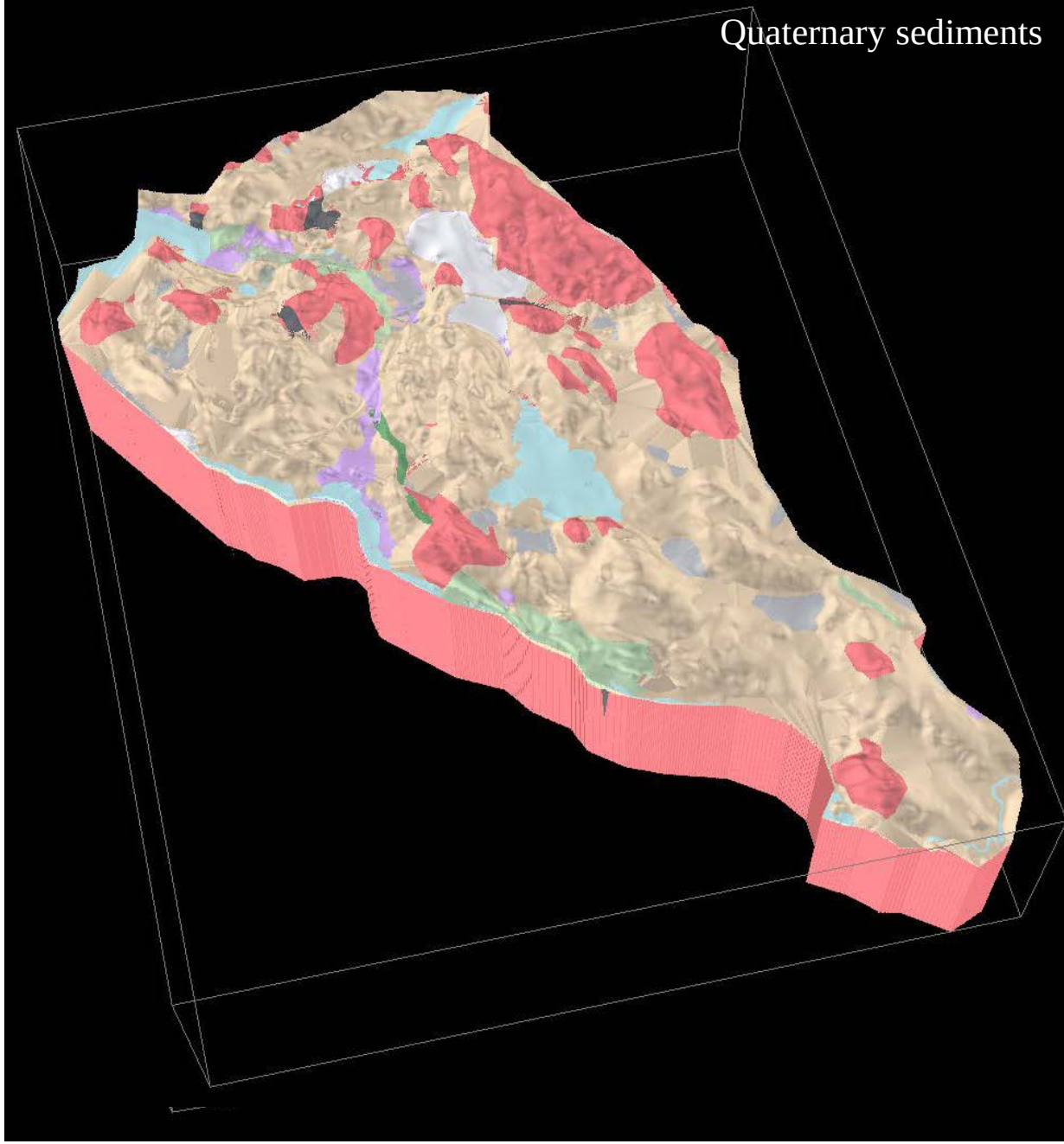
Applications

- Groundwater
- Patamäki: accident scenarios (Okkonen et al. 2011)



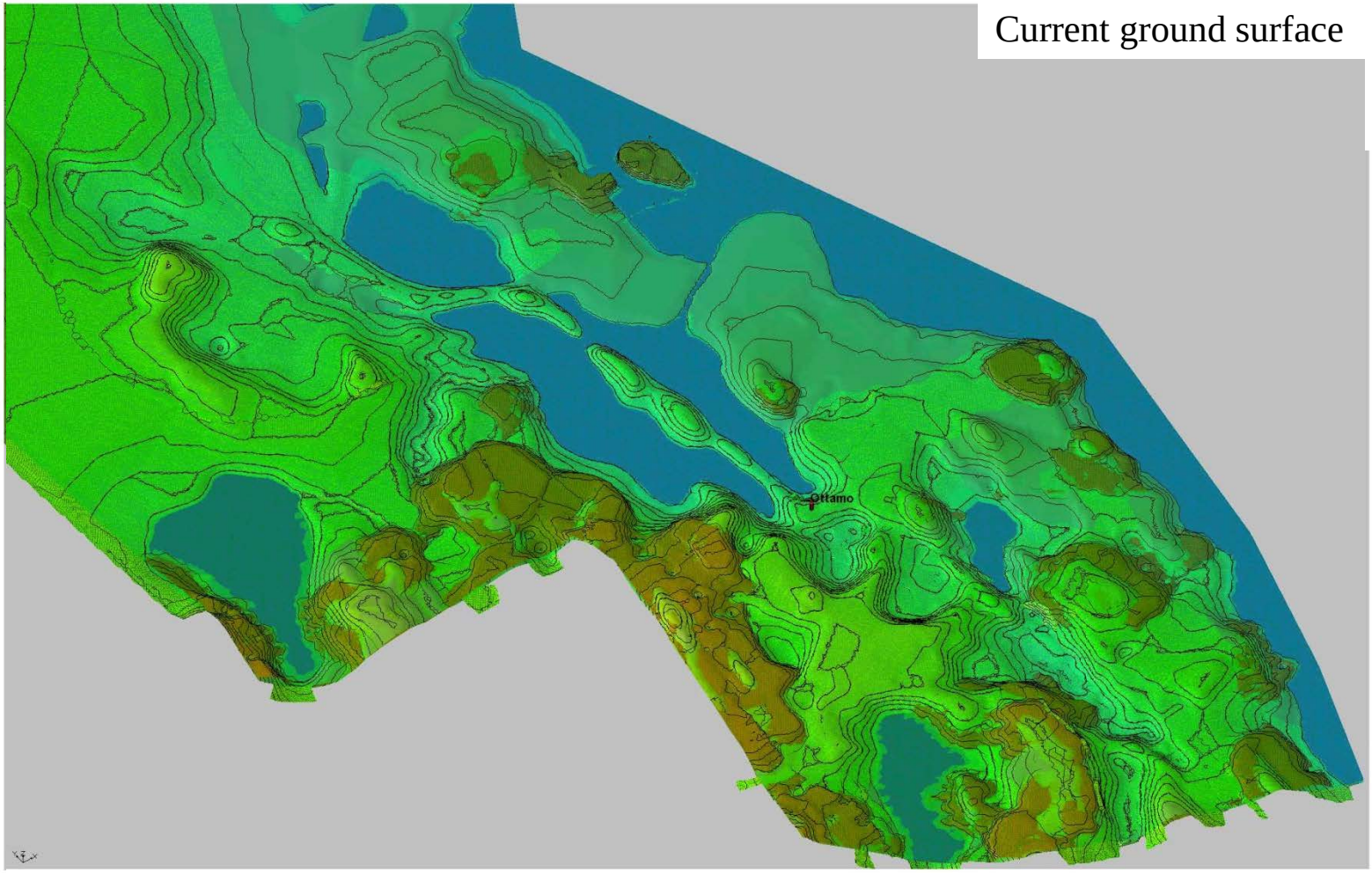
Applications

- Mine environment/ groundwater
- Luikonlahti Mine, Kaavi, Eastern Finland (Pasanen et al, 2012 in prep.)



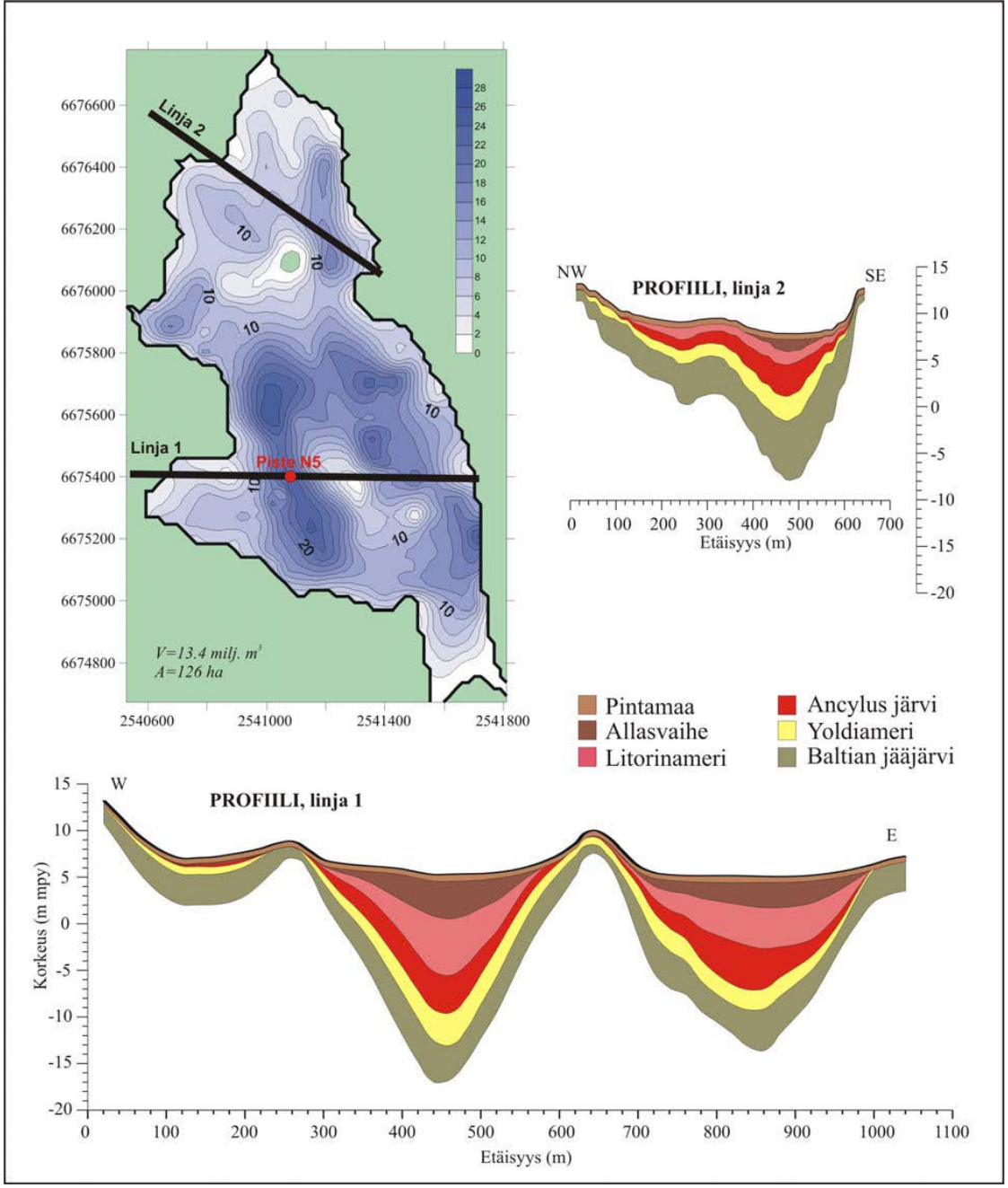
Applications

- Groundwater
- Pursiala, Mikkeli, Eastern Finland (Hyvönen et al. Pers. Comm)



Applications

- Urban geology
- Suurpelto, Espoo

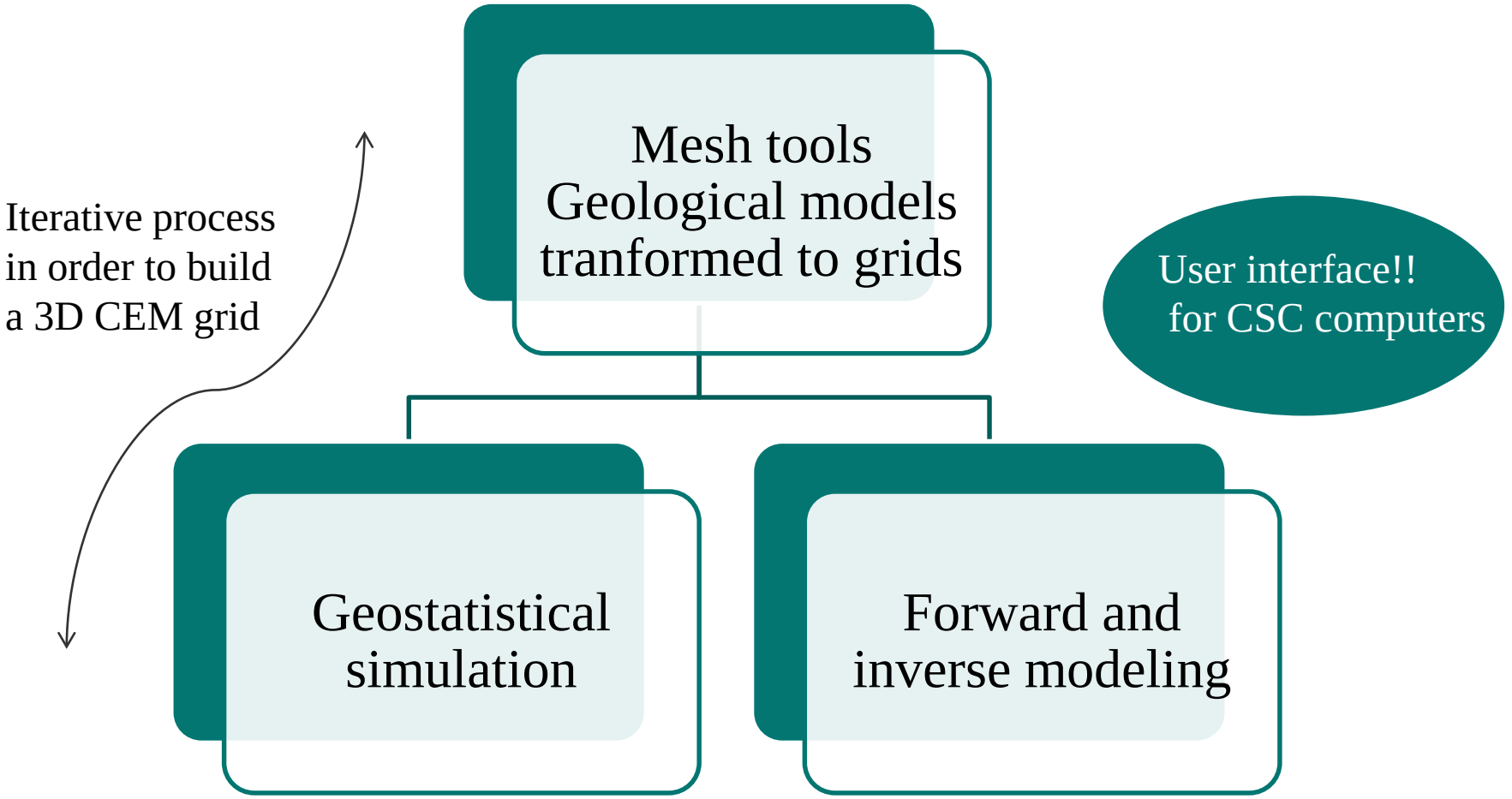


The thickness of fine sediments in the Suurpelto area and geological cross sections along the marked lines (Ojala et al. 2007).

Future

- Regional 3D database of selected targets?
- More numerical 3D modeling using CEM
- Development of 3D modeling practices

A work flow for high performace computing



Fracture simulations