XSodex

Experiment of Sodankylä Deep Exploration

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XSoDEx project plan

- Project aims to gain better understanding of the mineral systems by creating a 3D geologic regional model of the Sodankylä area
- Acquisition of deep penetrating data:
 - Reflection seismic surveys
 - Audio-magnetotelluric (AMT) surveys
 - Refraction seismic data
 - Gravity data
- Constraining interpretation and modeling with petrophysical measurements



XSoDEx Survey Lines



- one of the most important and most active mineral exploration areas in Scandinavia
- to study structural and lithological framework in depth to achieve a better understanding of the mineral system
- possibly finding linkage of the two major mineral deposits (Sakatti & Kevitsa)
- connect seismic reflection data previously acquired in the layered mafic intrusions to the orogenic gold deposits
- a completely new view on the two different geological environments and their structural relationship.



A: Crustal architecture of the Archean basement, eastern contact of Kittilä Suite at XSoDEx survey lines Petäjäselkä, thickness of overlying Proterozoic units 62000 502000 extending furthern north to Pomokaira 7520000 **B:** Suspected NE-SW striking shear zone possibly extending to (E.) through Pahtavaara Pahtavaara C:Koitelainen 500000 intrusion, orientation, 500000 thickness, relation to Archean basement & Sakatti Salla Group rocks D: Orientation and dips S-vergent thrust sheets of Savukoski Group, E: SE contact of Kittilä Suite, hosting also **2.05 Ga Kevitsa type** intrusions as well as 2.2 Ga mafic thickness of Savukoski Group 502000 komatiites, indications on structural sills. Thickness of Sodankylä & Kuusamo Groups in the south control of Pahtavaara deposit

Project partners

- GTK
 - Coordinates the project
 - AMT measurements, processing and interpretation
 - Participates seismic data acquisition and processing
 - Petrophysical measurements will be done in GTK laboratory
 - main responsible for data interpretation and 3D modeling
- **TU Bergakademie Freiberg**
 - Provides Vibroseis source and receivers (Geodes) to the project
 - Is main responsible for seismic data acquisition (field crew) and seismic data processing
 - provides advanced seismic imaging software and computing resources
 - Participates in data interpretation and 3D-modeling
- Oulu Mining School and Sodankylä Geophysical Observatory



- Provides Sercel Unite wireless recorders to be used for collection of refraction, long offset and/or cross-line data (40 3C receivers, 60 1C receivers)
- Participates data acquisition and processing
- Participates in data interpretation and 3D-modeling





How? Seismic reflection survey principle





How?

- ... having 15 Geodes, each 24 geophones (total of 360 channels) with 10 m spacing
- ...recording seismic signal produced by the Vibroseistruck (shot spacing 40 m)
- ... having 2 teams (7 people/team) operating the seismic reflection acquisition system and moving geophones 6 days a week
- measuring approximately 3.6 line-km of seismic reflection data per day for 2 months,
 - Goal: 150 km of seismic reflection profiles
- ...simultaneously with reflection seismic data, acquiring refraction seismic data by using wireless receivers



Why?

- ... seismic reflection survey? Because of methods superior depth penetration and resolution
- ... seismic refraction measurements? Because velocity information of subsurface is valuable as it is, and also because it can be utilized to improve reflection data processing



- ... AMT measurements? Because information about conductive subsurface features can be used to better understand geology and might lead to new exploration targets
- ... gravity measurements? Because combining it with seismic reflection profiles is expected to increase our understanding of subsurface density distribution
- ...petrophysical measurements? Because information about physical properties of rocks is crucial for all geophysical data interpretation



HIRE seismic reflection surveys (2007-2010)





Building a 3D model of lithological contacts and nearmine structures in the Kevitsa mining and exploration site, Northern Finland: constraints from 2D and 3D reflection seismic data





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Schedule

- Survey planning spring 2017
- Seismic data acquisition 3.7.-3.9.2017
- AMT data acquisition summer-autumn 2017
- Gravity data acquisition autumn 2017 spring 2018
- Processing, interpretation and modeling during 2018
- Project completed by the end of 2018







19.6.2017

Thank you for your attention!

