

Resistivity survey of Grímsvötn

Arnar Már Vilhjálmsson

Iceland GeoSurvey

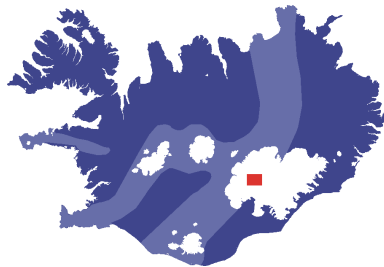
GEORG - General Assembly
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Overview

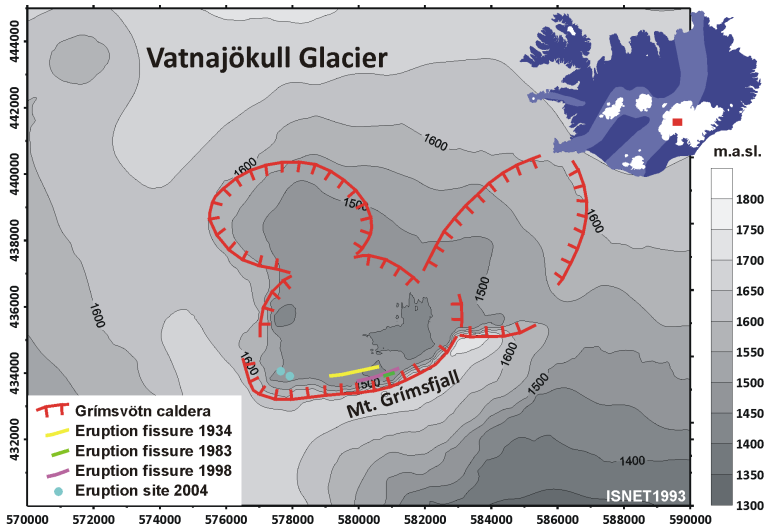
- 1 Introduction
- 2 Existing data
- 3 Resistivity
- 4 Method
- 5 Summary

The study area - Grímsvötn



- High temperature geothermal field
- The most active volcano in Iceland
- Located within Vatnajökull glacier
- Covered with 300 – 600 m thick ice
- Overlying ice acts as calorimeter
- Thermal output 2000 – 4000 MW

The study area - Grímsvötn



Main objectives of the project

- To map the spatial extend and depth span of resistivity anomalies within the Grímsvötn geothermal system
 - Calorimeter exists for Grímsvötn allowing comparison with other high-temperature geothermal systems
- To map the location and extent of magma bodies in the uppermost 3 – 5 km of the crust under the volcano
- To assess the thermal release from a pristine geothermal system for comparison with other geothermal systems under full exploitation

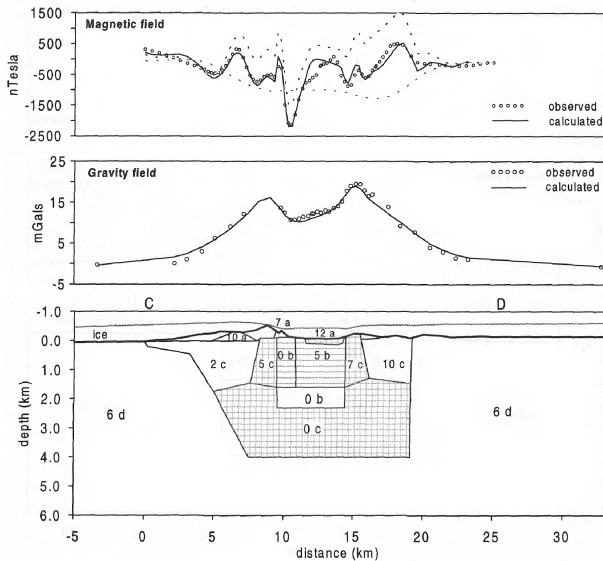
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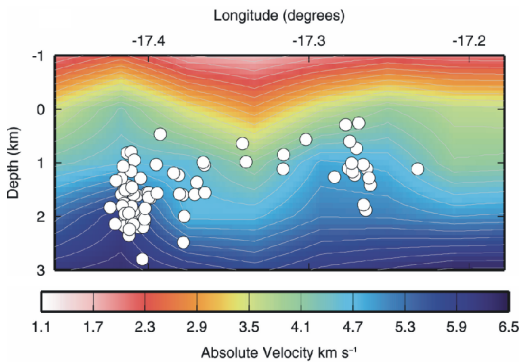
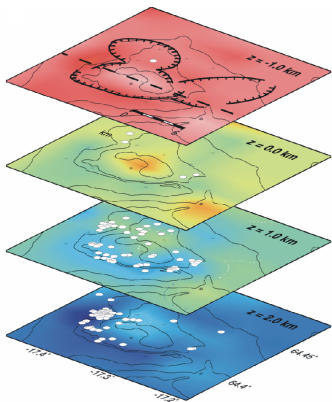
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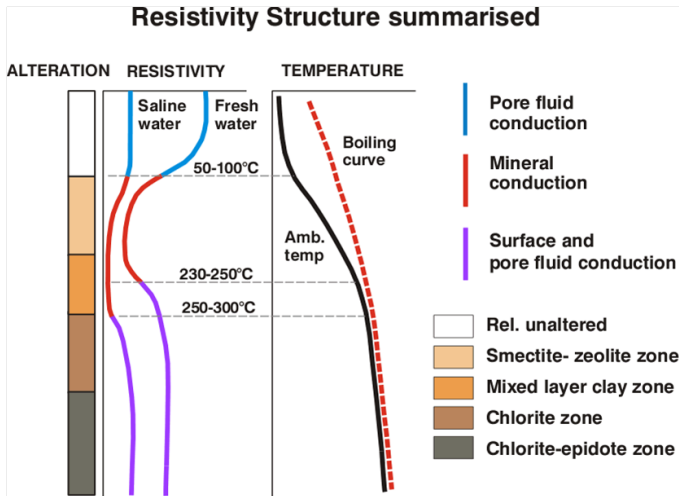
Gravity and magnetic data



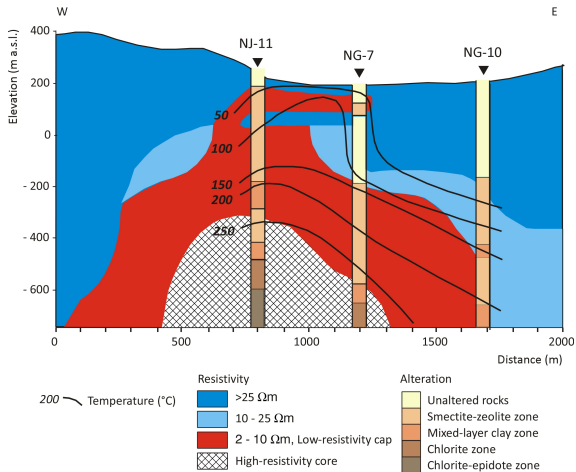
p-wave velocities



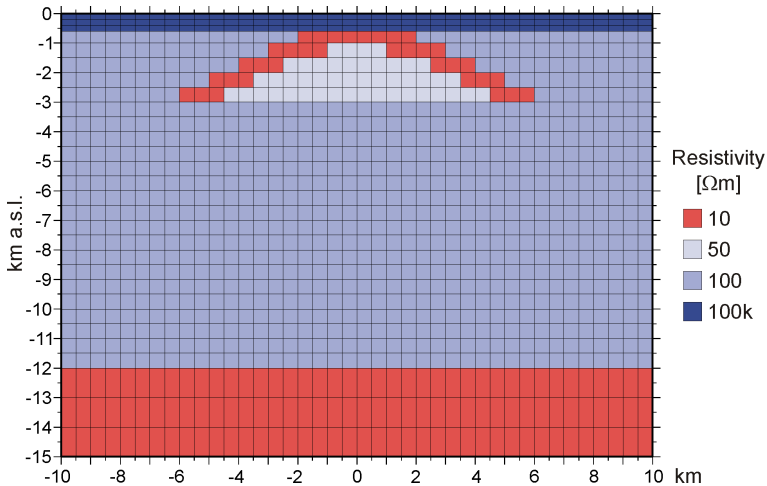
Alteration vs. resistivity



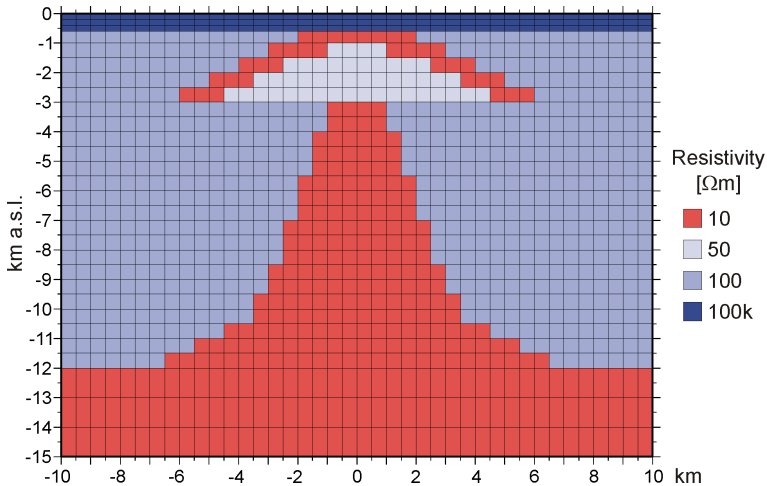
Example from Nesjavellir



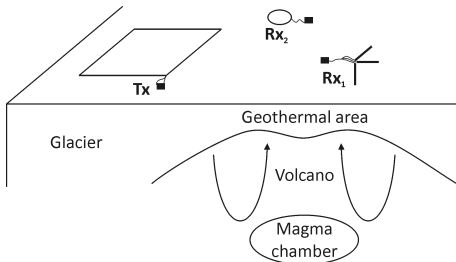
Grímsvötn - Simple model



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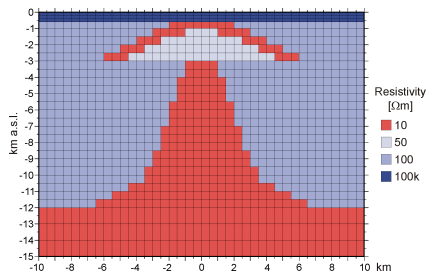
Data collection



- Two 3 weeks long resistivity surveys using LOTEM-method
 - 2×2 km source loop
 - 10 – 15 A square wave
 - TEM and MT equipment measures H_x , H_y and H_z
- ~ 300 sounding sites
- 3 – 4 source loop locations

3D inversion - Conceptual model

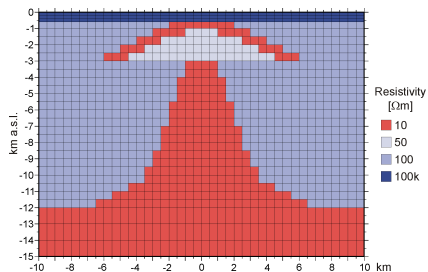
- Signal processing and inversion
 - 3D resistivity model



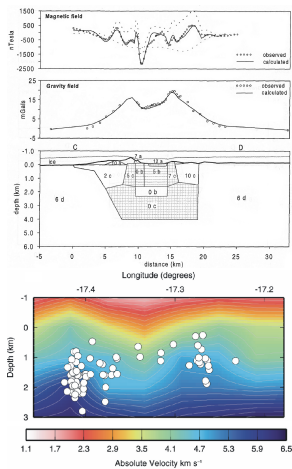
- Joint interpretation of resulting 3D resistivity model with other existing geophysical data

3D inversion - Conceptual model

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 - 3D resistivity model



- Joint interpretation of resulting 3D resistivity model with other existing geophysical data



Summary

Motivation

- Grímsvötn is amongst the most powerful high temperature geothermal areas in the world
- Resistivity structure of geothermal systems are very distinctive
- Resistivity survey has not been carried out in Grímsvötn

Expected outcome

- Deep insight into the Grímsvötn geothermal system
- Better understanding of geothermal systems in general
 - Study the interplay of volcanism and geothermal systems
 - How do volcanoes transfer heat, and how much, to the surface
- Initiate the use of LOTEM in Iceland

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