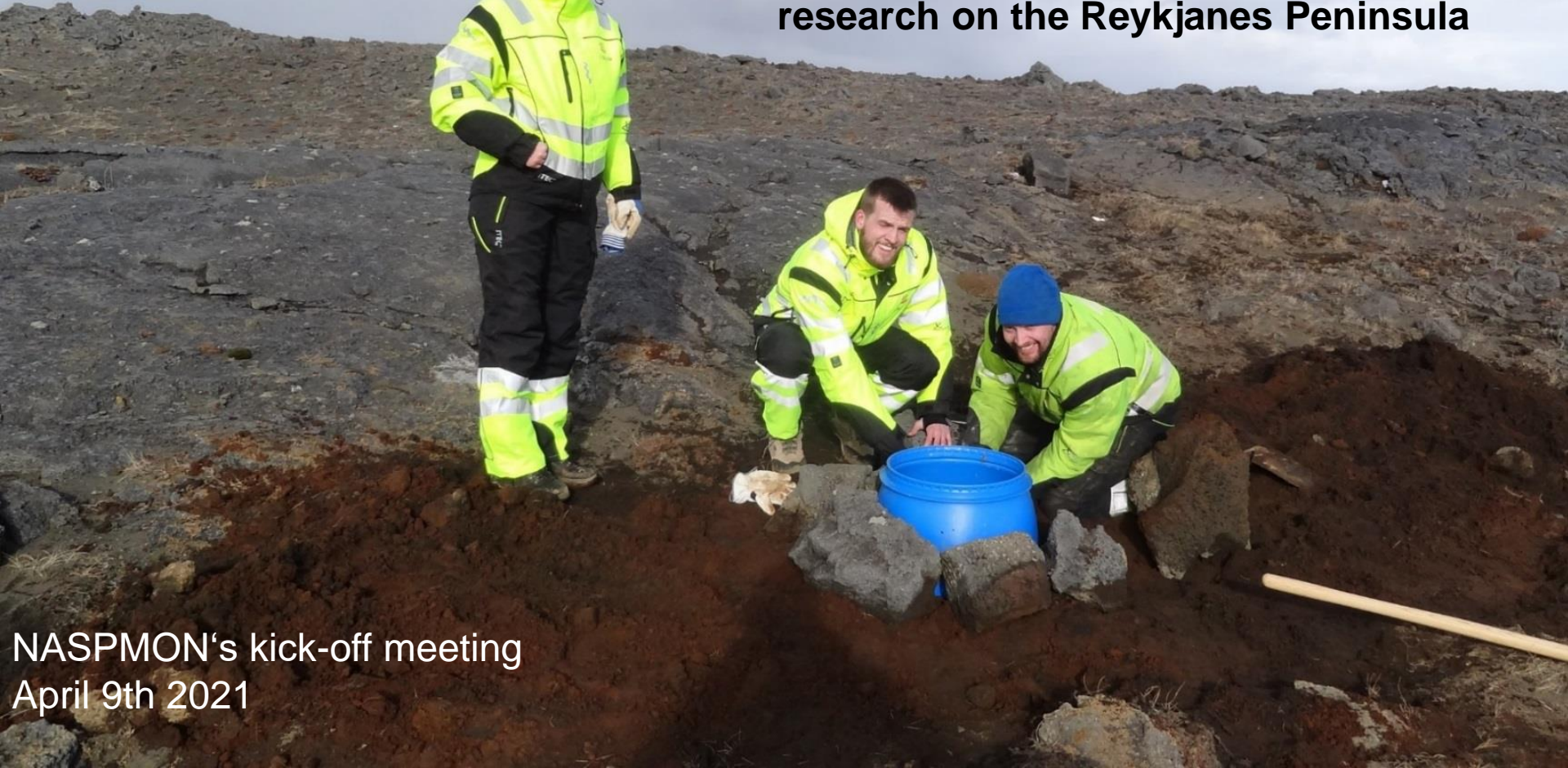
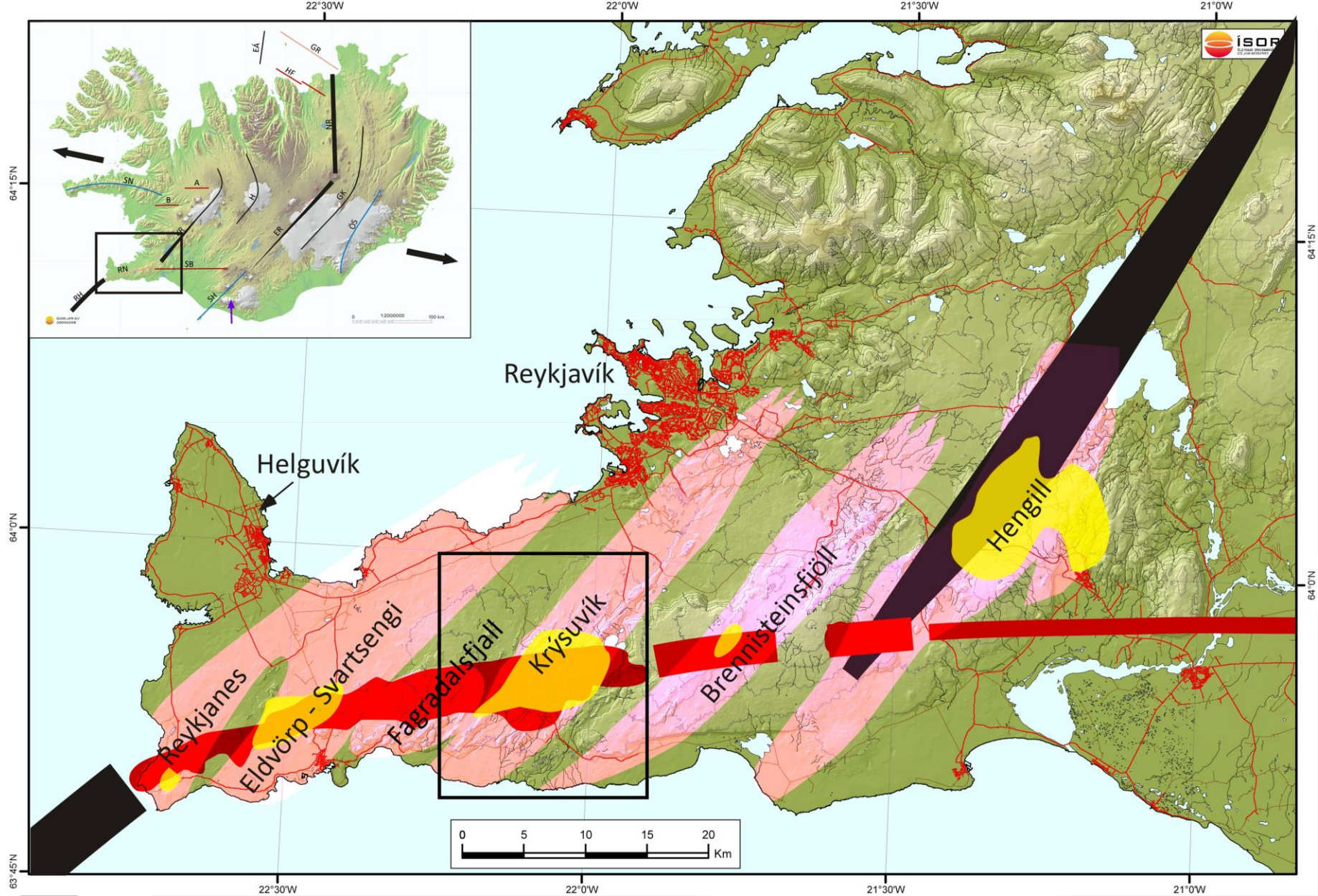


# Gylfi Páll Hersir, Þorbjörg Ágústsdóttir and Egill Árni Guðnason Iceland GeoSurvey

Seismological, geodynamic and geothermal  
research on the Reykjanes Peninsula



NASPMON's kick-off meeting  
April 9th 2021



NE-SW trending volcanic systems in pink. Geothermal fields in yellow at the centers of volcanic activity lining up within a seismic zone shown in red, which marks a trans-tensional plate boundary.

## What is so special about Reykjanes, besides the eruption?



An active obliquely rifting plate boundary of the American and Eurasian plates - consequence of rift and transform movement – Grímsey f. zone  
No magma chambers indicated nor calderas, quite primitive magma, no substantial deep seated low resistivity,

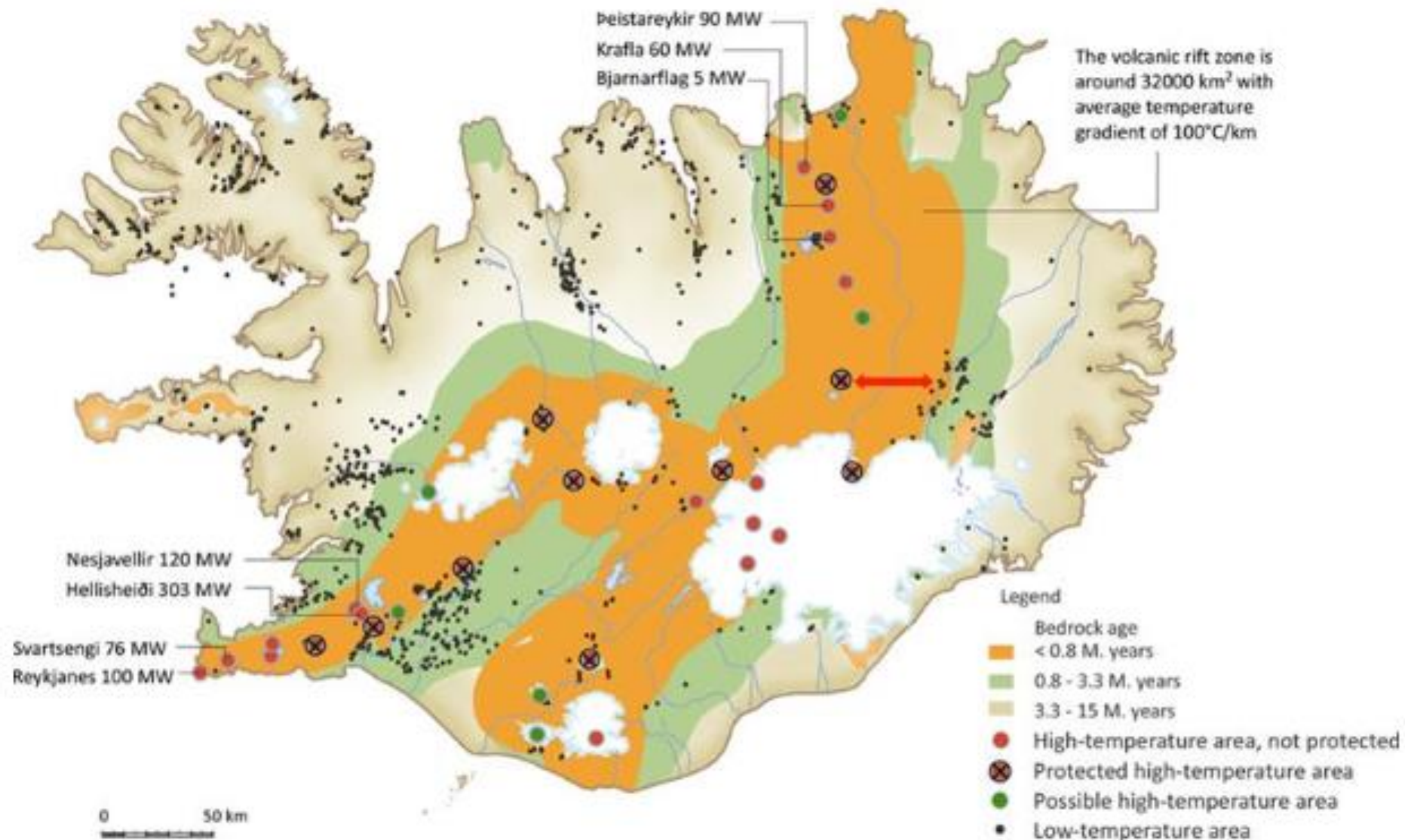


Extensive geothermal surface exploration studies exist from:  
Hengill, Krýsuvík, Brennisteinsfjöll, Svartsengi/Eldvörp and Reykjanes

- Geological (1:100.000), geochemical and geophysical
- Resistivity - 3D modelling of MT data, gravity, aeromagnetics, seismics
- Within NASPMON we do want to add geophysical data in the study area

Deep drilling: Hengill, Krýsuvík, Svartsengi/Eldvörp, Reykjanes

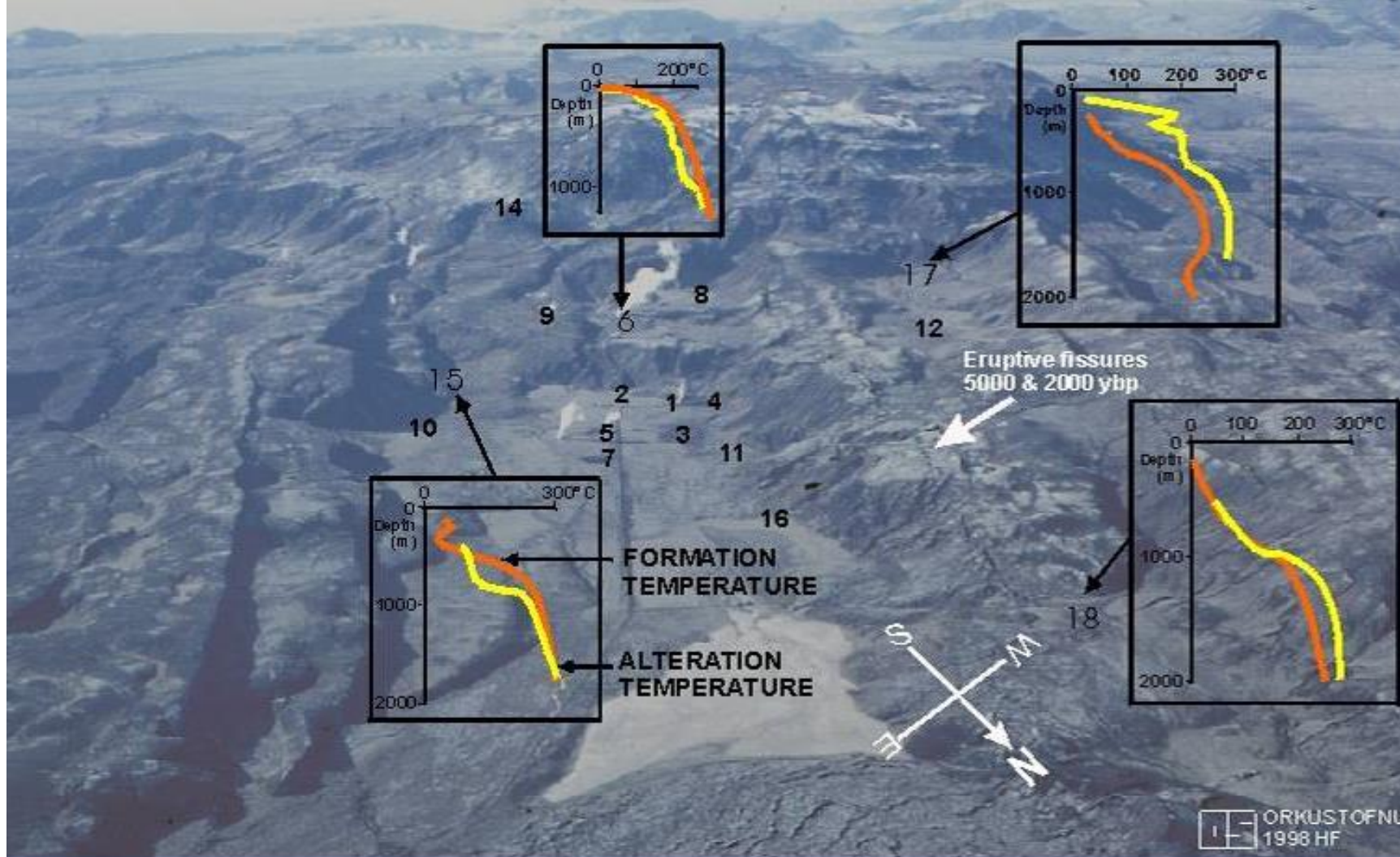




- Utilization of began in Hveragerði decades ago - Nesjavellir in 1990
- The Nesjavellir power plant (120 MWe, 340 MWt) and the Hellisheiði power plant (303 MWe, 200 MWt) opened in 2006
- Connected to the Hverahlíð subfield in 2016 with a steam pipe, where the most powerful boreholes in the Hengill area are located
- As of October 2020, there are 116 deep wells (> 1 km) drilled in Hengill. Of these, 63 wells are used for production and 20 for injection

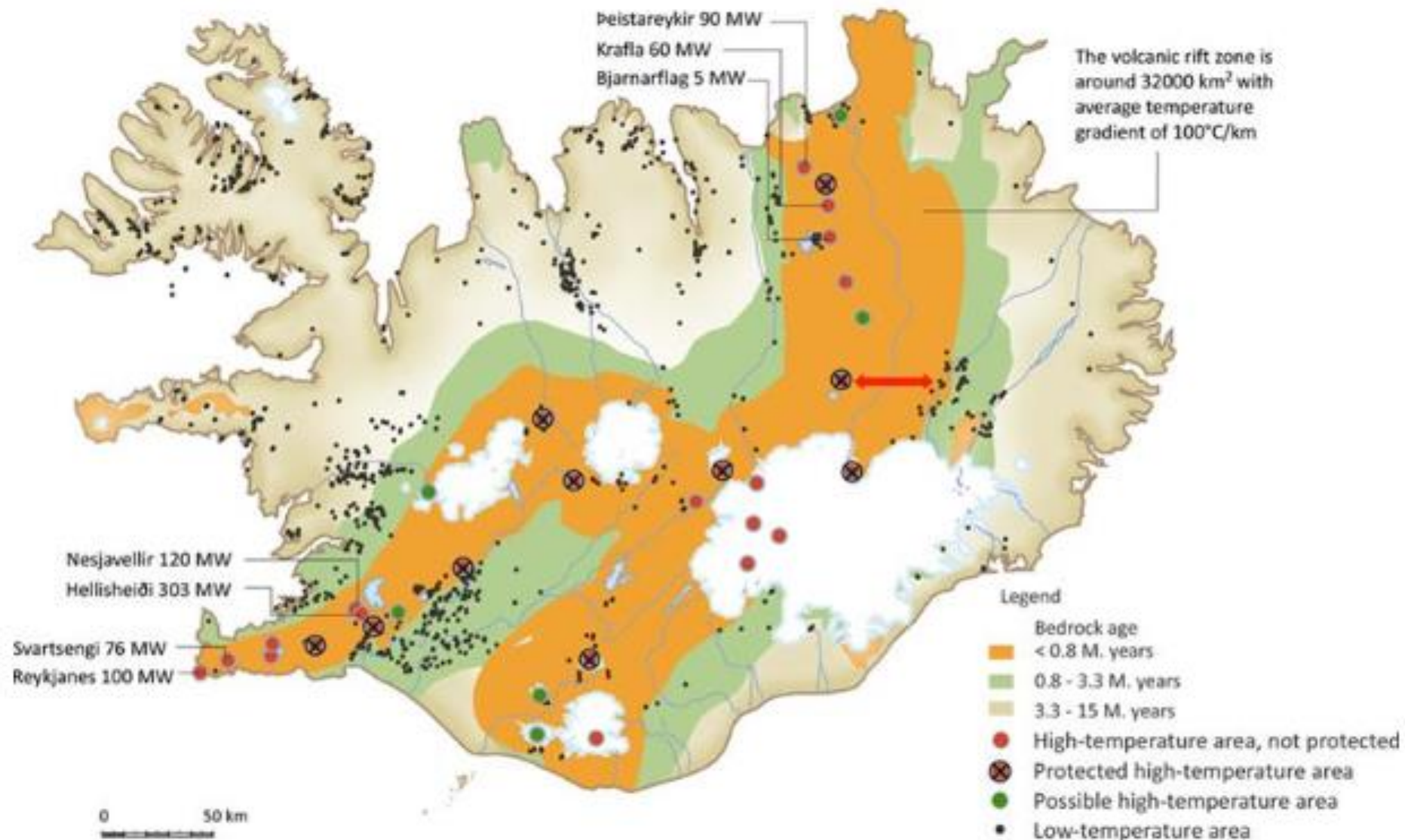


## Reykjavík Energy: Hengill



**Comparison of formation temperature and alteration temperature shows:**

- 1. Heating in southern part**
- 2. Cooling in western part**
- 3. Cooling/heating in east and north**





# HS Orka: Reykjanes Power Plant

Operating since 2006: 2 x 50 MWe



ÍSOR

ICELAND GEOSURVEY



## **Svartsengi:**

Beginning in 1976: 150 MWth

Beginning in 1978: 74 MWe

## Hengill

Seismic surveys - RE

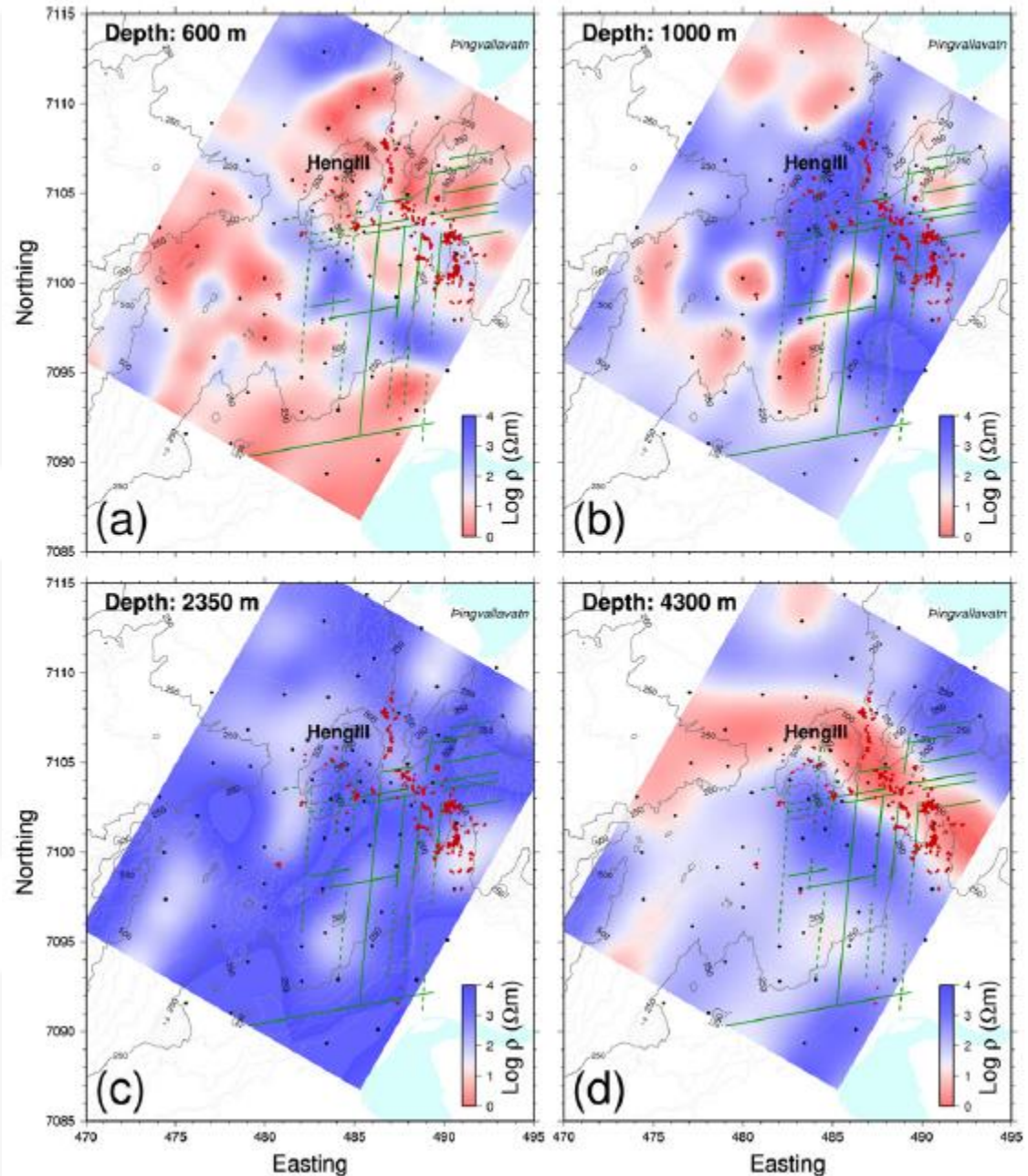
Resistivity – horizontal slices  
at different depths, based on 3D  
inversion of MT data

Red dots: geothermal surface  
manifestations

Black dots: MT soundings;

Green lines: faults inferred from  
seismic data

Taken from Árnason et al., 2010



22.7° W

22.3° W

22° W

21.7° W

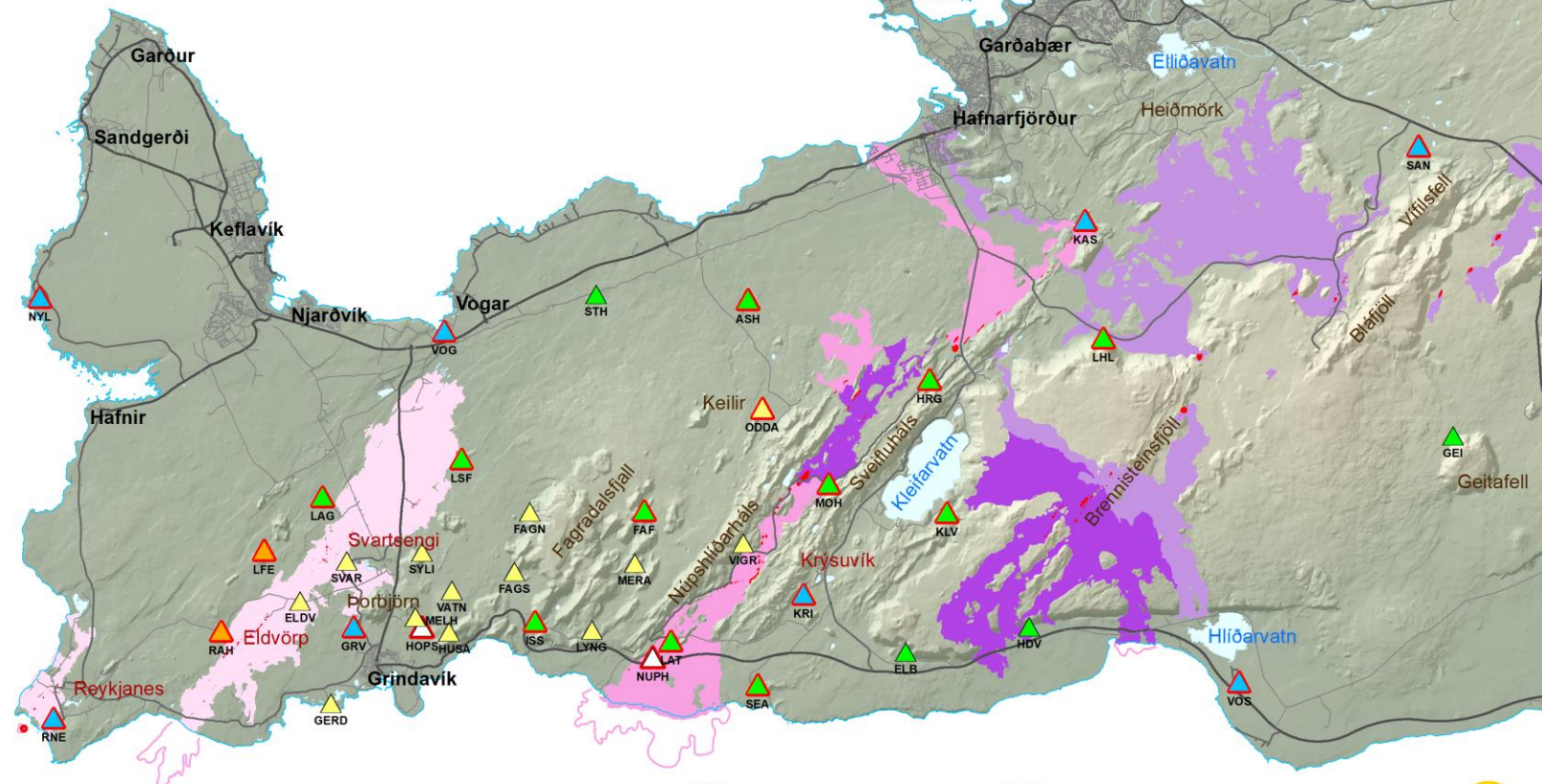
64.1° N

64° N

63.9° N

63.8° N

- Craters and crater rows
- Offshore lava margin
- Lava formed in 8th-9th century AD
- Lava formed in 10th century AD
- Krýsuvík Fires 1151-1188 AD
- Reykjanes Fires 1210-1240 AD
- ▲ IMO
- ▲ ÍSOR / IMO
- ▲ CAS / ÍSOR
- ▲ UC / UI
- ▲ UP / ÍSOR



© ÍSOR/EÁG 0 2.5 5 10 km



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UNIVERSITY OF CAMBRIDGE



ICELAND GEOSURVEY

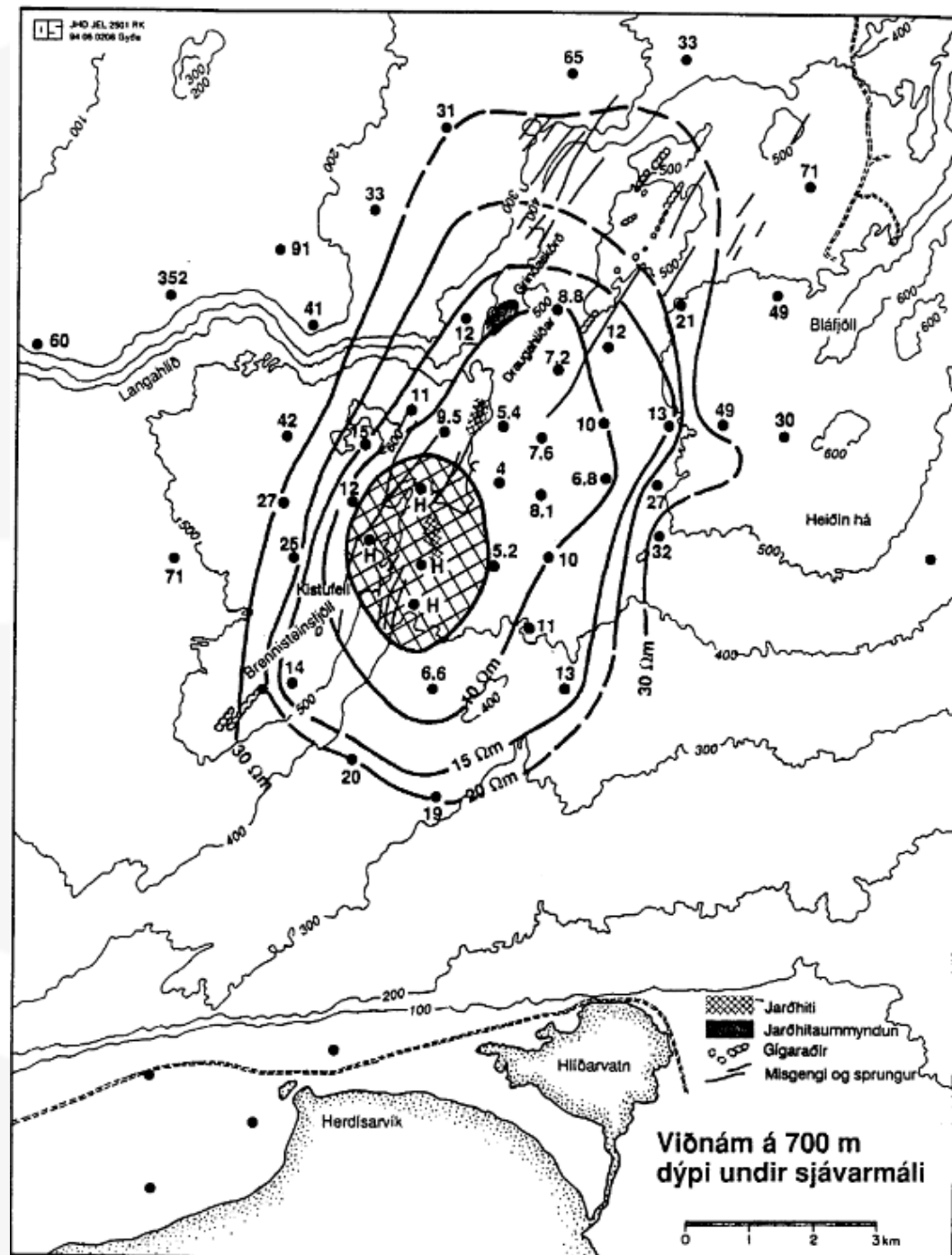
## Brennisteinsfjöll:

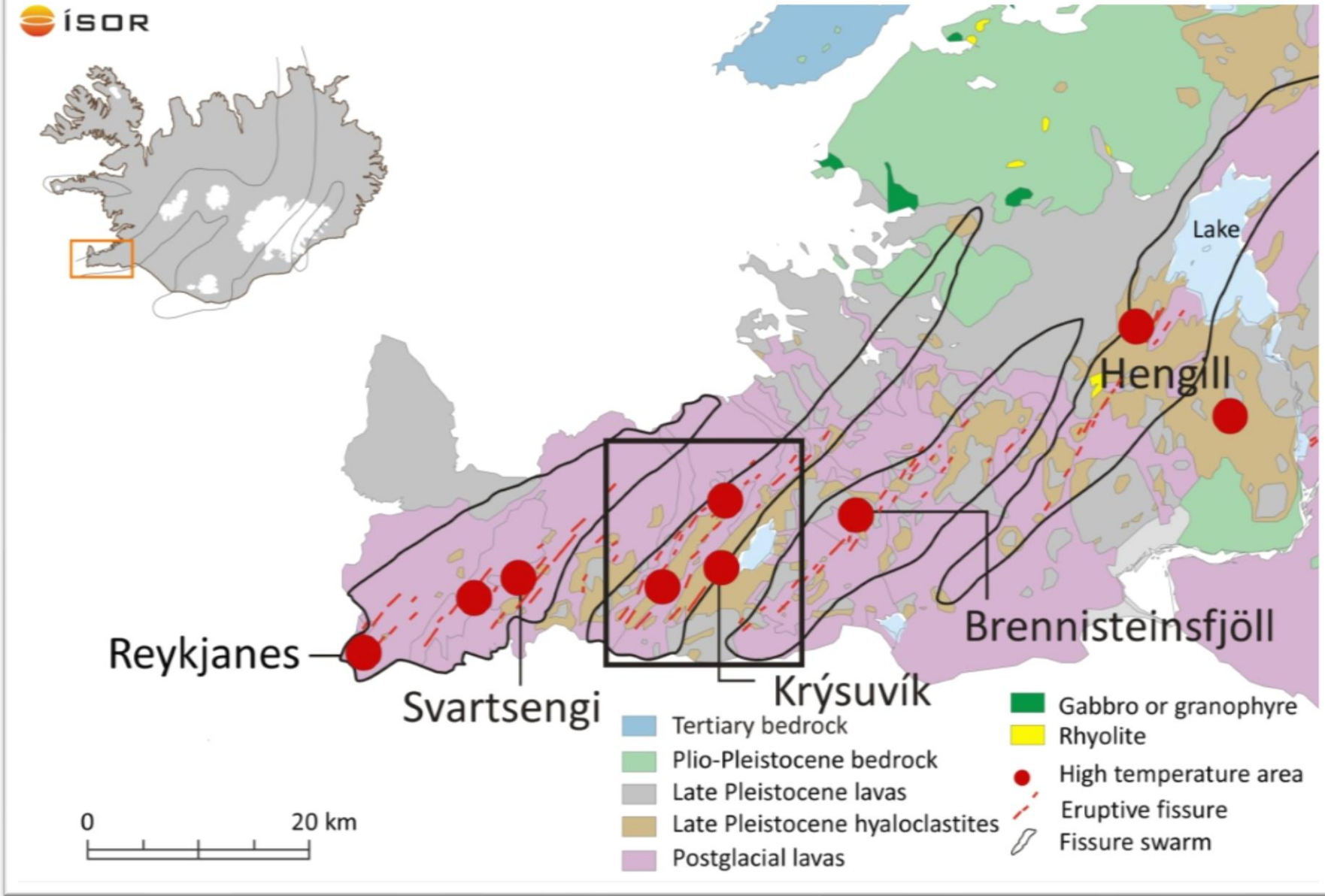
Resistivity at 700 m below sea-level,  
based on TEM soundings

Geothermal surface manifestations  
and alteration are shown as well

No wells exist

Taken from: Karlsdóttir R., 1995

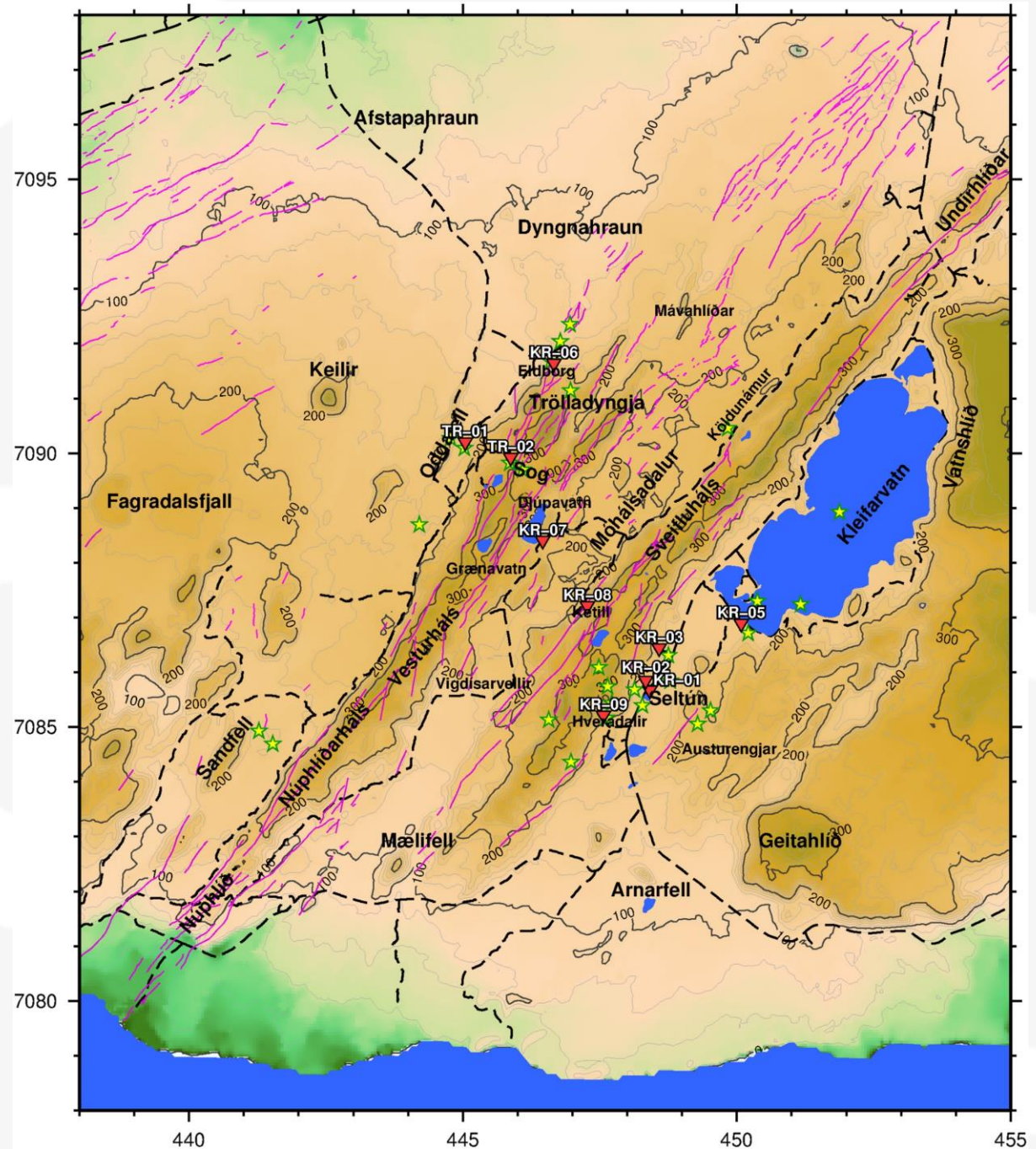




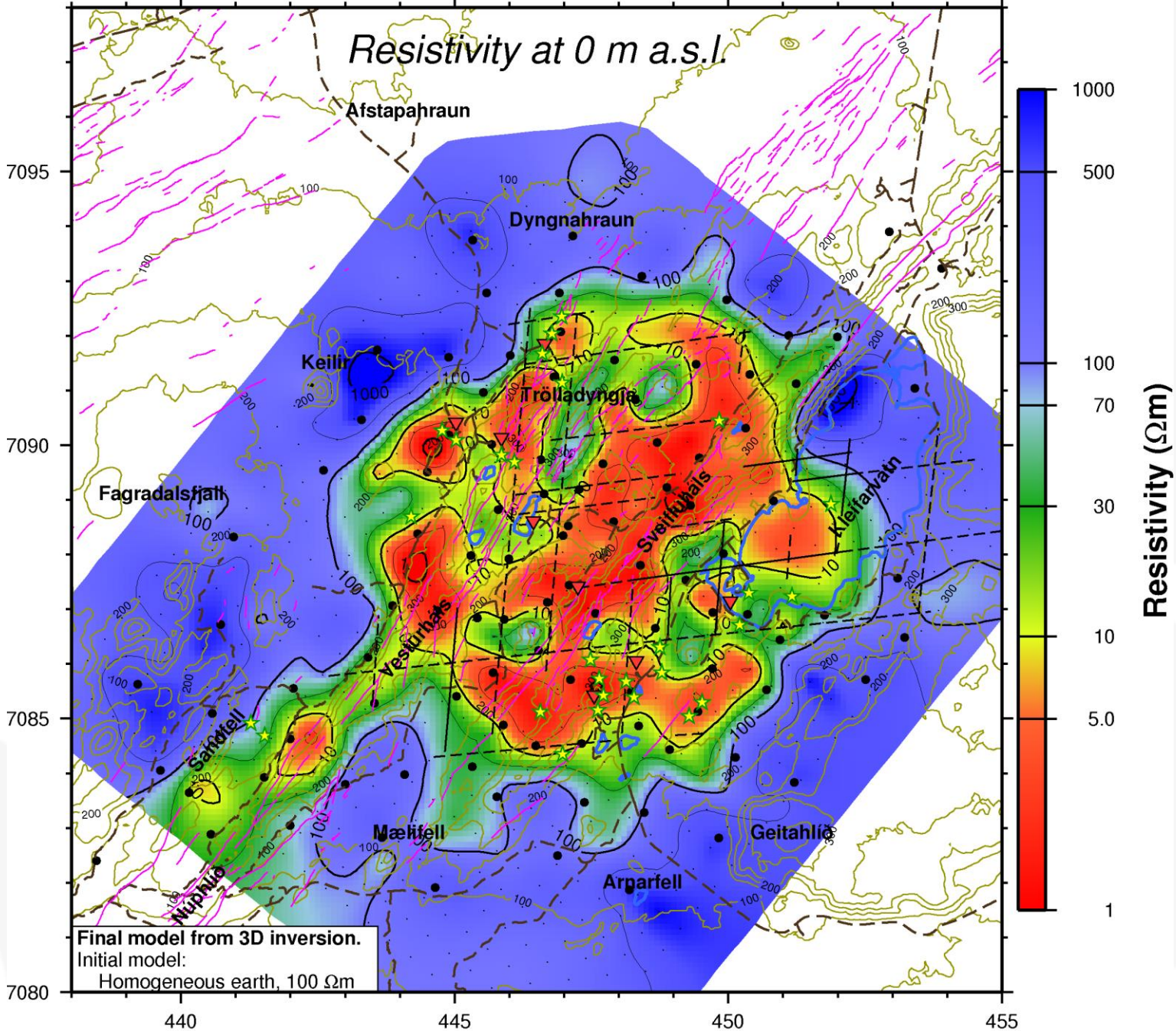
# Krýsuvík:

Big plans for years

Resistivity model  
taken from Hersir et  
al., 2018



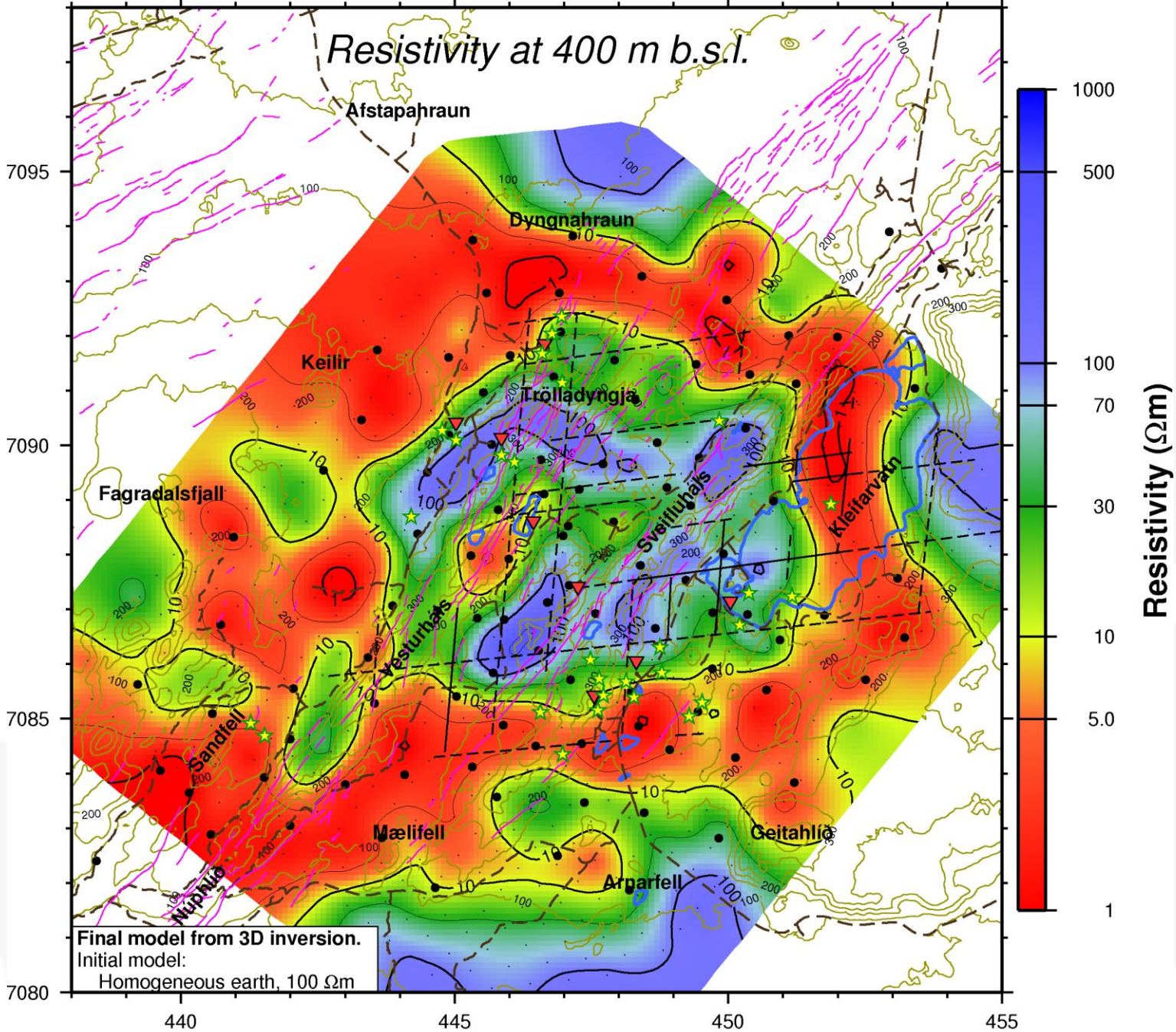
# Resistivity at 0 m a.s.l.



ÍSOR

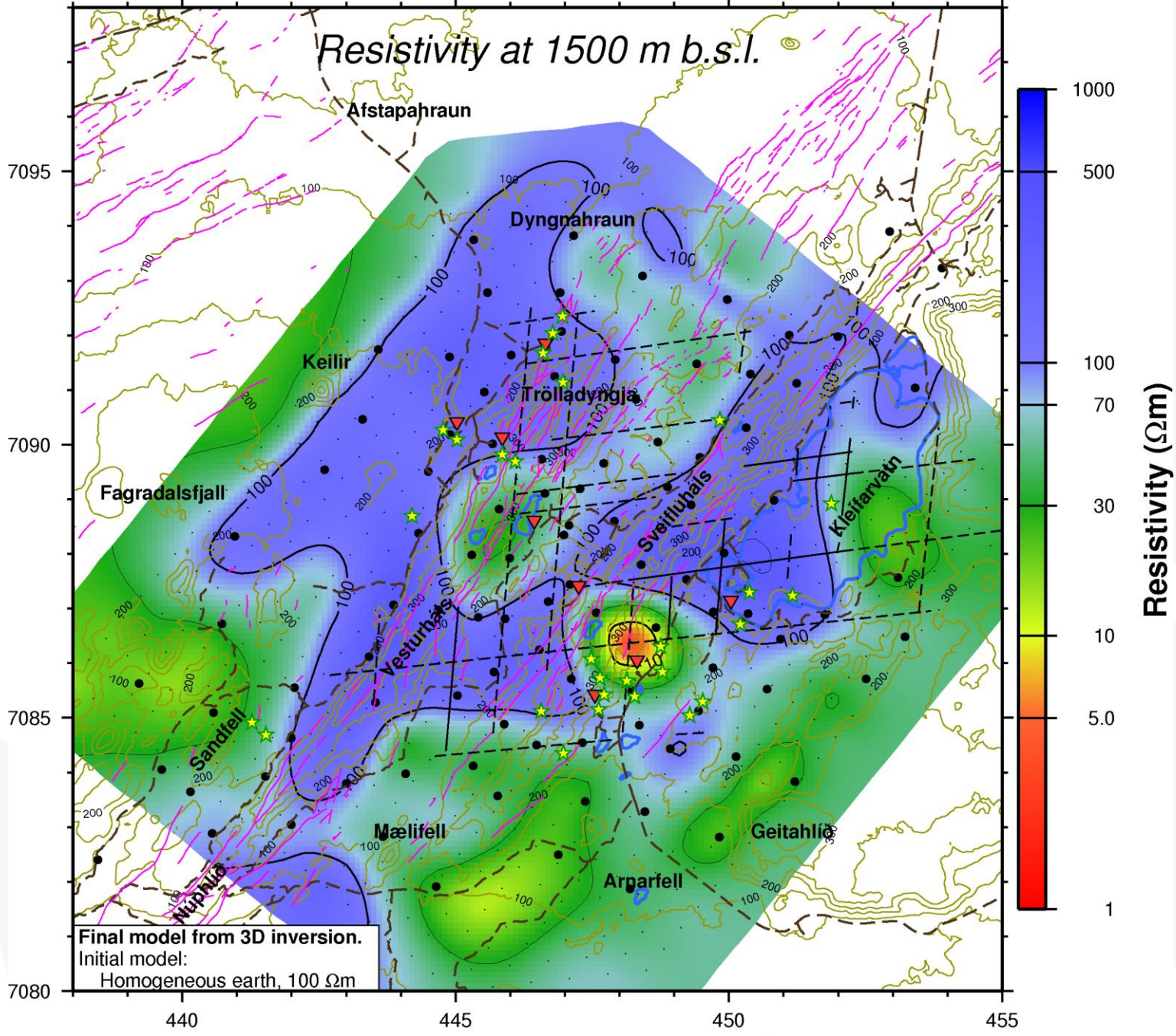


# Resistivity at 400 m b.s.l.



Final model from 3D inversion.  
Initial model:  
Homogeneous earth, 100  $\Omega\text{m}$

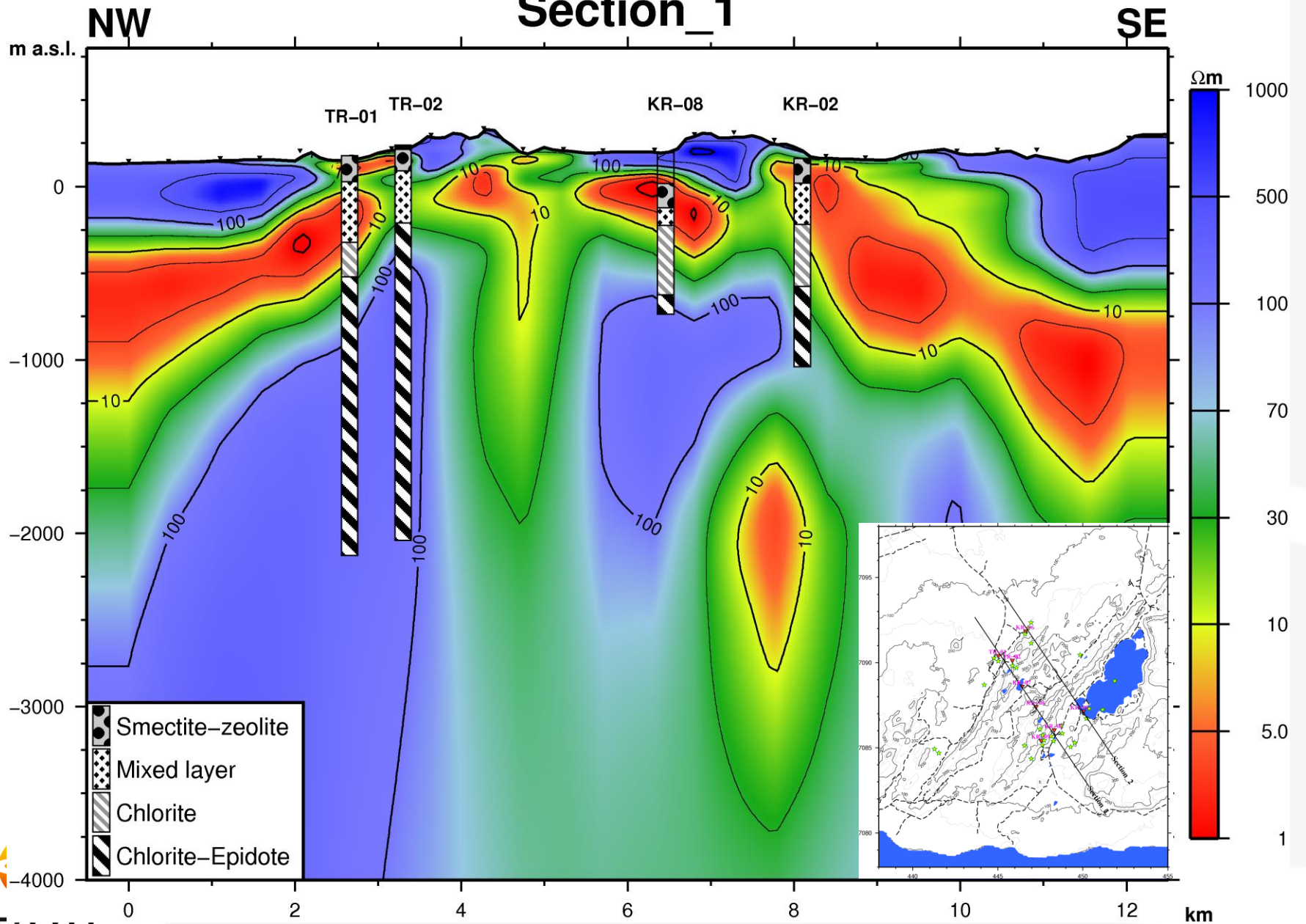
# Resistivity at 1500 m b.s.l.



Final model from 3D inversion.  
Initial model:  
Homogeneous earth, 100  $\Omega\text{m}$

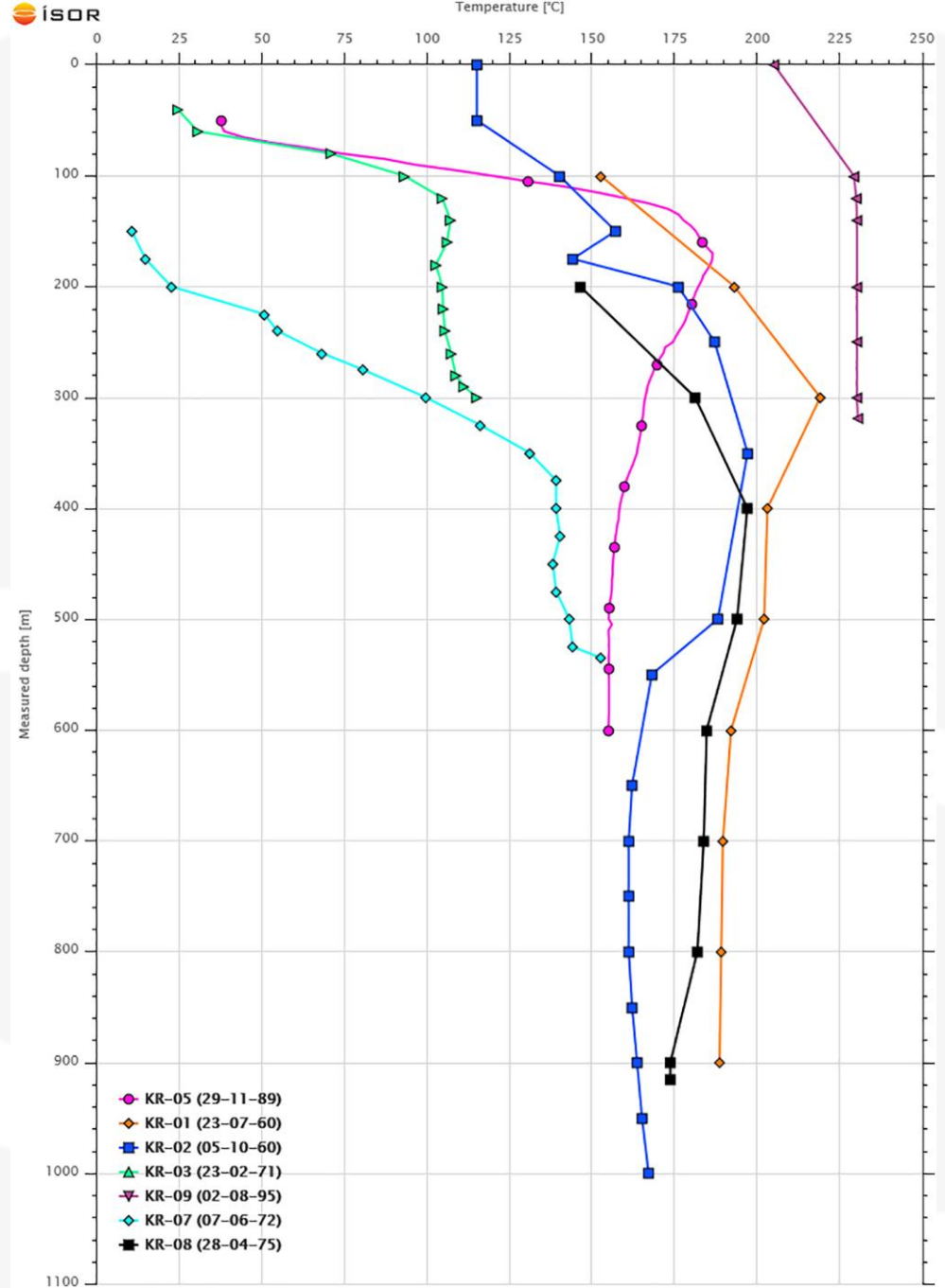
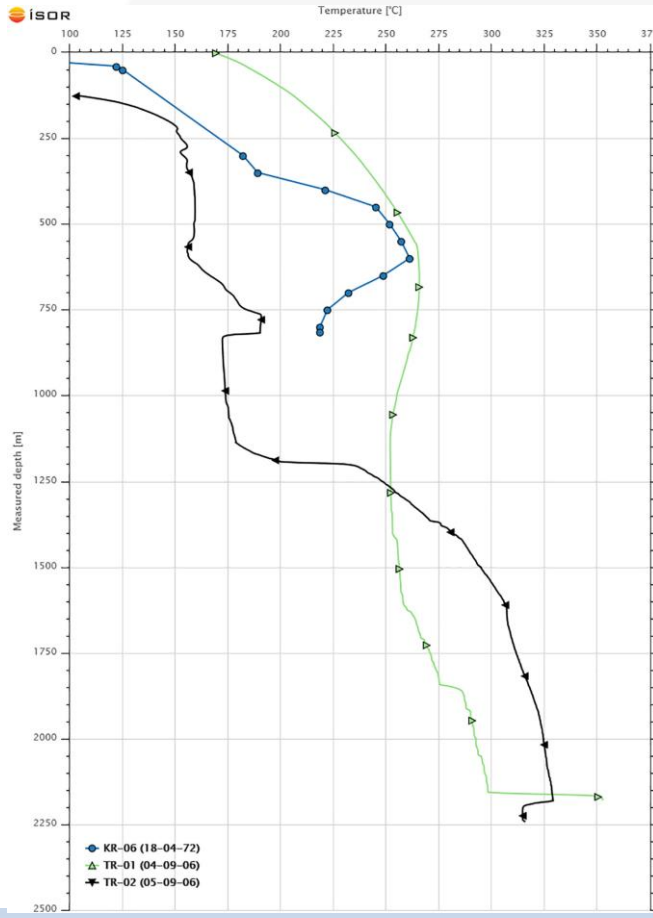


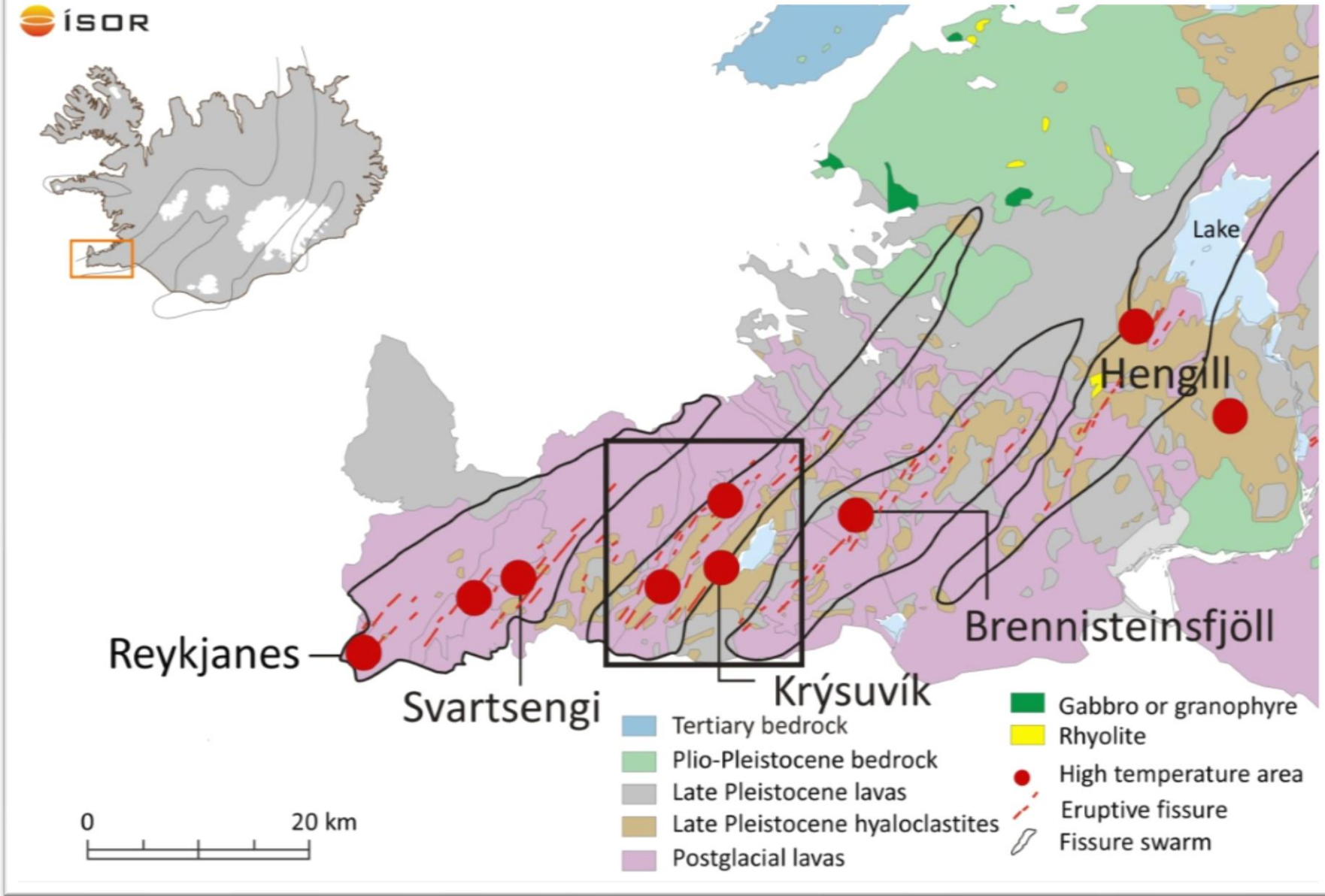
# Section\_1



# Krýsuvík:

Since 1941 some 34 boreholes have been drilled in the area until 2007, ranging in depth from < 100 m to 2307 m. Taken from Hersir et al., 2018





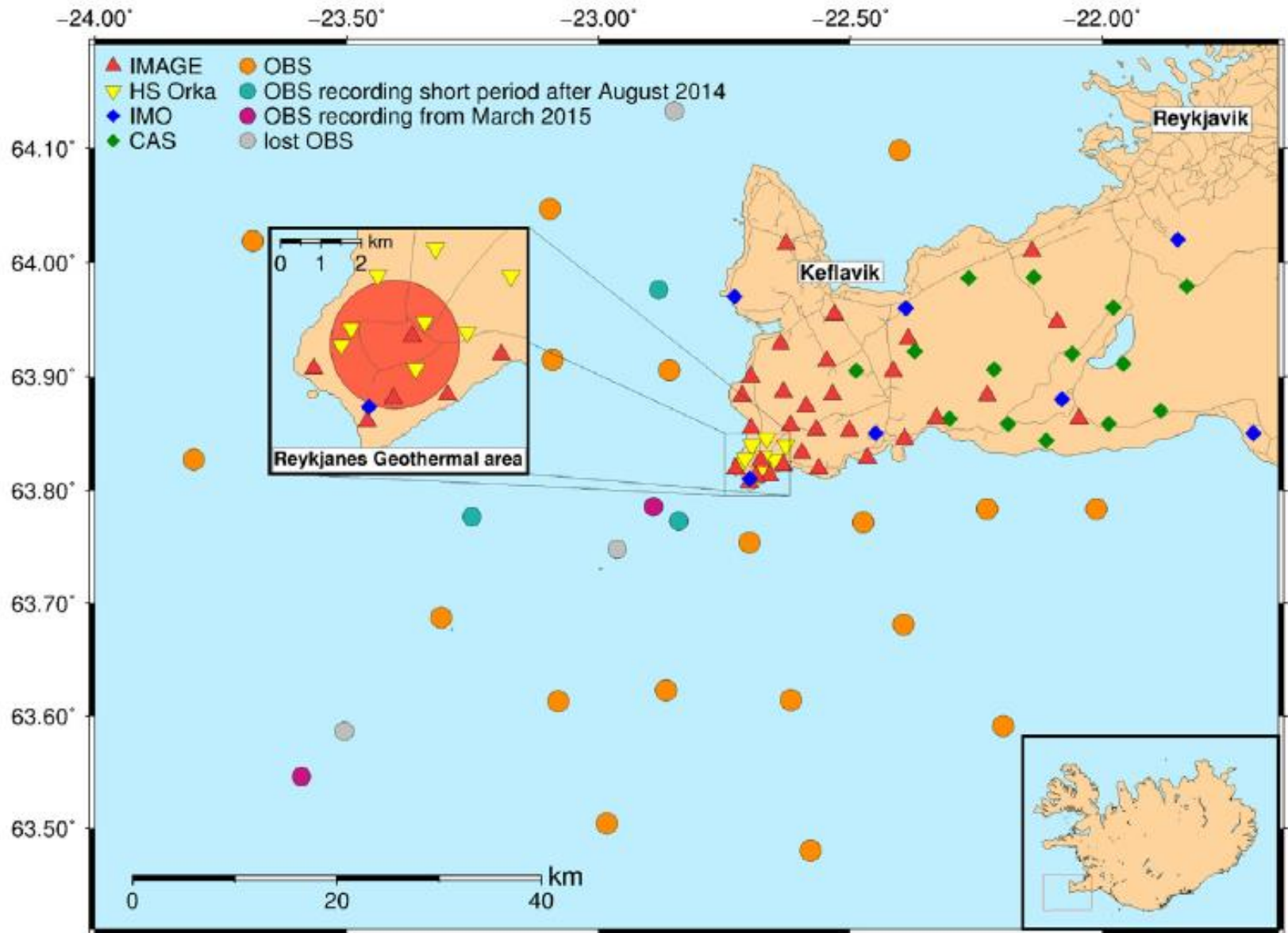
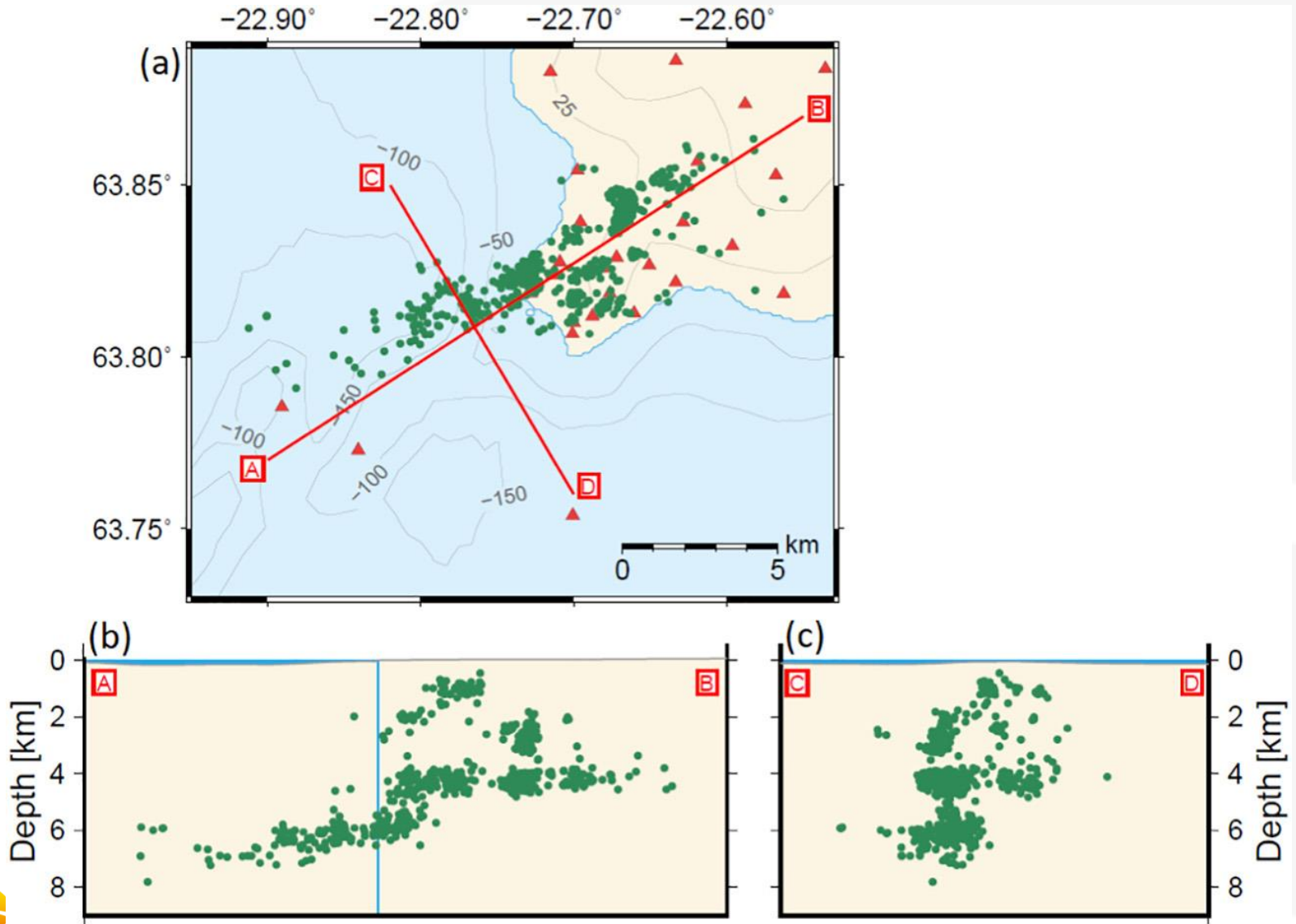
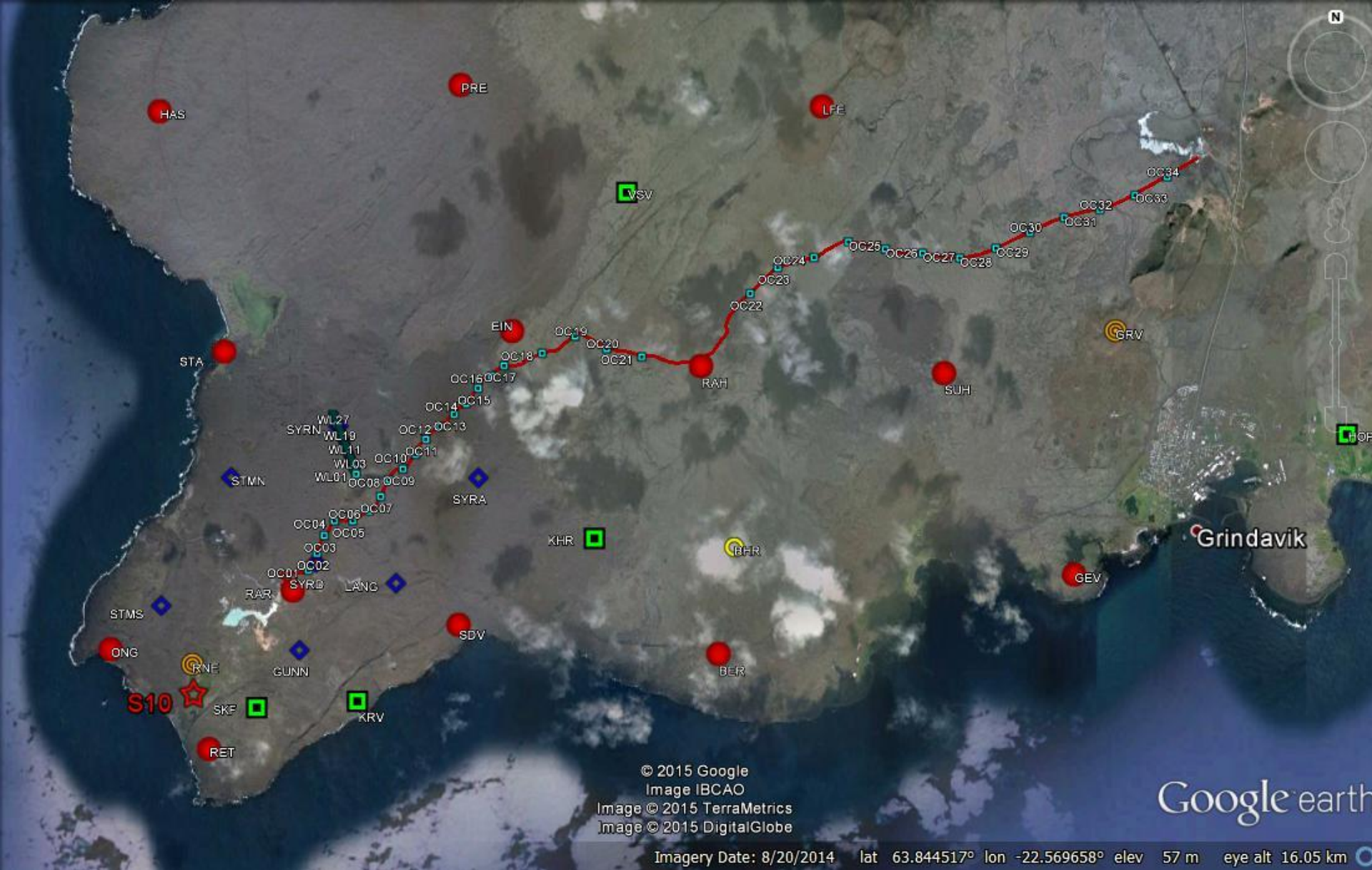


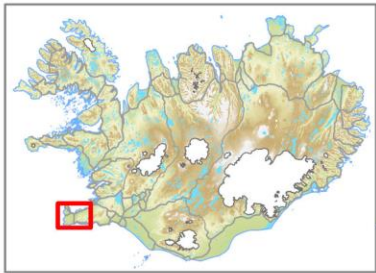
IMAGE: 30 (20 Trillium (120 s) + 10 Mark (1 Hz)) + 24 OBSs (30 s), 8 ISOR/HSOrka (Lennartz (5 s)), 7 IMO (Lennartz (5 s)), 15 CAS (Güralp (120 s)) – Recording: March/April 2014 – August 2015 (2000)











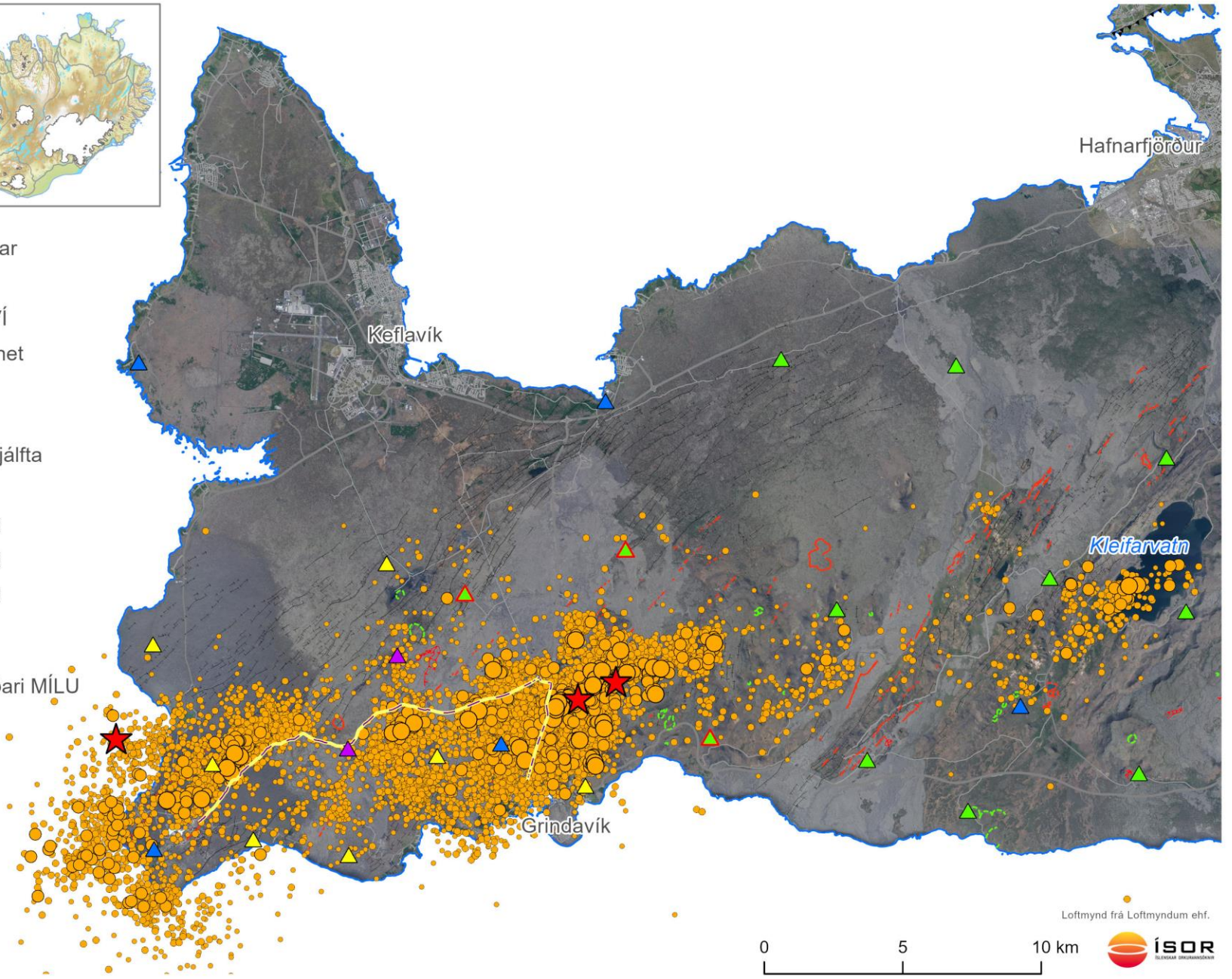
### Skjálftastöðvar

- ▲ GFZ
- ▲ ÍSOR/VÍ
- ▲ Reykjanet
- ▲ SIL

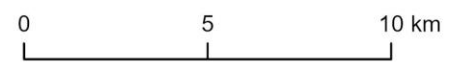
### Stærð jarðskjálfta

- ≤ 1 M
- ≤ 1-2 M
- ≤ 2-3 M
- ≤ 3-4 M
- ★ > 4 M

— Ljósleiðari MÍLU



Loftmynd frá Loftmyndum ehf.





Red triangles: ÍSOR/HS Orka – blue triangles DEEP-EGS  
Running for one year 2016-2017:

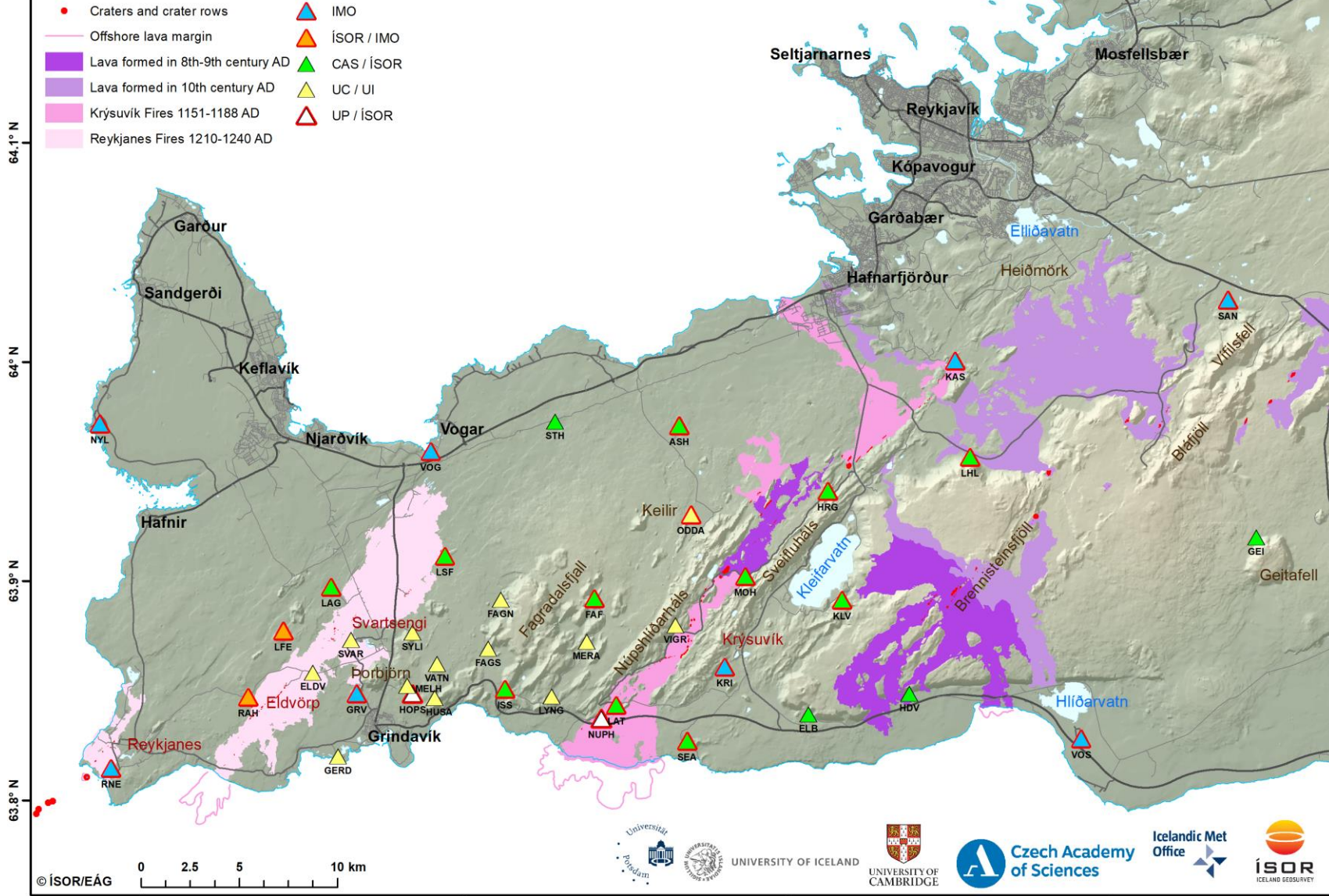


22.7° W

22.3° W

22° W

21.7° W





This was it  
Thanks for the attention