Development of a 3-D Crustal Model in the Western Dronning Maud Land Region, Antarctica, from the Interpretation of different geophysical data sets

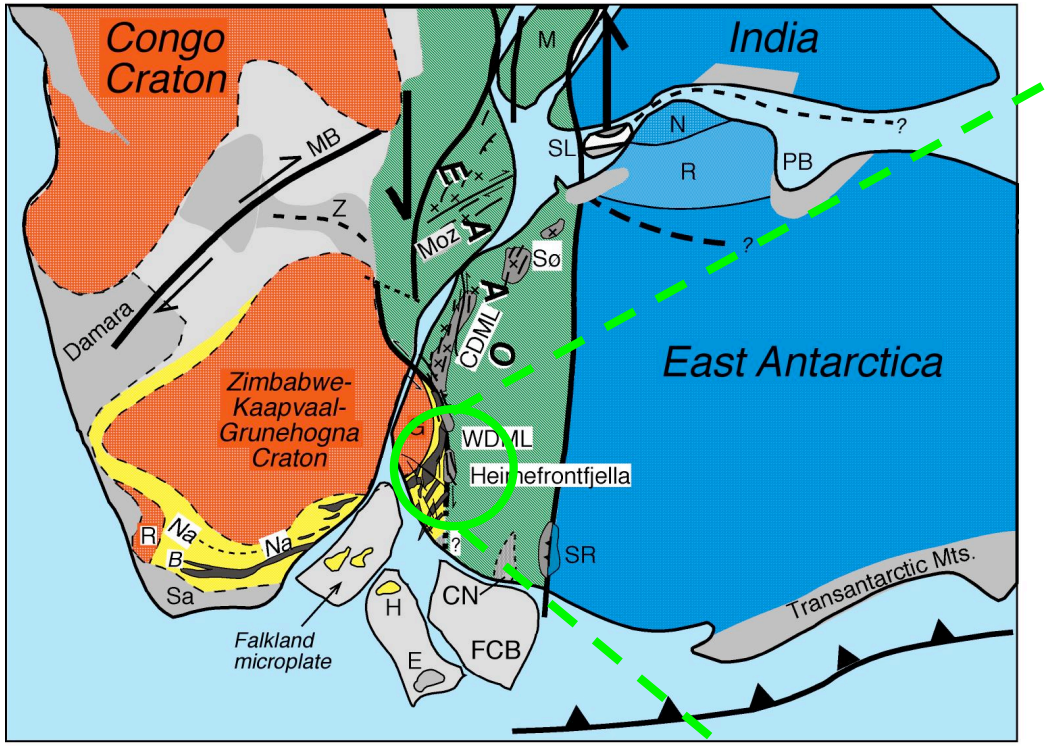
M. Hoffmann, A. Eckstaller, W. Jokat, H. Miller

Outline

- Introduction into the region
- Available data sets
  - seismic surveys
  - seismolgical data
  - airborne gravity and magnetic data
- Receiver Function Analysis
- Development of a 3D crustal model
- Outlook

Introduction

Gondwana Reconstruction at c. 1 Ga

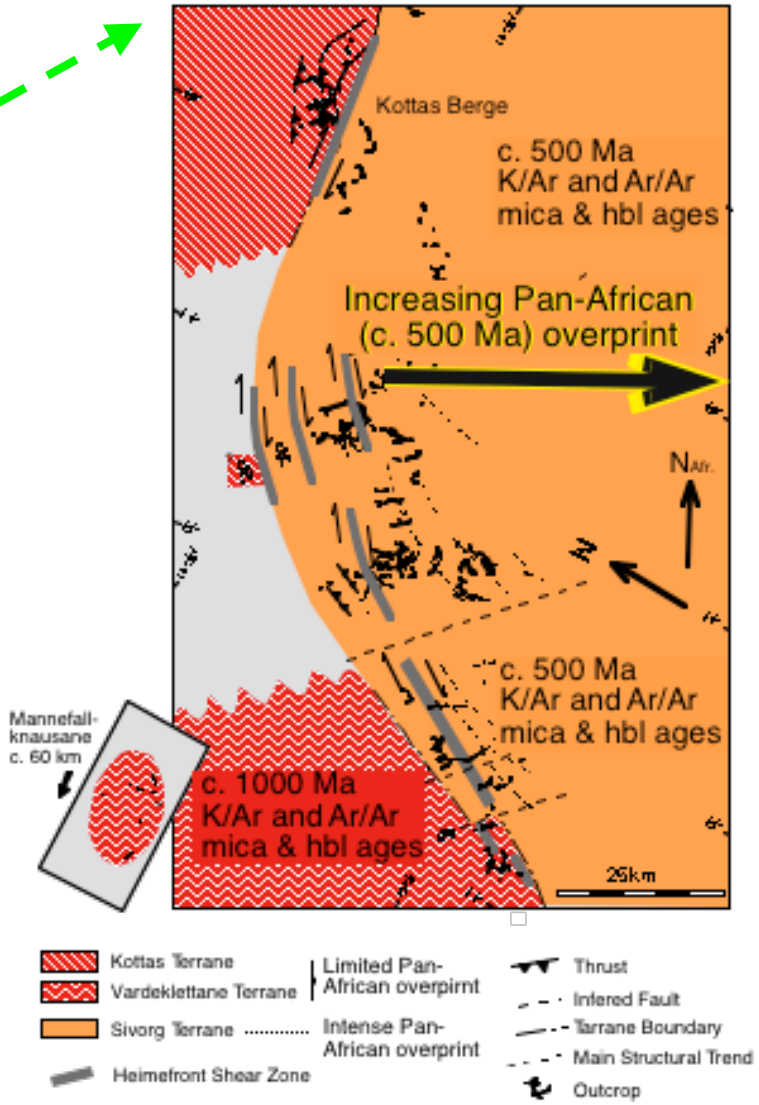


CDML – central Dronning Maud Land
CN – Coats Land, E – Ellsworth Mts
EAAO – East Antarctic/African Orogen
FCB – Filchner Crustal Block
G – Grunehogna Craton
H – Haag Nunataks
LH – Lützow Holm Bay

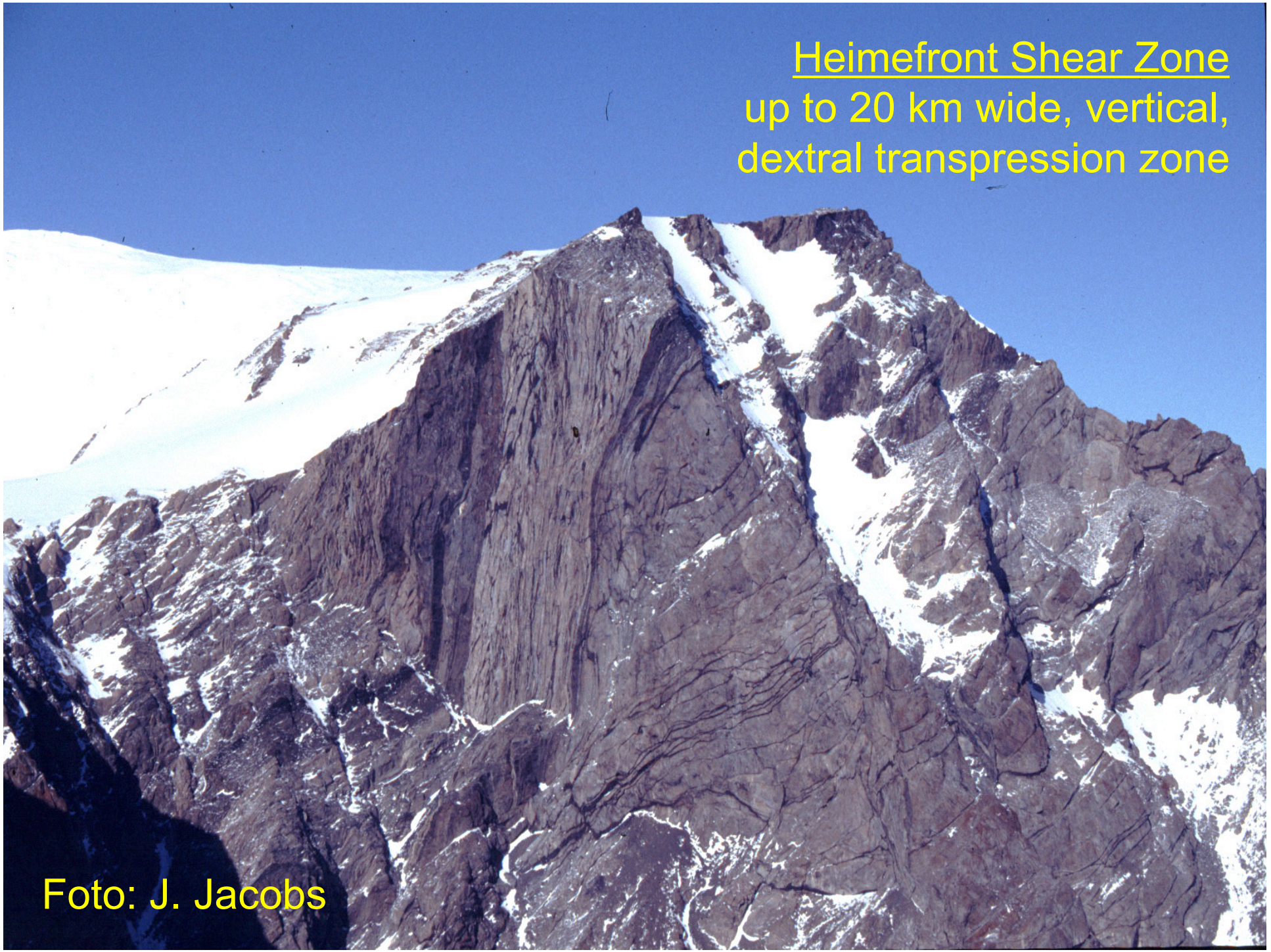
MB – Mwembeshi Shear Zone
Na-Na – Namaqua-Natal Belt
PB – Prydz Bay
R – Richtersveld Craton
M – Madagascar
Moz – Mozambique Belt

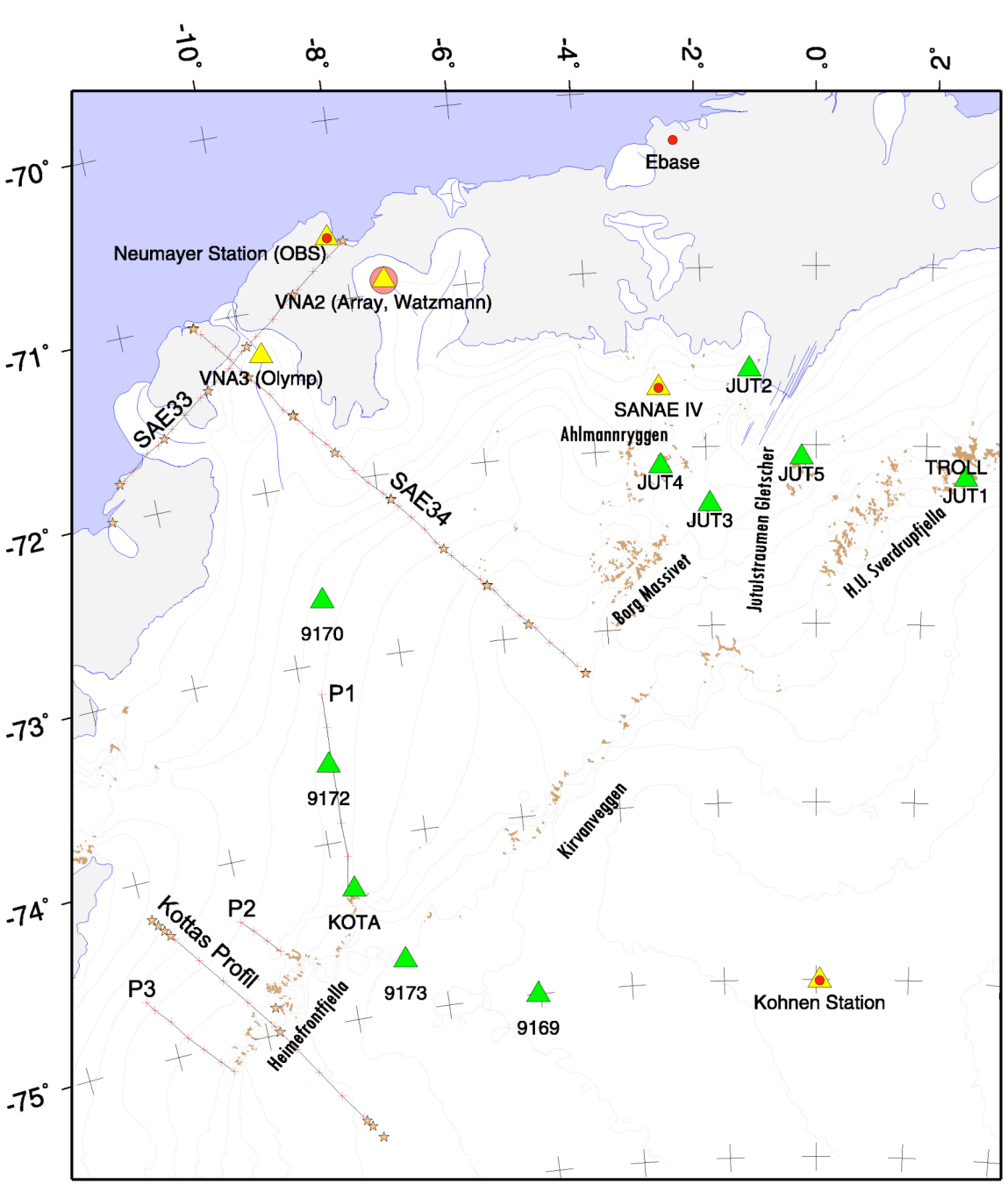
Sa – Saldania Belt
SL – Sri Lanka
Sø – Sør Rondane
SR – Shackleton Range
WDML – western Dronning Maud Land
Z – Zambezi Belt

Heimefrontfjella Shear Zone



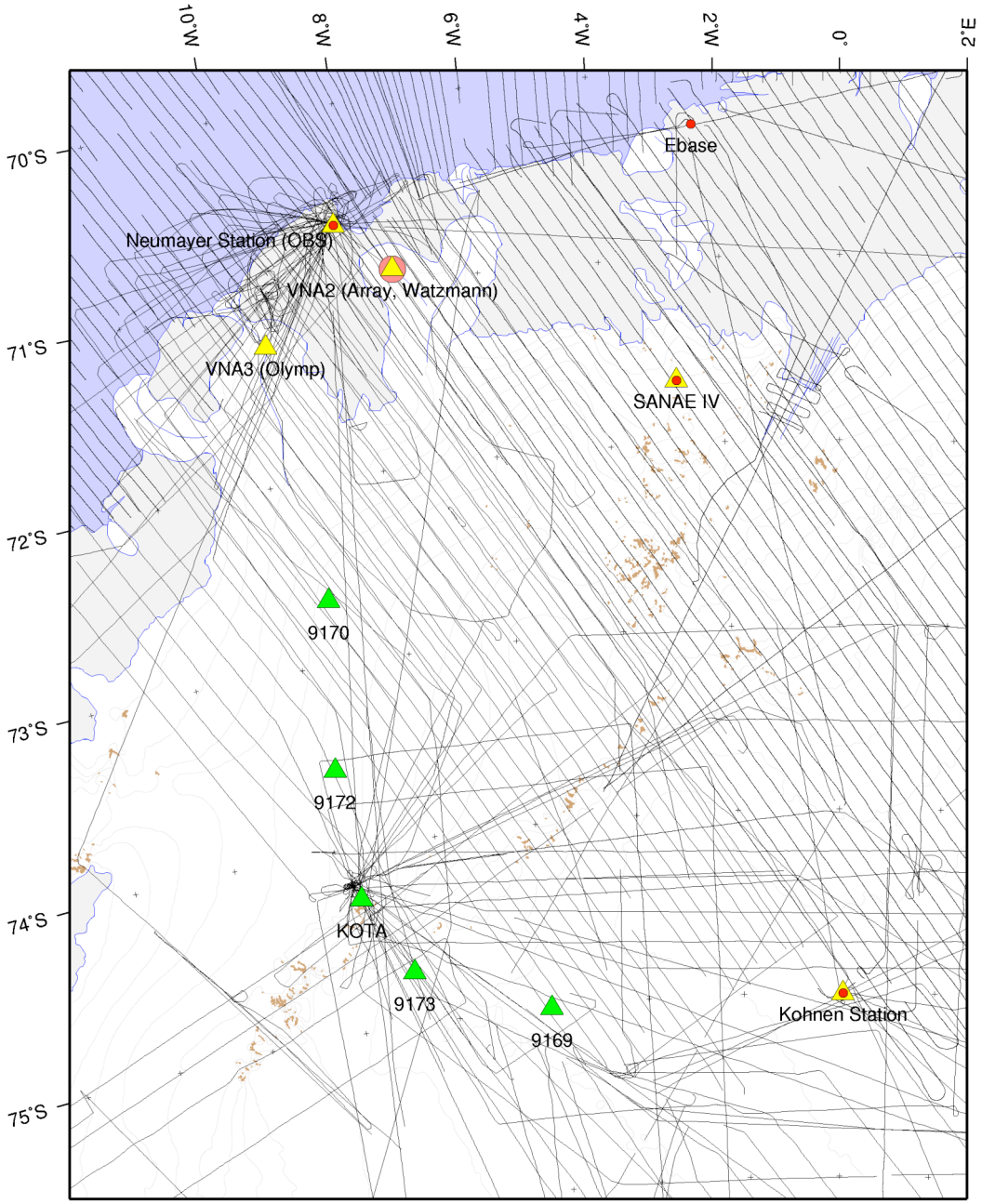
(both figures after J. Jacobs)


Heimefront Shear Zone
up to 20 km wide, vertical,
dextral transpression zone
Foto: J. Jacobs



Available Data Sets

- refraction and reflection seismic data
- permanent installed seismometer stations
- temporarily installed seismometer stations



Flight Lines in CDML

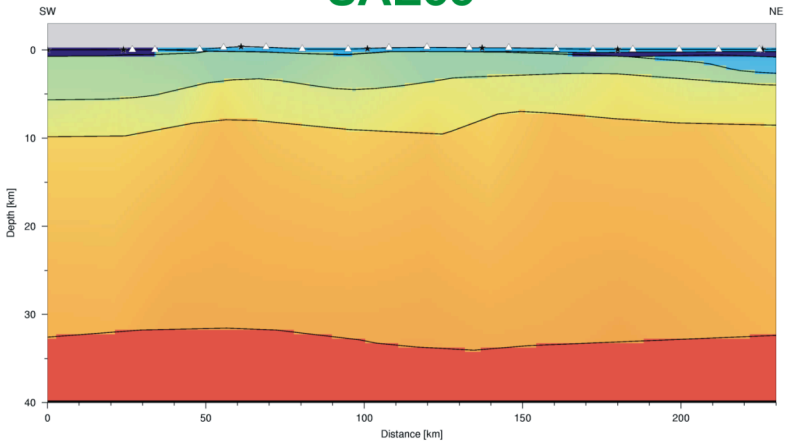
Available Data Sets

- Aerogravity
- Aeromagnetics
- EMR Radar (ice thickness)

(data partly processed)

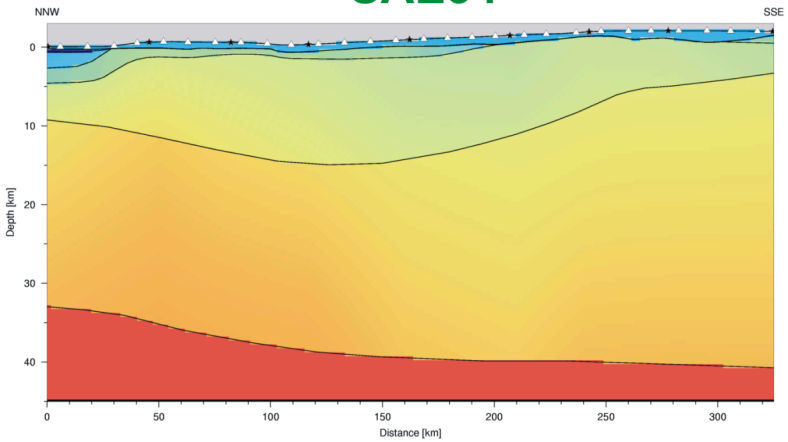
Interpretation of Seismic Profiles from western Dronning Maud Land

SAE33

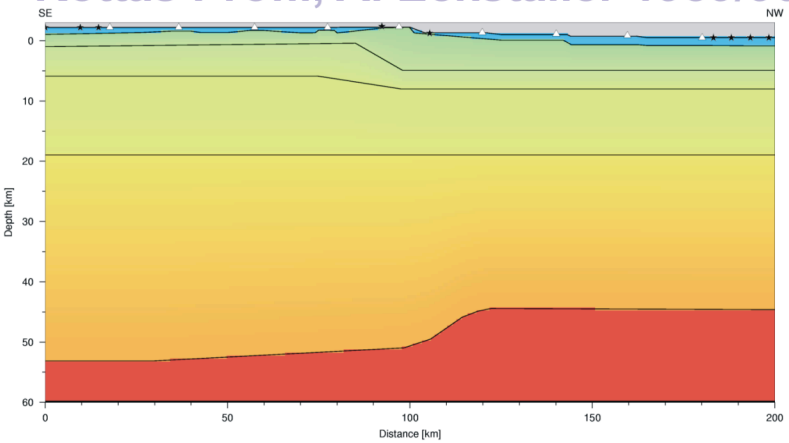


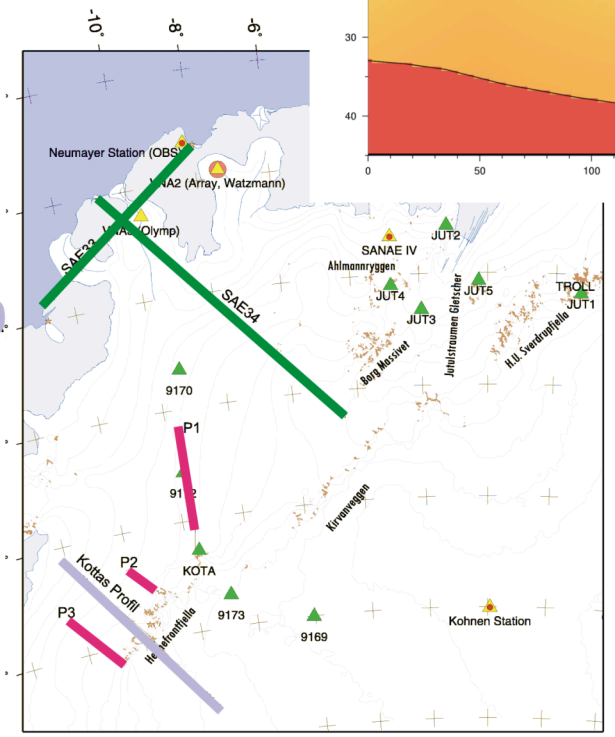
Kudryavtzev 1989

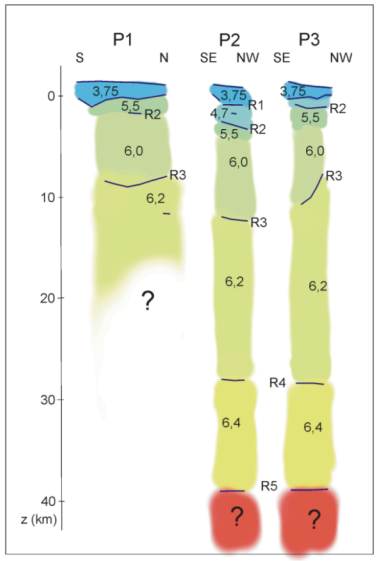
SAE34



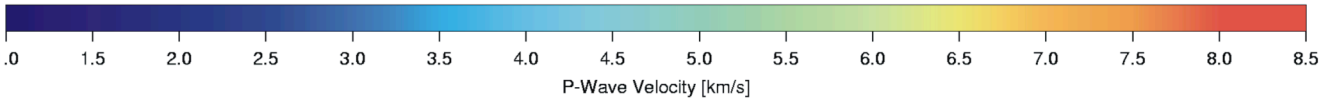
Kottas Profil, A. Eckstaller 1989/90





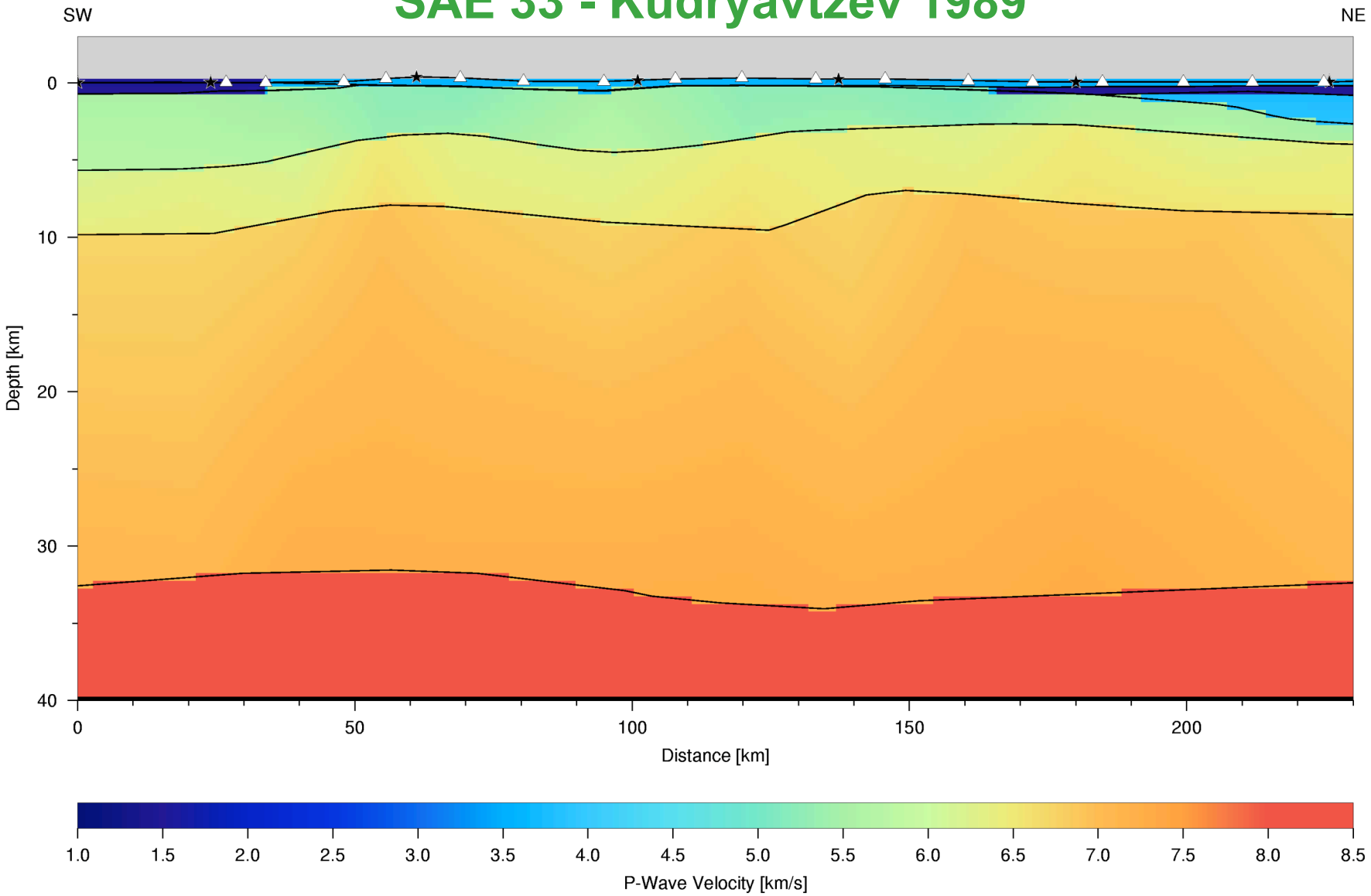


Hungeling & Thyssen 1985/86



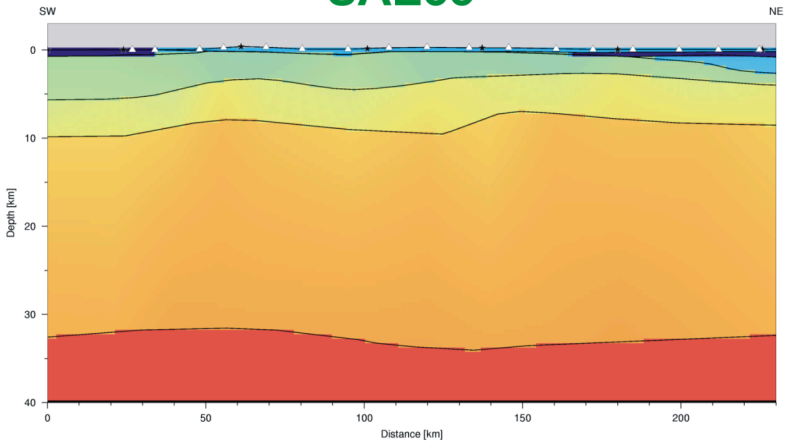
Interpretation of Seismic Profiles from western Dronning Maud Land

SAE 33 - Kudryavtzev 1989



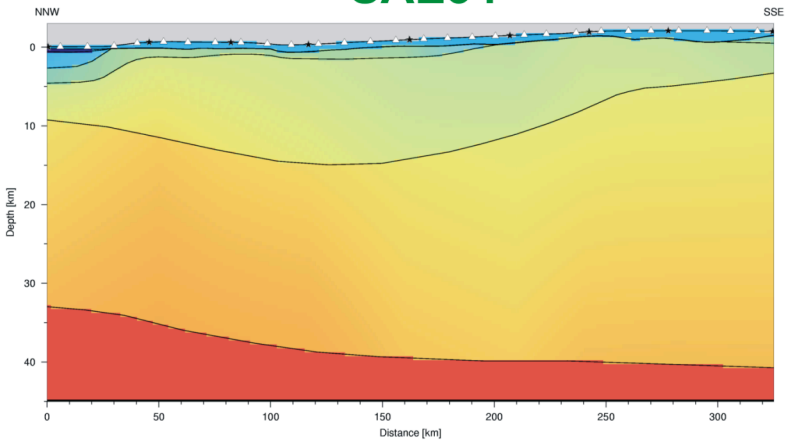
Interpretation of Seismic Profiles from western Dronning Maud Land

SAE33

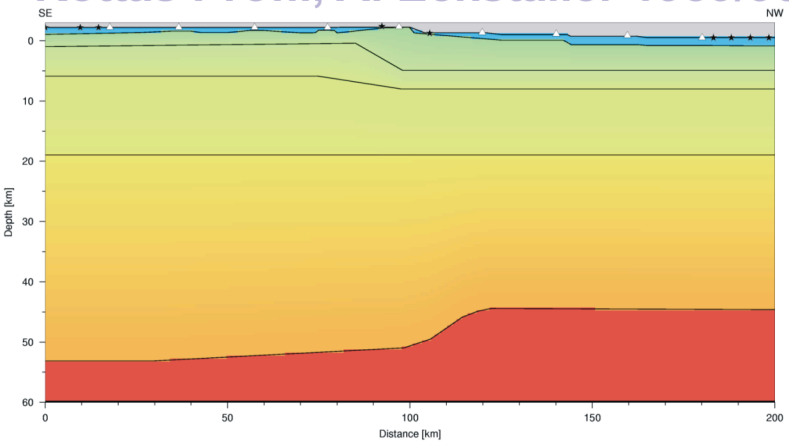


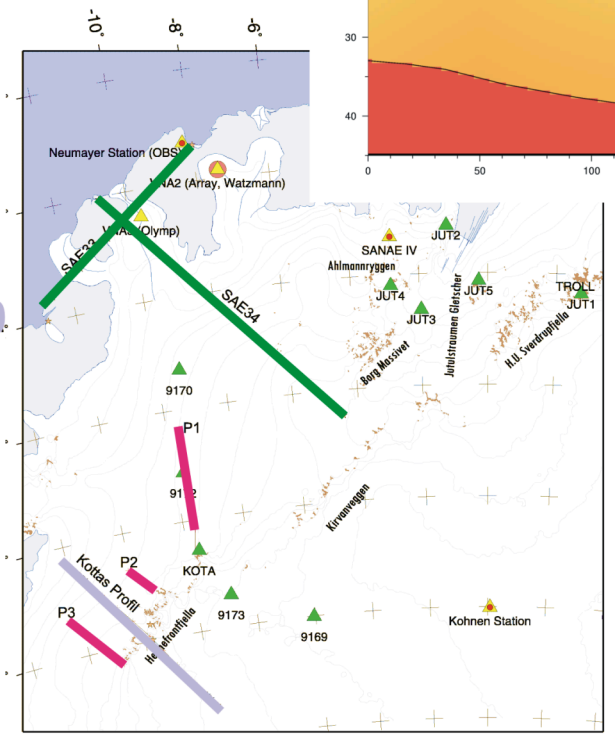
Kudryavtzev 1989

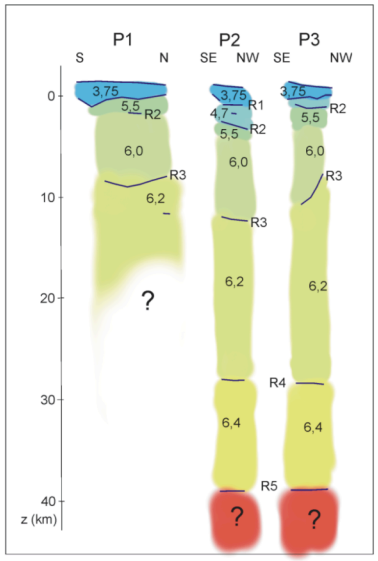
SAE34



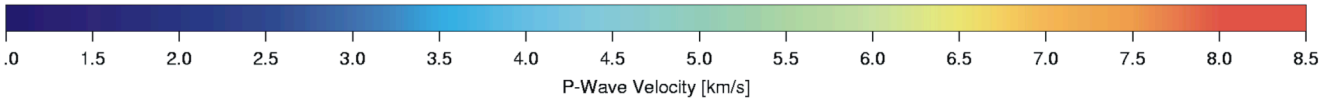
Kottas Profil, A. Eckstaller 1989/90





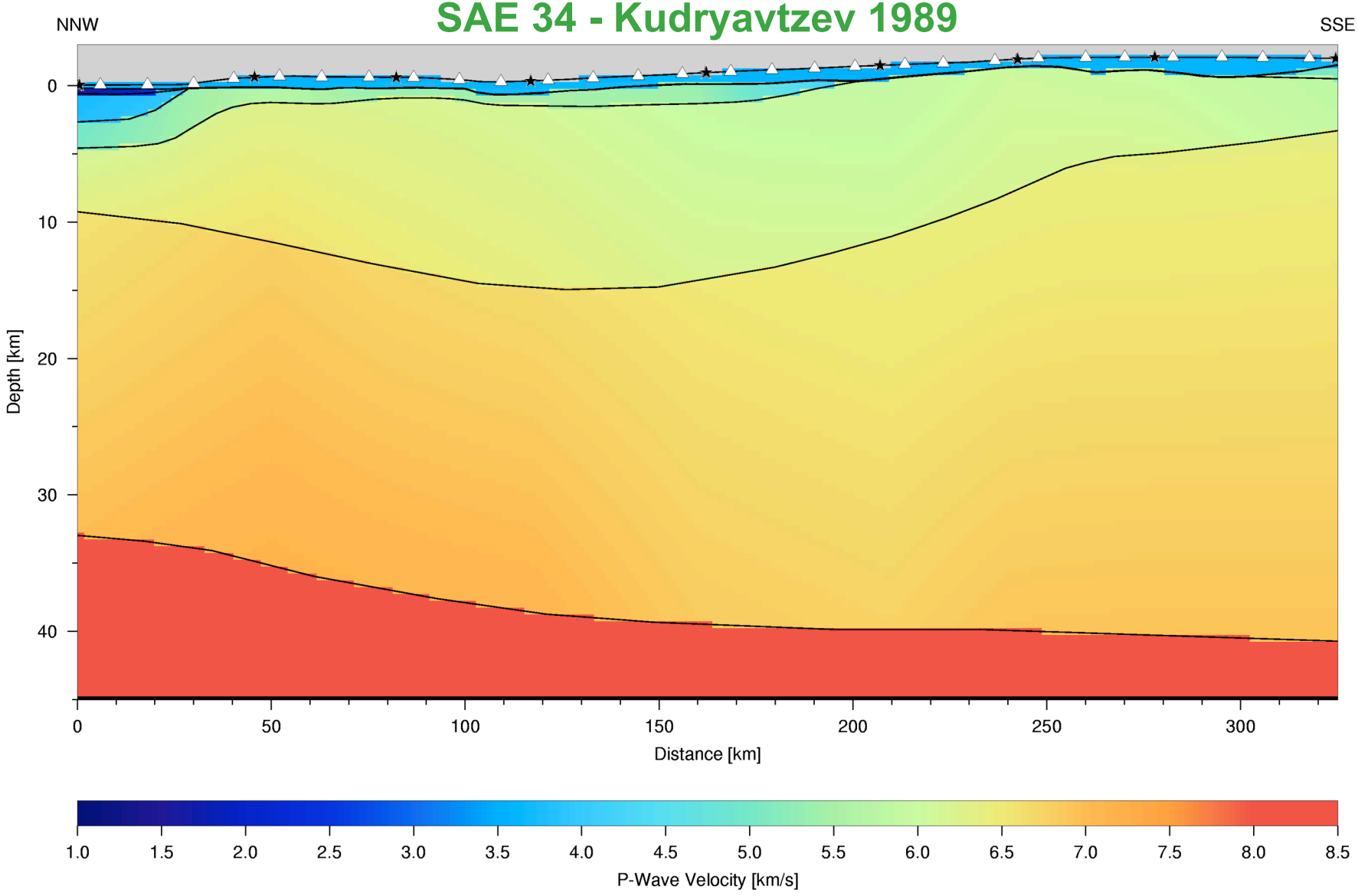


Hungeling & Thyssen 1985/86



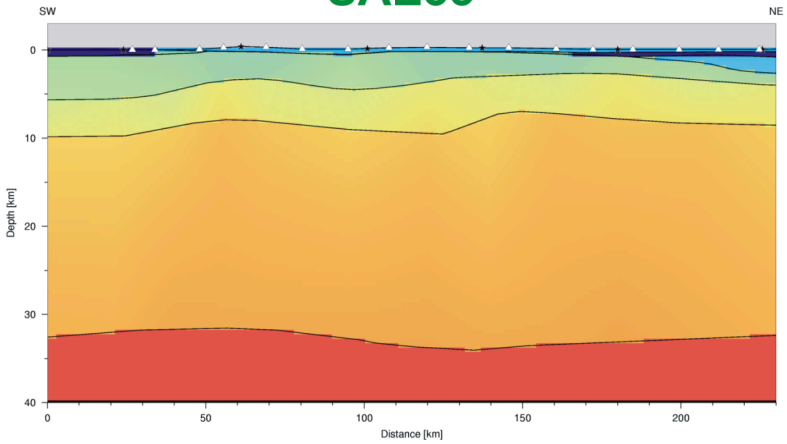
Interpretation of Seismic Profiles from western Dronning Maud Land

SAE 34 - Kudryavtzev 1989



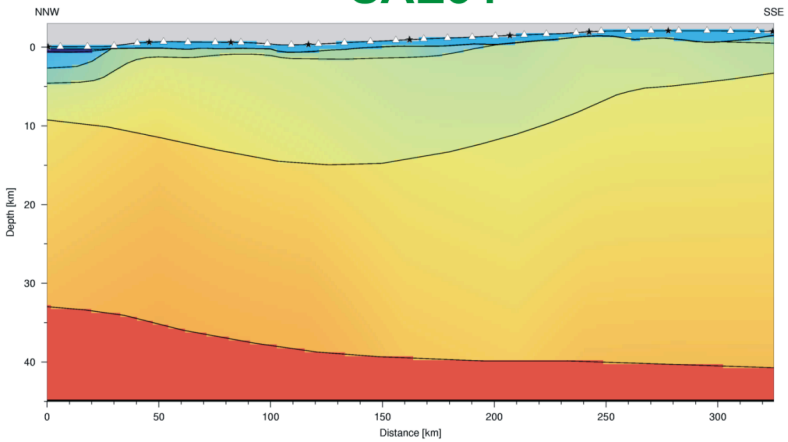
Interpretation of Seismic Profiles from western Dronning Maud Land

SAE33

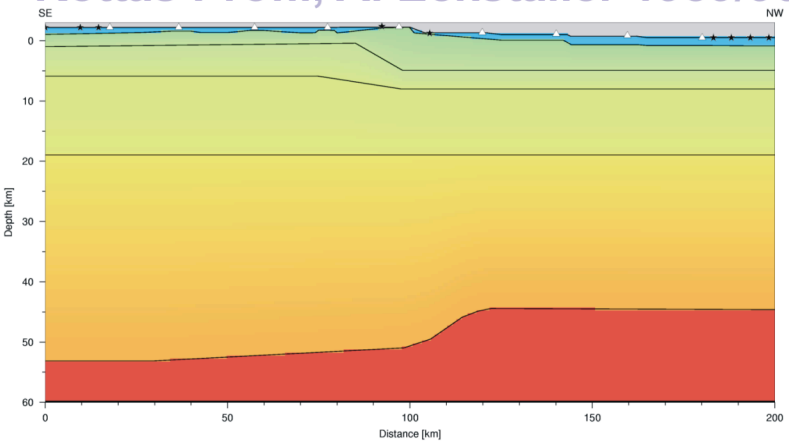


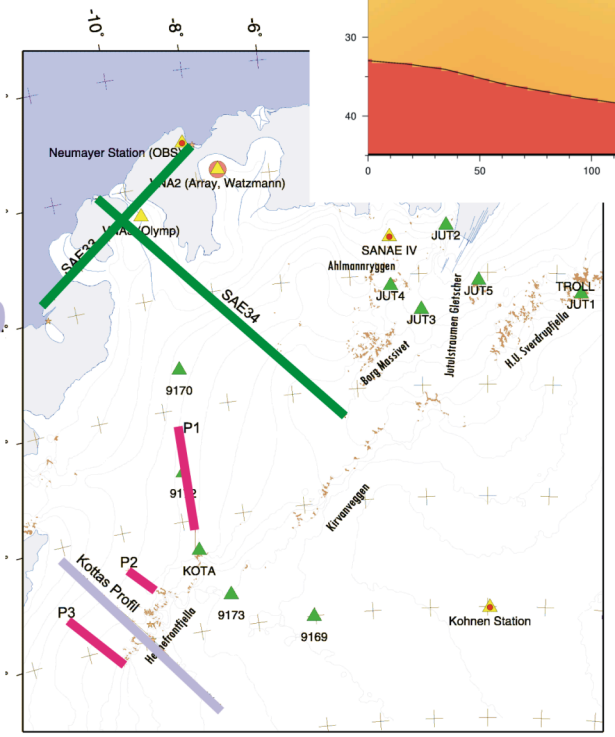
Kudryavtzev 1989

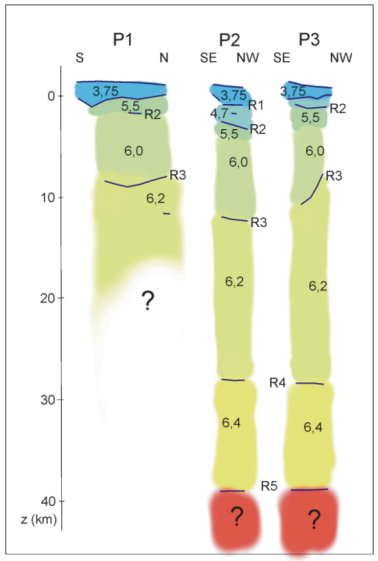
SAE34



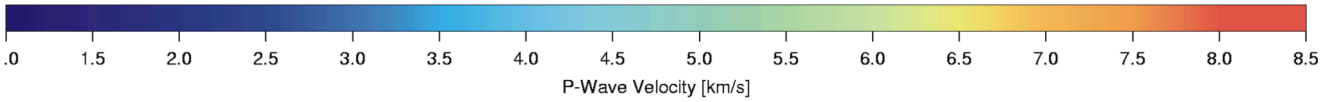
Kottas Profil, A. Eckstaller 1989/90





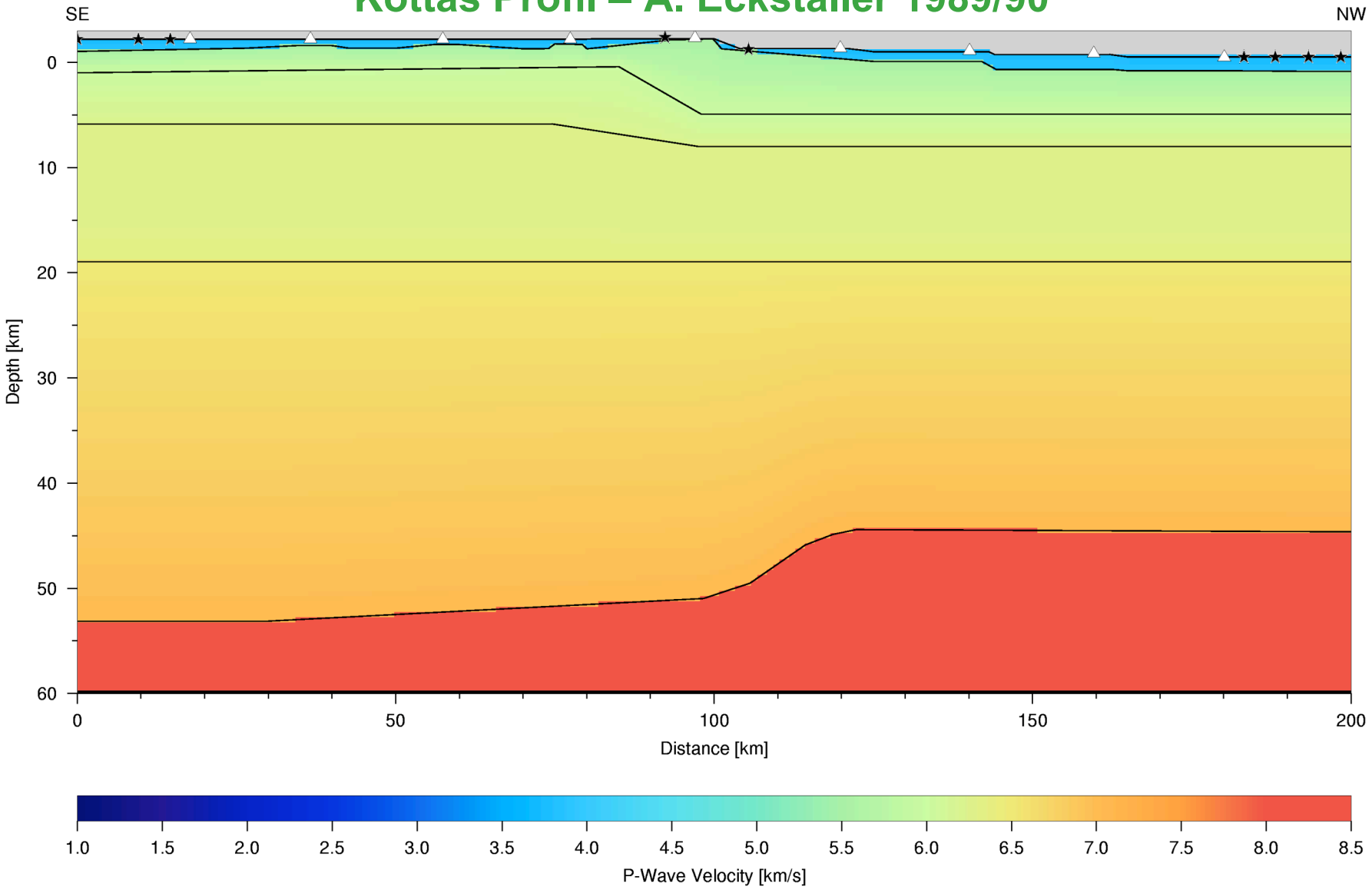


Hungeling & Thyssen 1985/86



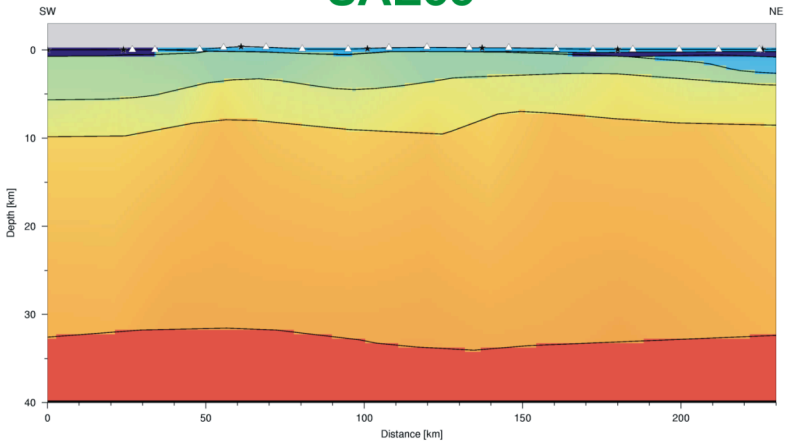
Interpretation of Seismic Profiles from western Dronning Maud Land

Kottas Profil – A. Eckstaller 1989/90



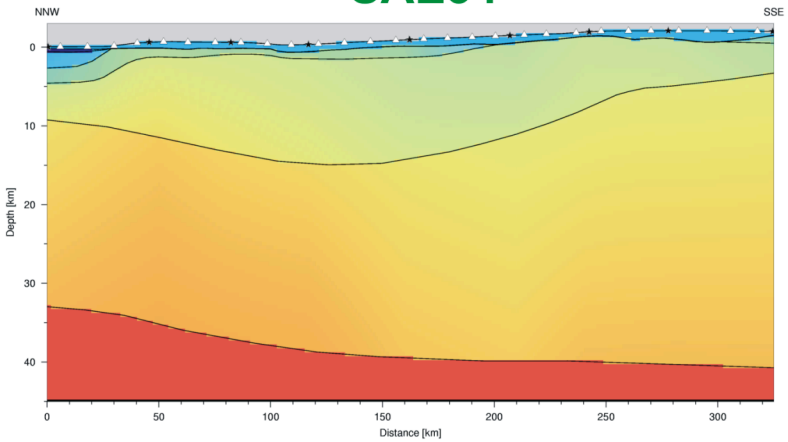
Interpretation of Seismic Profiles from western Dronning Maud Land

SAE33

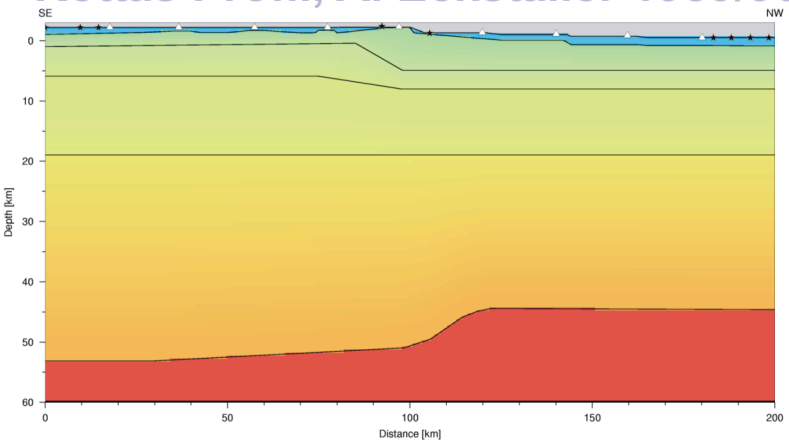


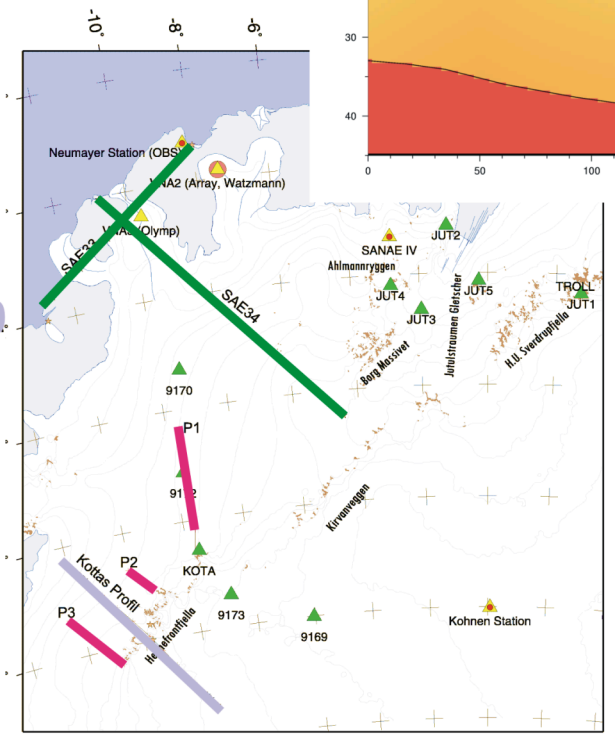
Kudryavtzev 1989

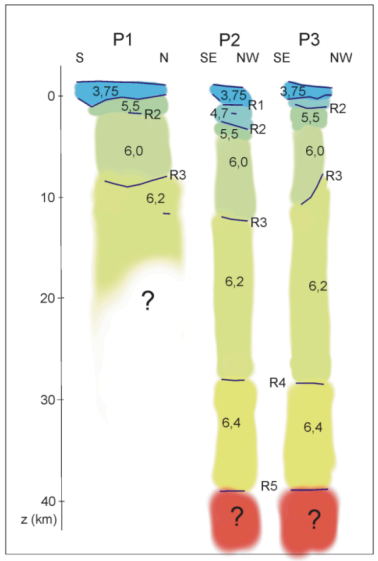
SAE34



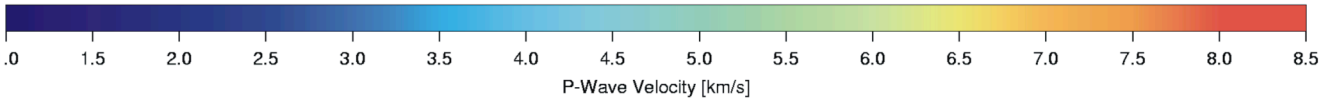
Kottas Profil, A. Eckstaller 1989/90



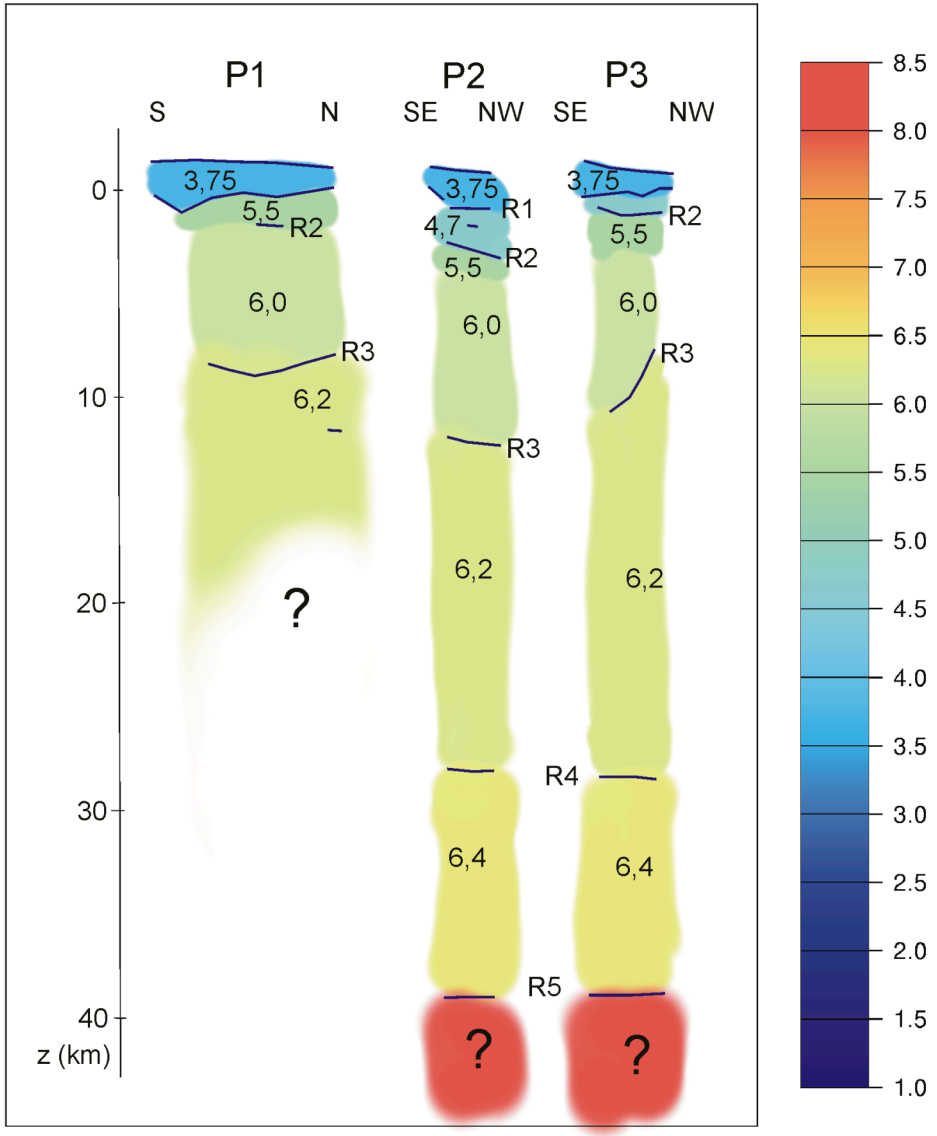




Hungeling & Thyssen 1985/86

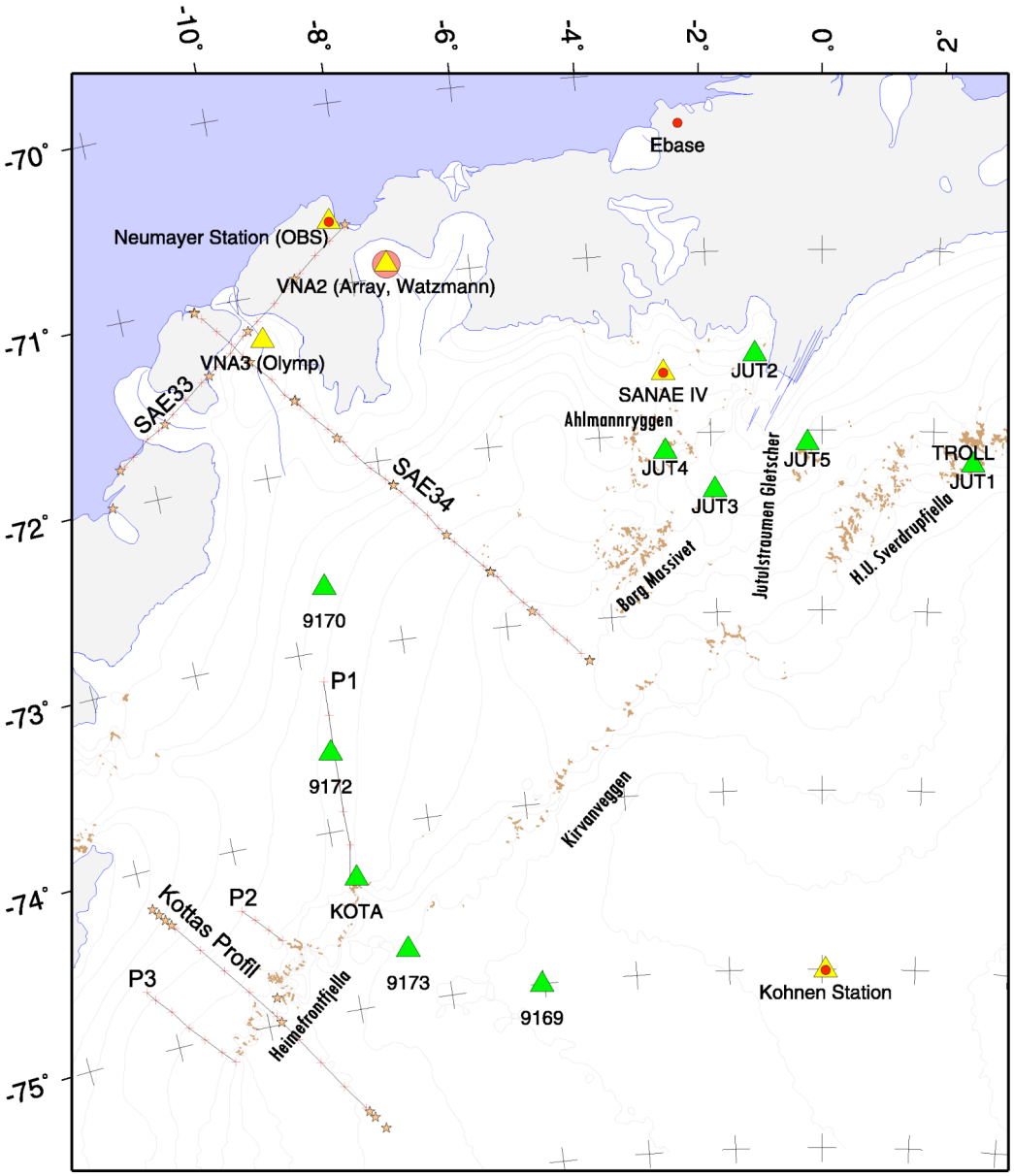


Interpretation of Seismic Profiles from western Dronning Maud Land



Hungeling & Thyssen 1985/1986

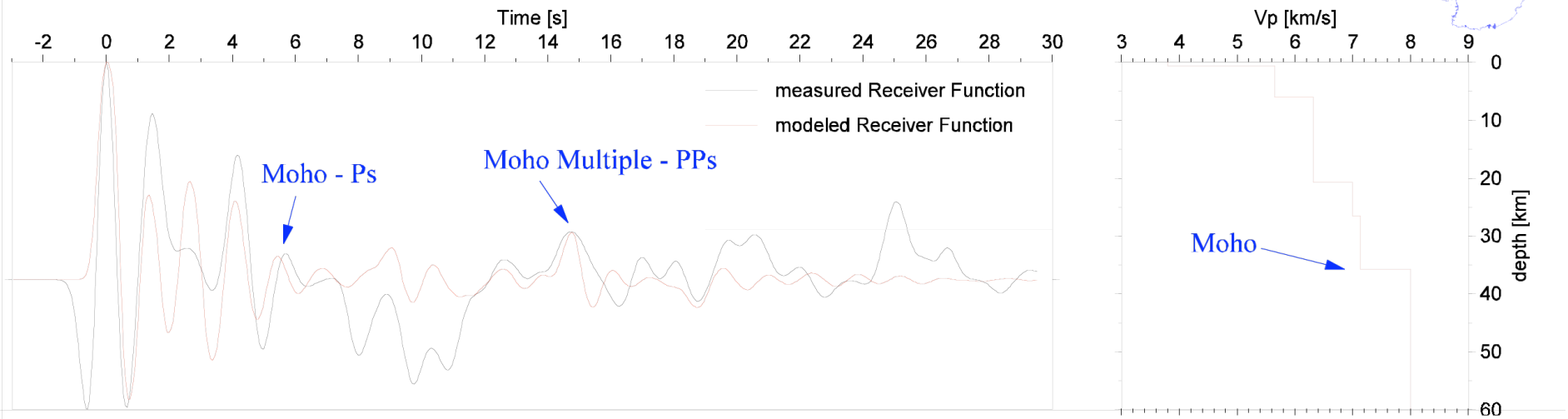
Seismological Data



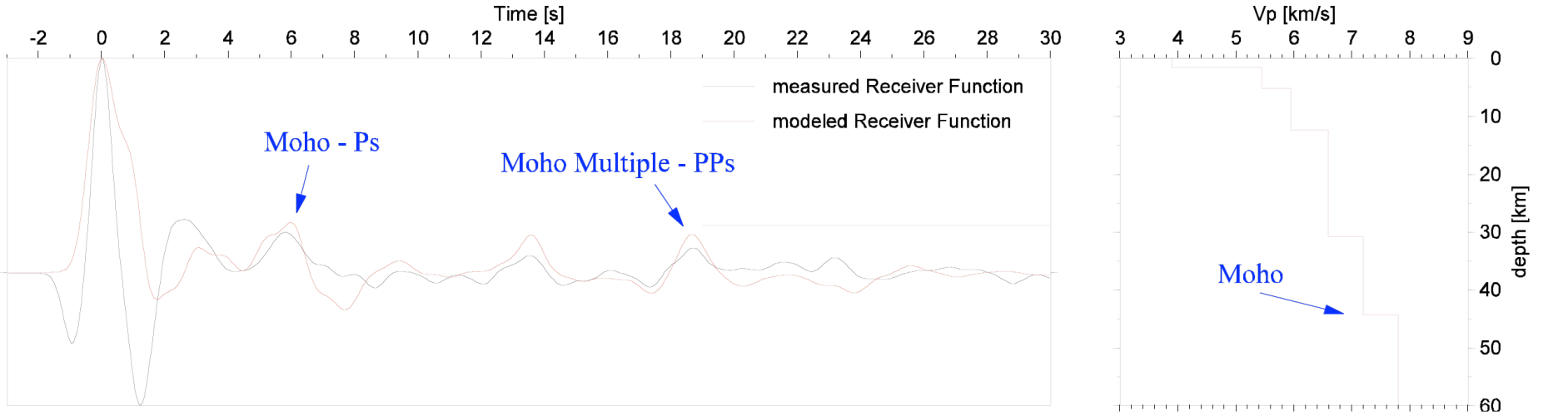
Receiver Function Studies

- problem at stations on ice: large reverberations hide weak Moho conversions
- use of simple models based on seismic interpretations

Receiver Function Analysis

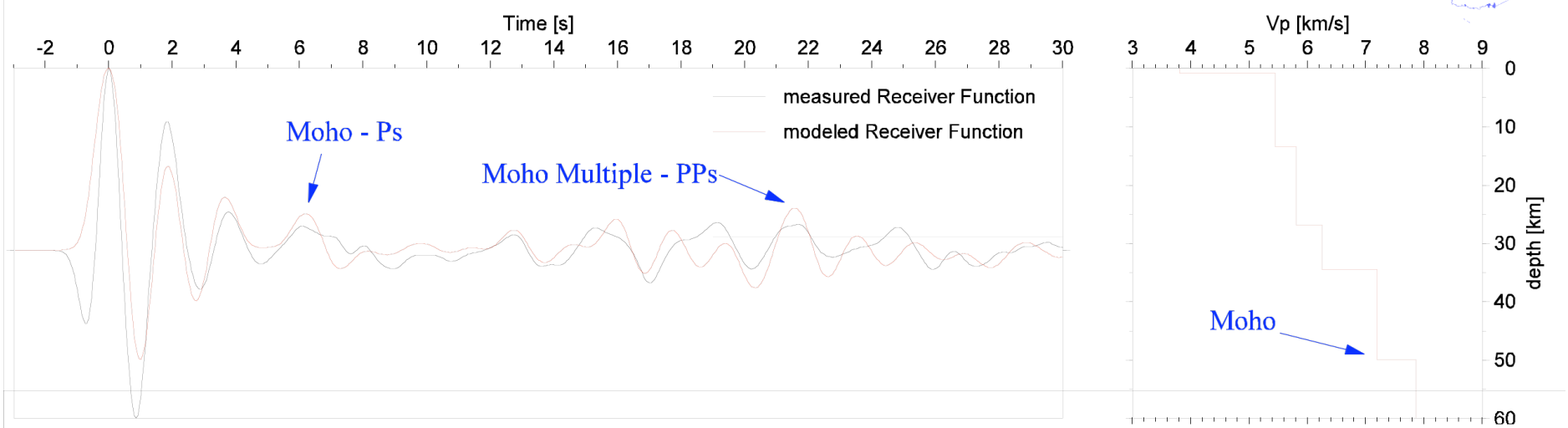


Station 9170, ice thickness 850 m

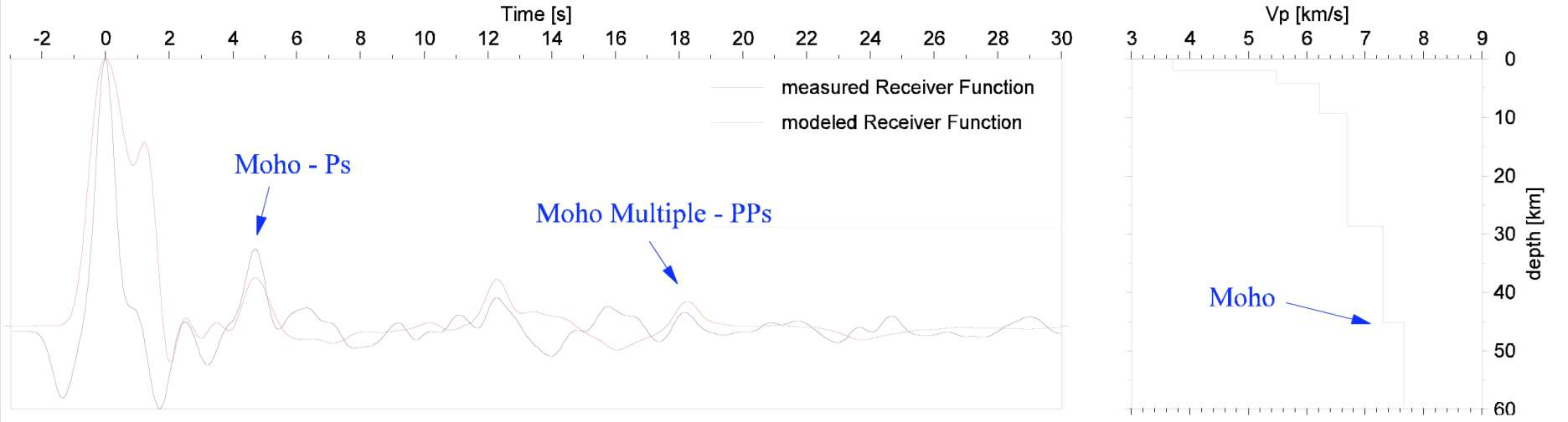


Station 9172, ice thickness 1569 m

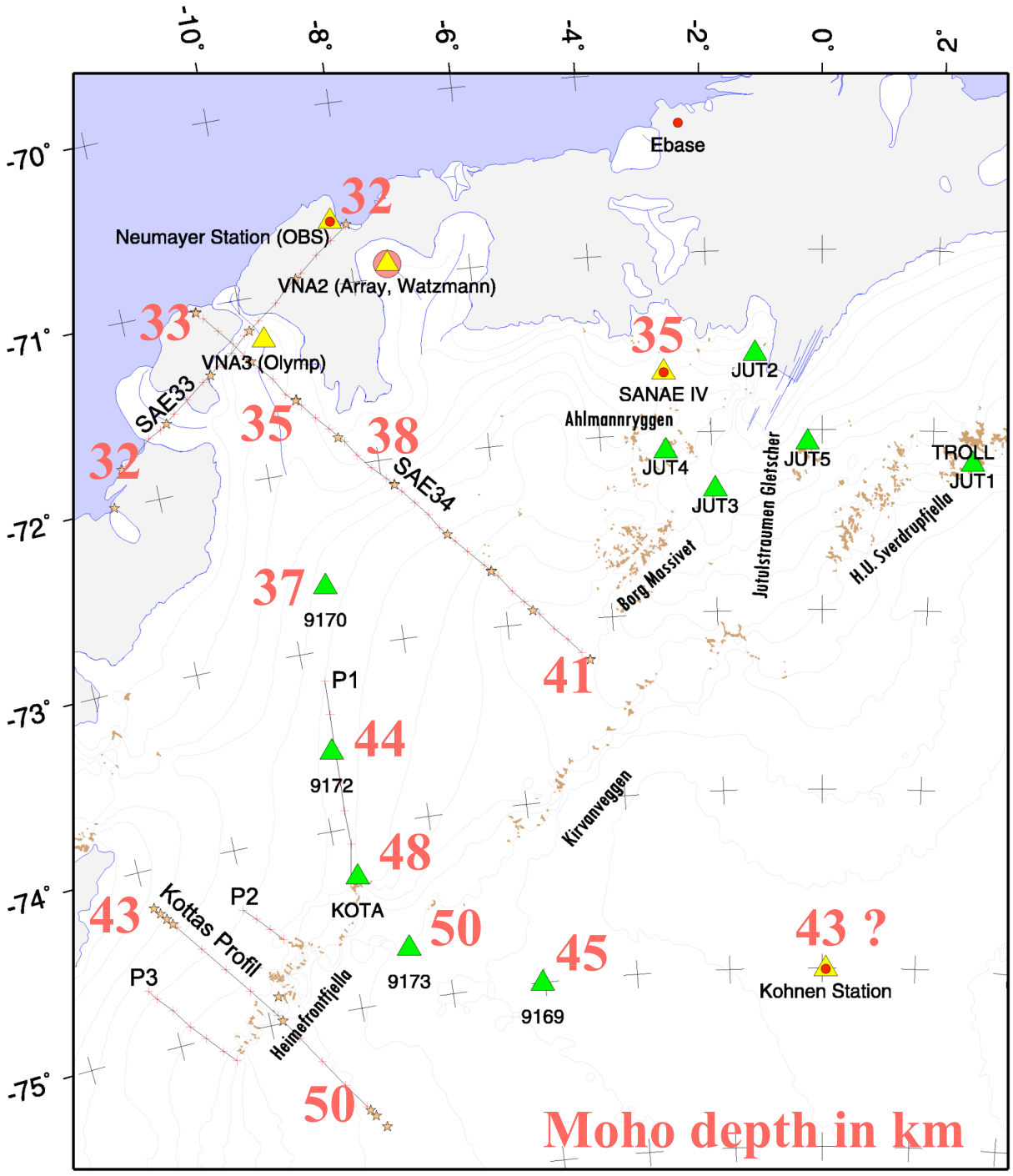
Receiver Function Analysis



Station 9173, ice thickness 1075 m



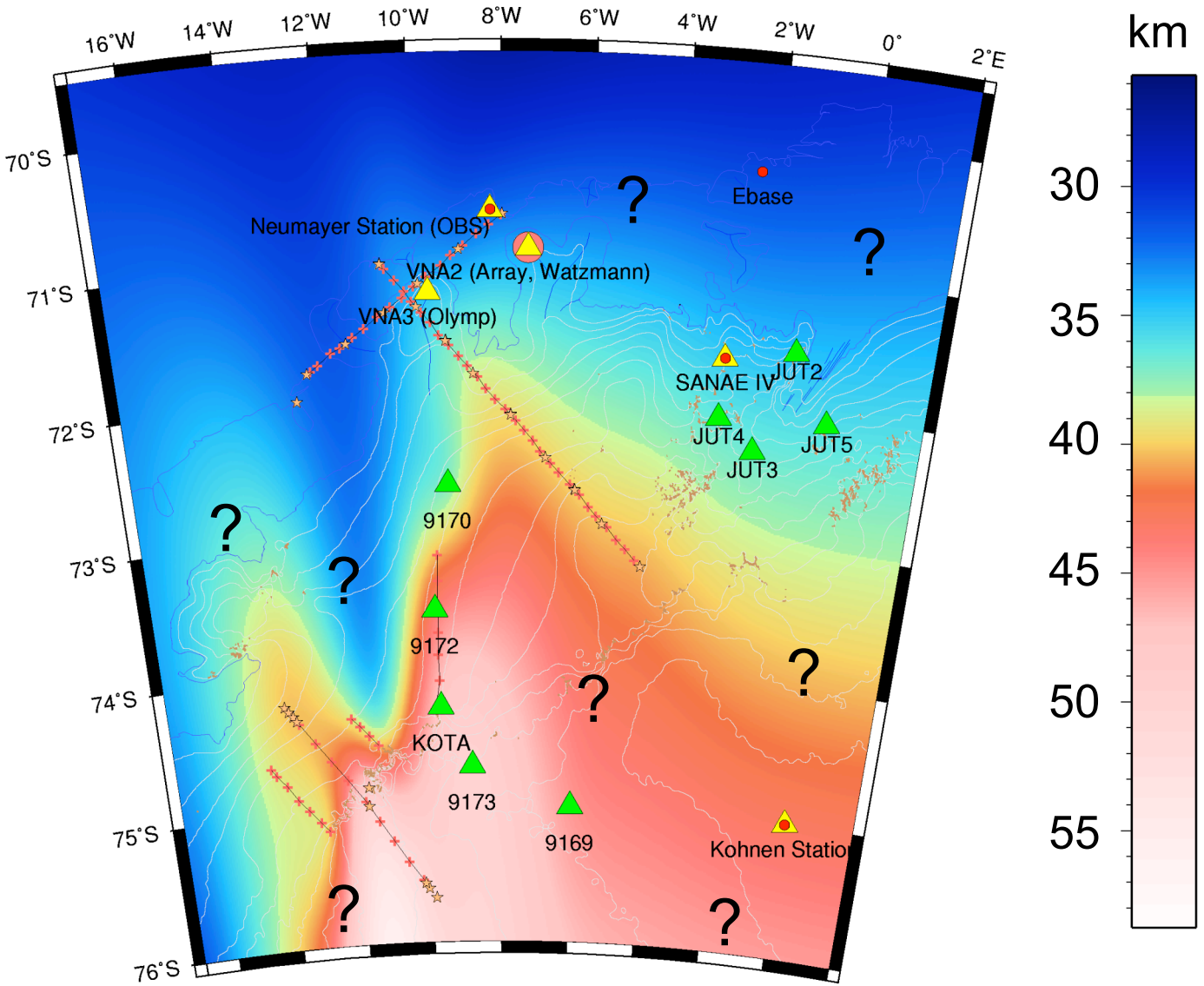
Station 9169, ice thickness 2075 m



Obtained Moho Depth

- results from seismological and seismic studies
- spatial distribution
- seismic and seismological results show similar Moho depths

First Attempt to gridd the Moho Depth



Discussion & Outlook

• Receiver Function studies show similiar results like the results obtained from seismic data

• the results show, that the Heimefrontfjella shear zone is also a boundary in terms of crustal evolution

• a denser data distribution for obtaining the Moho depth and the use of aeromagnetic and aerogravity Data leads to a proper 3D Model

• enhanced Receiver Function Analysis in combination with Shear Wave Splitting investigations will give more detailled results