# Investigations of crustal structures beneath Dronning Maud Land, Antarctica

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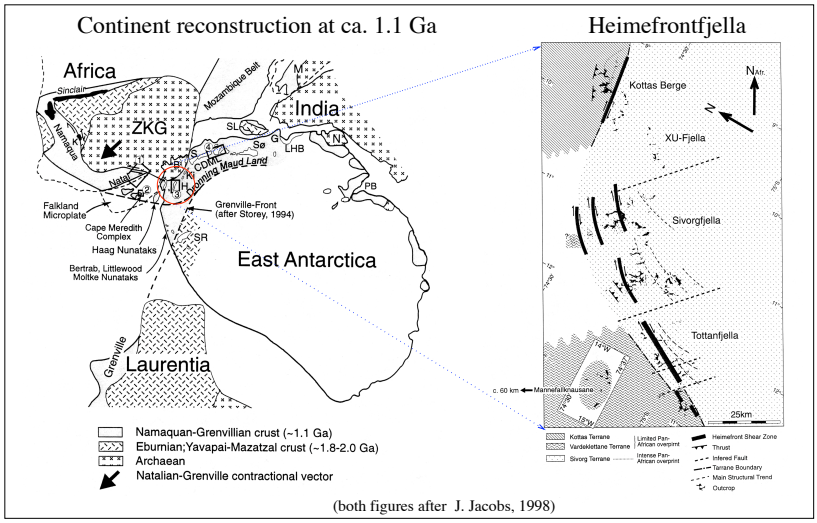
## Introduction

The western part of Dronning Maud Land (DML), Antarctica, principally consist of the Archean Grunehogna Craton and the Grenville-age (1.1 Ga) Maud Province (Jacobs, 1991). Most of the area is covered by ice. Outcrops are the mountain ranges Heimefrontfjella, Kirvanveggen and Sverdrupfjella. These are the western parts of the East Antarctic Orogen, the southern continuation of the East African Orogen, formed during the collision of East and West Gondwana (Pan-African orogenesis, ca 550. Ma).

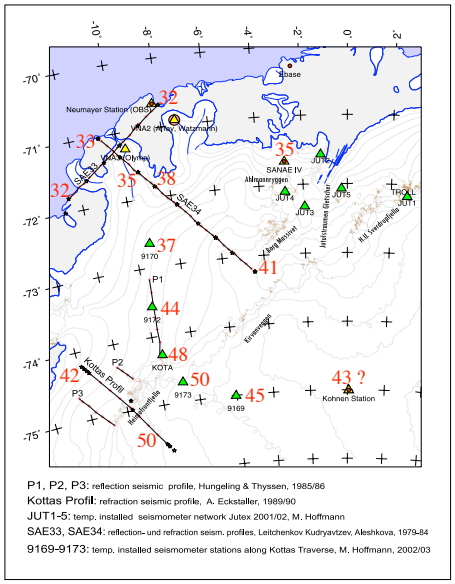
The Heimefrontfjella metamorphic complex is splitted by the Heimefront shear zone. This steeply dipping and NE trending dextral shear zone separates two regions with a different tectonic history: the Vardeklettane and Kottas terrane with Grenvillian crust at the NW side and the Sivorgfjella Terrane with strong Pan-African tectono-thermal overprinted crust at the SE side of the shear zone. (Golynsky & Jacobs, 2001)

The structure of the crust and mantle in western DML is mostly unknown. Especially the deeper crustal fabric along the geological boundaries is of great interest. Thus, during the Antarctic summer 2002/2003, a temporary seismometer network consisting of five seismometers was installed along a 250 km line crossing the Heimefrontfjella shear zone. In addition a permanent broadband seismometer station at Kohnen Station (ca. 75°S, 0°E) was established. In combination with registrations from the Neumayer seismometer network and the seismometer at the South African SANAE IV Station, a spatial mapping of crust thickness (Moho depth) by means of calculating the receiver functions will be obtained. Further analysis of the data will yield to the recent/past strain/stress distribution (seismic anisotropy) and the detection of local seismicity.




## Data base

For the determination of crustal thickness. data sets from different seismic and seismological surveys in Western Dronning Maud Land were used. Big red numbers in the plot above indicate the obtained Moho depth. Triangles represent seismometer stations.




P1, P2, P3: reflection seismic profile, Hungeling & Thyssen, 1985/86
Kottas Profil: refraction seismic profile, A. Eckstaller, 1989/90
JUT1-5: temp. installed seismometer network Jutex 2001/02, M. Hoffmann
SAE33, SAE34: reflection- und refraction seism. profiles, Leitchenkov Kudryavtzev, Aleshkova, 1979-84
9169-9173: temp. installed seismometer stations along Kottas Traverse, M. Hoffmann, 2002/03

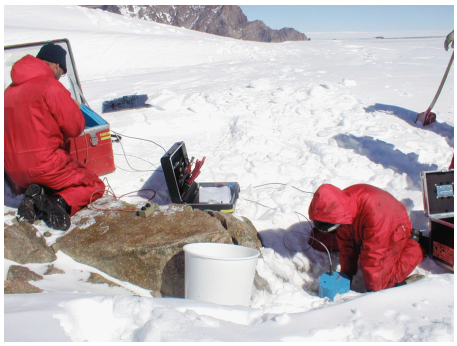
## Experimental set up (summer campaign 2002/03)

Field campaign 2002/2003, temp. installed seismometer network along the trail from Neumayer Station to Kohnen Station (stations 9169 - 9173)

seismometer
4 Lennartz 3D-20sec placed on ice
1 Lennartz 3D-5sec placed on solid rock

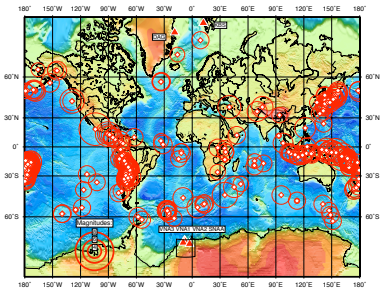
data acquisition
5 RefTek DAS-130 seimic field recorder
data stream: 3 ch @ 20 sps, continuous trigger mode
operating time: 55 to 61 days

recorded events
780 picked events, thereof
319 assigned events (according to NEIC lists)
328 regional events
27 local events
106 not classified events



seismometer set up at Weigel Nunatak (KOTA) Kottas Mountains, Antarctica

## assigned earthquakes

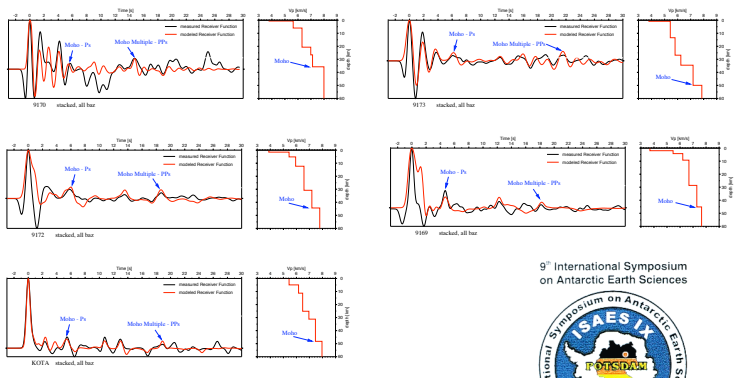


319 assigned events, recorded by the temp. seismometer network 9169-9173 at the time Jan. & Feb. 2003

## data processing

For receiver function analysis, the software package from Charles J. Ammon was used. After rotating the seismogramms into source direction, the iterative deconvolution method was choosen to obtain the receiver function. Calculating a velocity-depth model by means of automatic inversion methods failed, because of huge reverberations produced by the thick ice coverage. So we developed an interactive tool for receiver function modeling. Now it is easily possible to discover weak and hidden moho conversions and their multiples.

## sample receiver function's




## Discussion and Outlook

Preliminary results from analysis of a refraction seismic profile, perpendicular to the Heimefrontfjella shear zone („Kottas Profil"), are showing different regions of crustal thickness: in the north-west 42 km and in the south-east 50 km. According results from Receiver Function studies confirm that the Heimefrontfjella shear zone is also a boundary in terms of crustal evoloution and fabric. The interpretation of seismic profiles together with new obtained aerogravity, aeromagnetic and ice thickness data in combination with the seismological data will provide a 3-D model of the crustal structures beneath western Dronning Maud Land.

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