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The geoid gravity potential inversion to dense anomalies and their comparison with the seismic tomography models

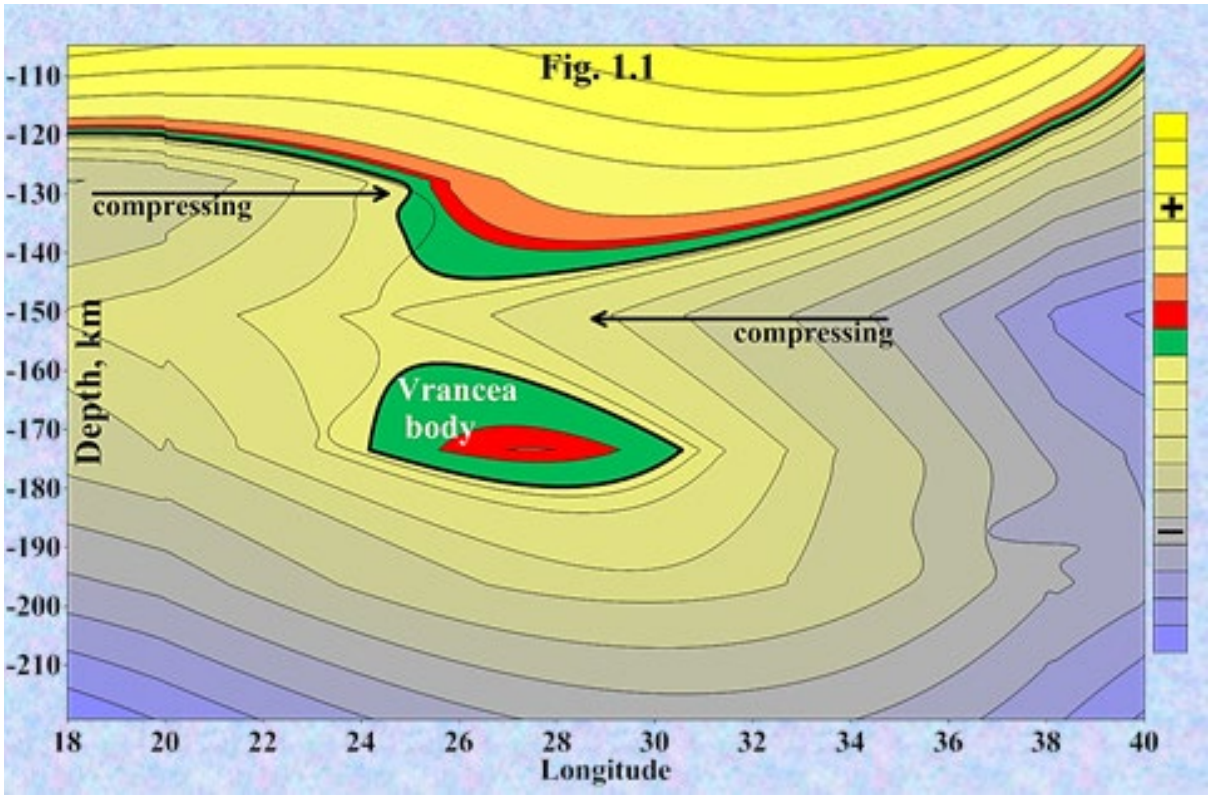
Thanks to Professor Moritz's book [Moritz H. 1990. The Figure of the Earth. Theoretical Geodesy and the Earth's Interior. Wichmann, Karlsruhe] we came up with a Gravitational Tomographic Modelling of the structure of the Earth from Gravitational Potential Data (call by Solicited author: Saskia Goes).

The initial data is the latest geoid model EGM08 n, m = 2190 and a spatial resolution of 20000/n = 10 km for the entire Earth.

Density anomalies relative to the PREM model do not exceed 10-12%. The depth harmonic density, as is known (formula), is the sum of each individual mass bodies within the colon from the core up to the Earth surface

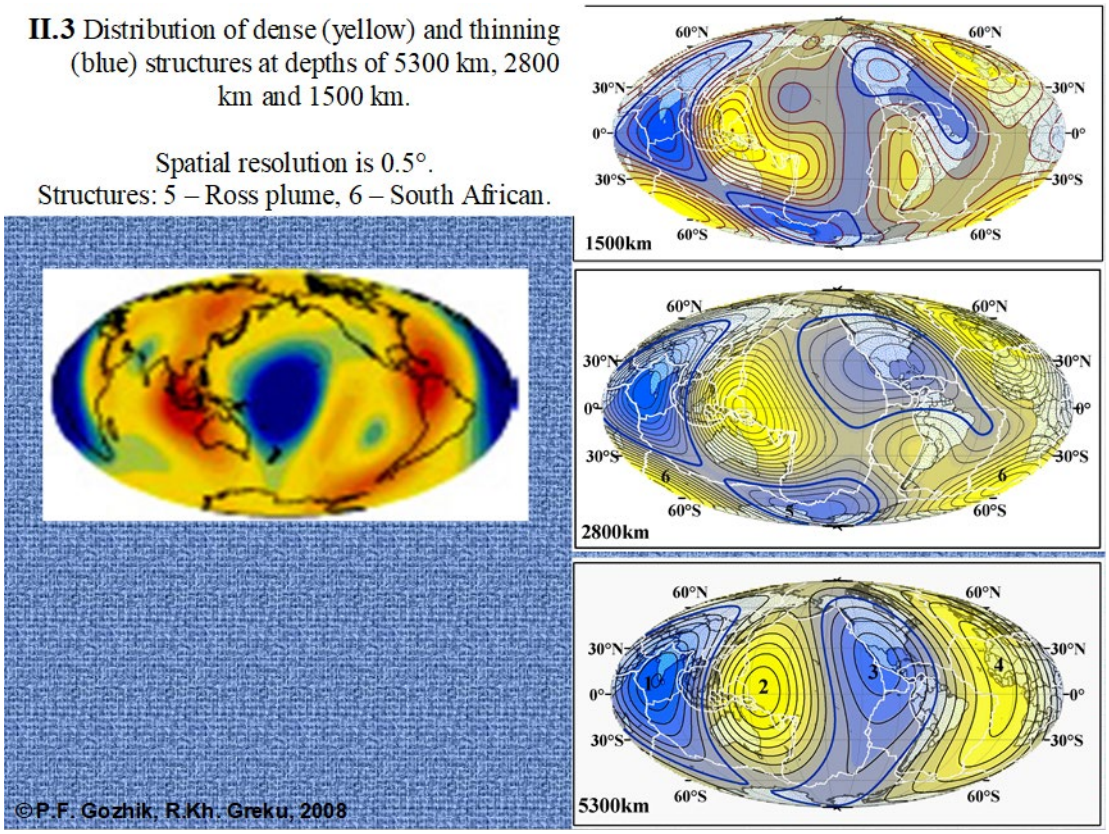
$$\rho_h = \sum_{n=2}^{z}\sum_{m=0}^{n} \frac{M(2n+1)(2n+3)}{4\pi R^{n+3}} \cdot r^n (c_{nm}\cos m\lambda + s_{nm}\sin m\lambda) P_{nm}(\cos B)$$

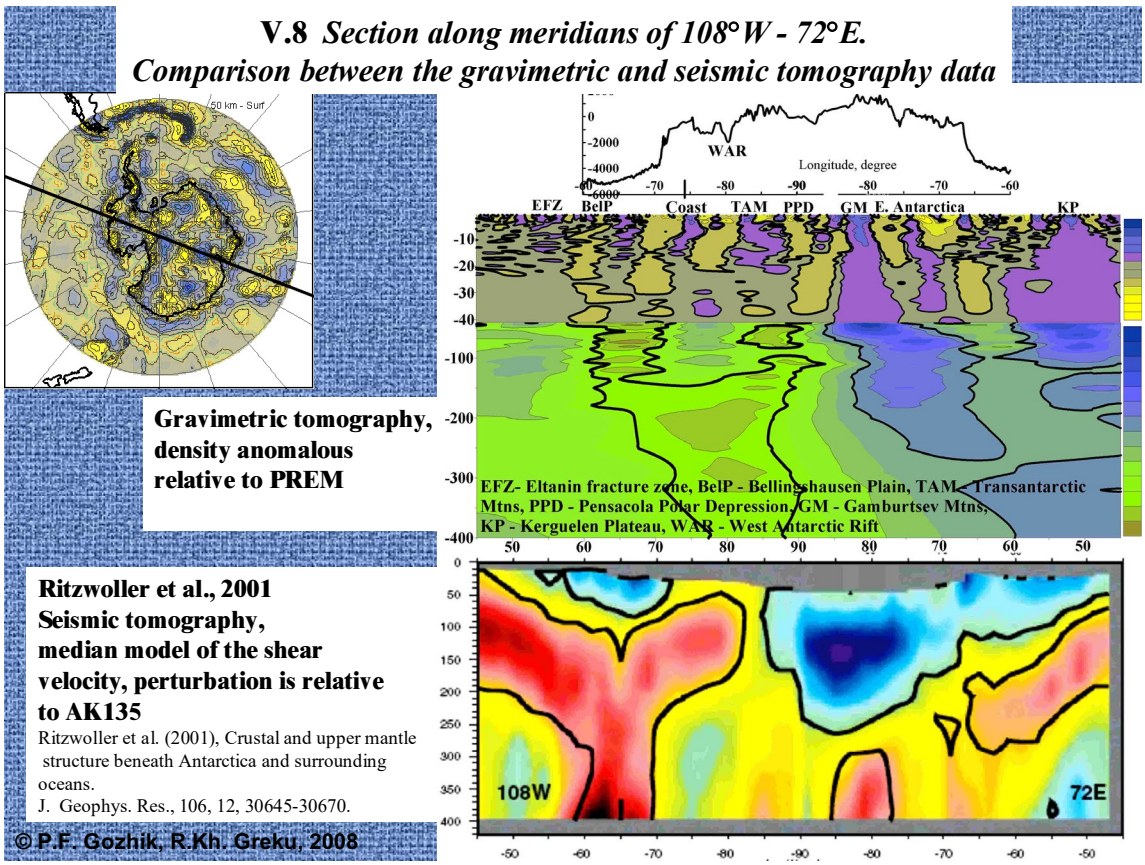
Here is an example of the Vrancea earthquake source area in the Carpathian region of Eastern Europe. If we exclude the total influence of the density of the lower horizons (according to the above formula), then we see the actual anomalous perturbing body, which is the result of delamination (compression and separation) from the upper horizons at a depth of 150 km and a depth of up to 170 km. This is consistent with seismic data.



Using the same technology of Gravitational Tomography, we investigated the deep structure of the Antarctic regions, presented in our Atlas
https://issuu.com/bizinetmedia/docs/atlas_of_the_antarctic_deep_structure_electronic_v

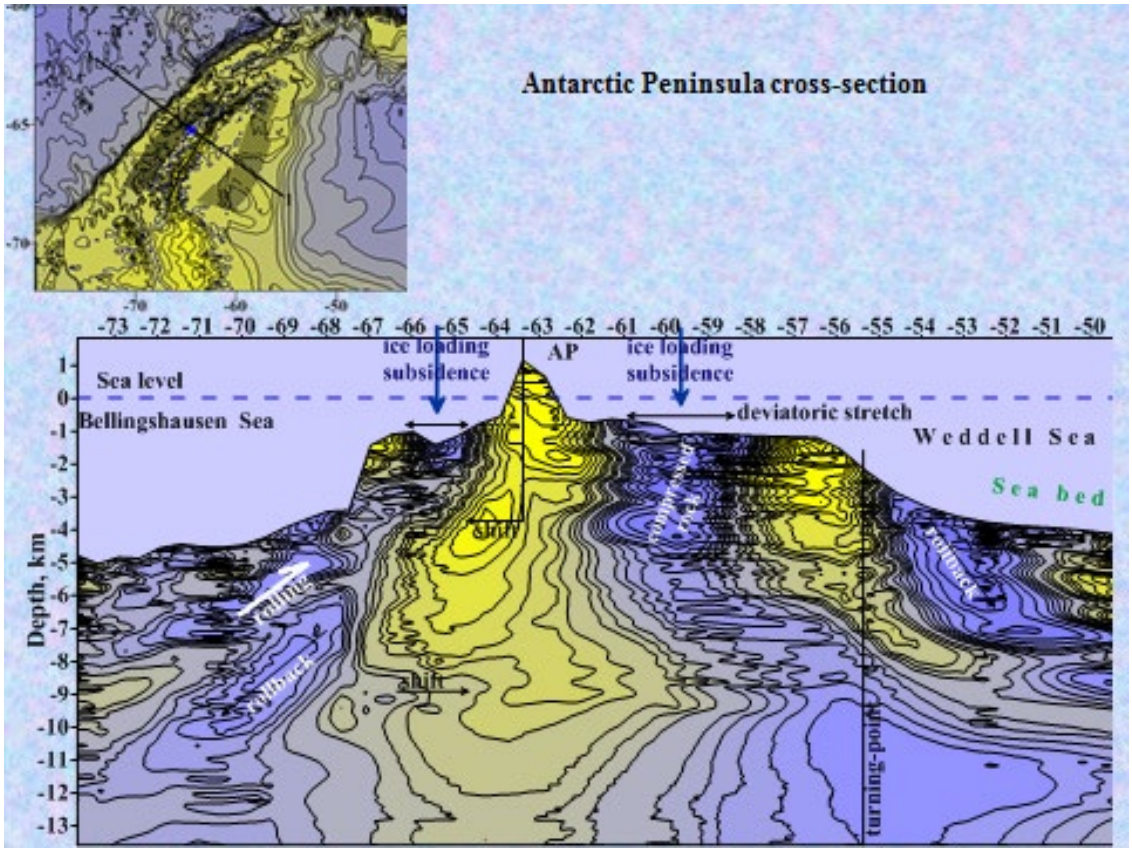
The Atlas shows comparisons with seismic tomography data (Figure left at a depth of 2800 km. Ishii M. and J. Tromp (2004), Constraining large-scale mantle heterogeneity using mantle and inner-core sensitive normal modes, Physics of the Earth and Planetary Interiors, 146, 113-124).





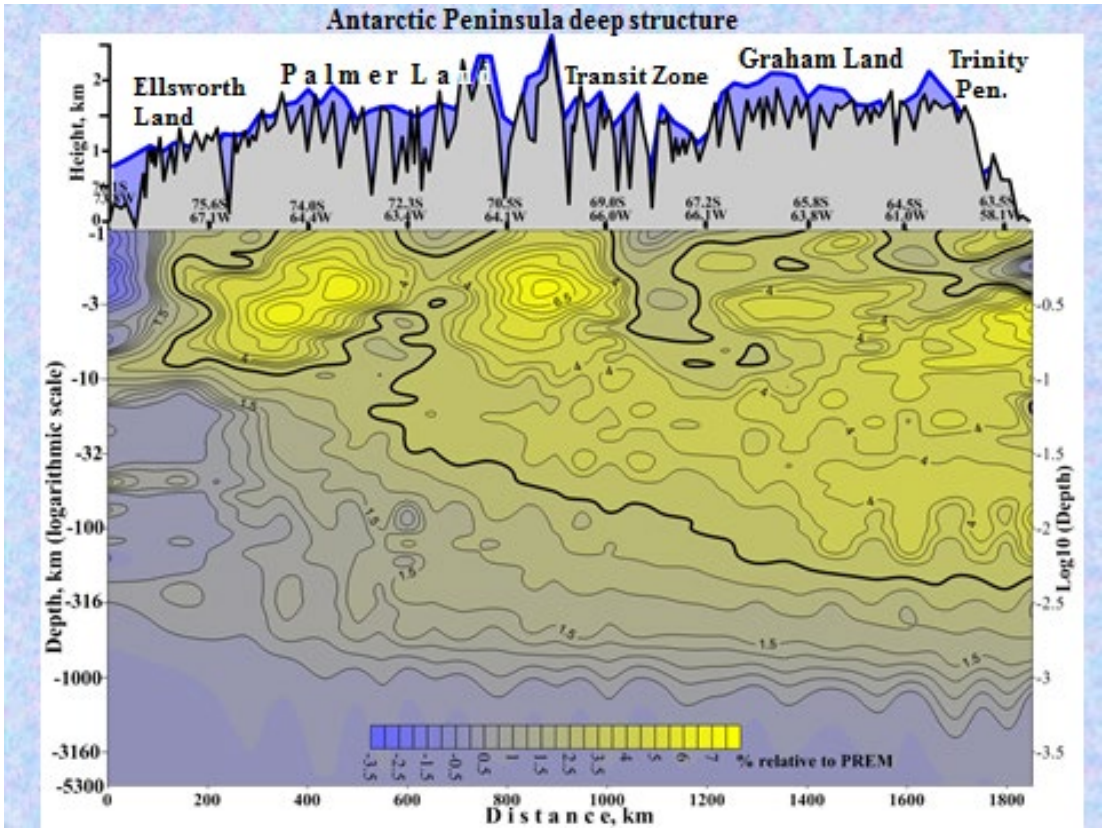
Of course, there may be discrepancies with seismic tomography data since both methods use different physical properties of the environment: reflections of seismic waves and a disturbing gravitational potential.

There are many other illustrations in the Atlas. An interesting example of local geodynamics is the geodynamics of changes in the structure of the shelf zone of the Antarctic Peninsula in the cross section of the Gravitomographic Model.

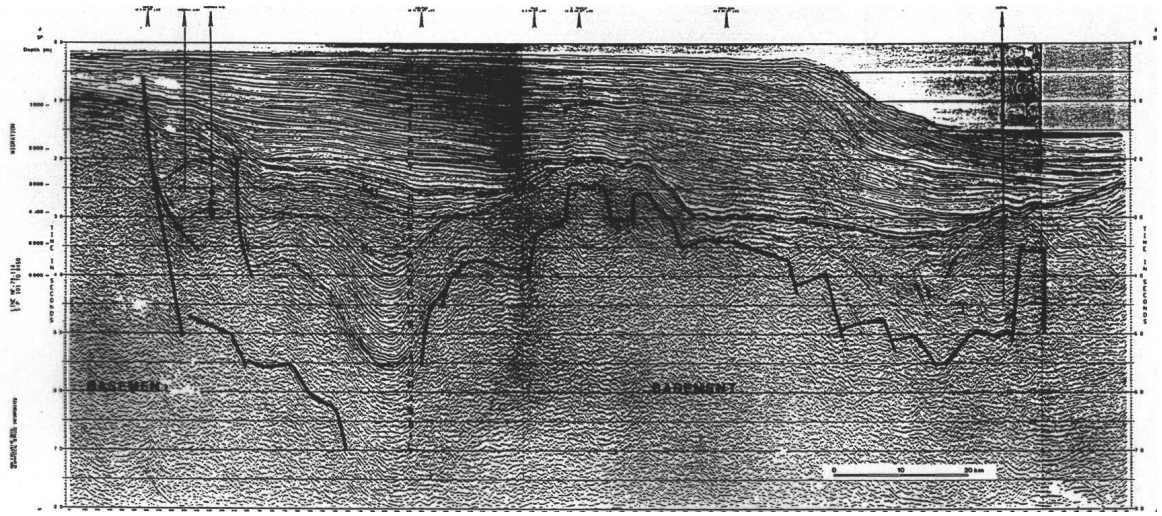


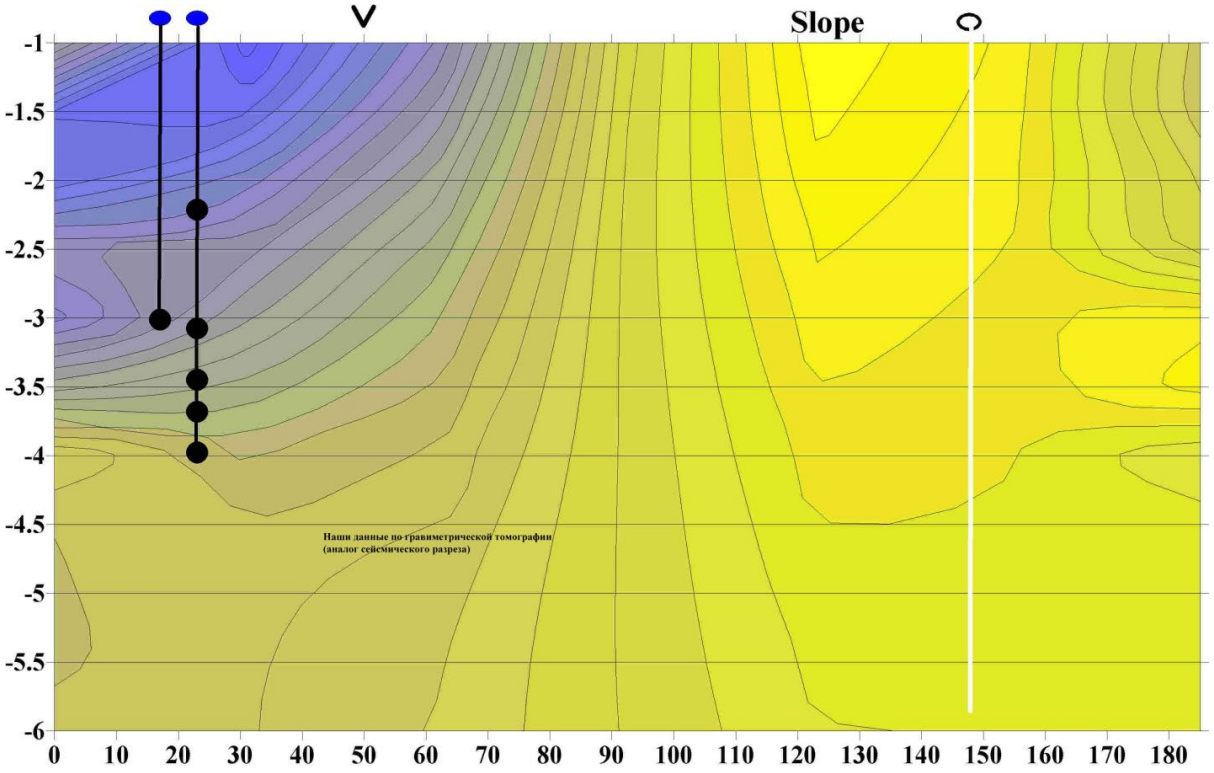
Here we see the geodynamic effect of the expansion of the shelf zone on the western and eastern margins of the Peninsula, caused by an additional centuries-old snow load (places of subsidence and deviatoric stretch). The difference in the intensity (width) of the expansion is clearly visible: in the west the width is smaller, in the east it is larger. This is due to the fact that in the east behind the mountain range of the Peninsula, the intensity of the snow cover is greater. Therefore, the sag and the width of the deviatoric stretch are more intense.

According to our data on the gravitational potential and density anomalies, it is also possible to look at great depths to the outer core of the Earth up to 5300 km using the example of the deep structure of the Antarctic Peninsula.



Easily and without performing offshore exploration and drilling, all known oil and gas hydrocarbon deposits are revealed using Gravity Tomography models.





In general, we are ready to cooperate with fellow mining firms, geologists and geophysicists in developing natural resources, solving problems of the structure and geodynamics of the Earth in the formulation as presented in “Solicited author: Saskia Goes”.

Best Regards,

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