Session title: JA08a - Probing the Earth's Lithosphere and Its Dynamics Using Geophysical Modeling (IAGA, IASPEI, IAVCEI, IAG)

Session type: Joint Symposium

Symposium: JA08

Presentation number: IUGG19-4040

Abstract title:

3D Density, Thermal and Compositional Model for the Antarctic Lithosphere

C. Haeger[1], M. Kaban[1], M. Tesauro[2], A. Petrunin[1], W. Mooney[3].
[1]German Research Centre for Geoscience, Earth System Modelling, Potsdam, Germany.
[2]Universita degli Srudi di Trieste, Dipartimento di Matematica e Geoscienze, Trieste, Italy.
[3]US Geological Survey, Earthquake Science Center, Menlo Park, USA.

We create a 3D density, temperature and composition model of the Antarctic lithosphere using an integrative approach combining gravity, tomography data with mineral physics constraints, topography data and seismic data on crustal structures. The latter is used to create a new Moho and crustal density model. Temperature and thermal density variations are estimated based on S-wave velocities from two independent tomography models (SL2013sv and AN1-S). Results of the Antarctic continent show the well-known distinction between East and West Antarctica in temperature and density to a depth of about 200 km. Incorporating compositional variations in the temperature calculations increases temperatures in depleted regions by up to 150°C, giving improved insights into thermal structures. The thickness of the lithospheric root also varies strongly between these regions, with values below 100 km in the west and above 200 km in the east. Regions with negative compositional density variations (<-0.040 g/cm³ at 100 km), high depletion (Mg #>91.5) and low temperatures (<800°C) (central Dronning Maud Land, along the east flank of the Transantarctic Mountains) are interpreted as Precambrian cratonic fragments. Nearly undepleted lithosphere is found in the Lambert Graben and the Aurora Subglacial Basin and is attributed to Mesozoic rifting activity that has caused lithospheric rejuvenation.