Velocity structure and lithospheric age of the Gamburtsev Subglacial Mountains

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The Gamburtsev Subglacial Mountains (GSM) located near the center of the East Antarctic Ice Sheet is one of the least explored and most poorly understood mountain ranges on earth. During IPY, the Gamburtsev Subglacial Mountain Seismic Imaging Experiment (AGAP/GAMSEIS) undertook a passive seismic survey of the GSM and surrounding regions. Using a multinational array of 28 broadband seismometers we conduct Rayleigh wave phase velocity tomography of the region using the two-plane wave method of *Forsyth and Li* [2005]. We use these phase velocity measurements to perform inversions for shear-wave velocity structure in the region. We find that the GSM are largely defined by thick crust (in excess of 50km just to the north of Dome A) and a seismically fast mantle to depths of nearly 250 km. Detailed comparison of the phase velocity profile of this region with global phase velocity models and models of crustal age around the world shows that the GSM continental lithosphere closely resembles that of Paleoproterozoic and/or Archean age. These results suggest that the lithosphere of the region dates to the Archean or Paleoproterozoic and the high elevations result from thickened crust that developed during later tectonic events, most likely associated with the late Proterozoic or early Paleozoic assembly of Gondwana. The thickened root and high topography may result from an extremely low average erosion rate and a cold lithosphere that limits retrograde metamorphism within the existing crustal root. Reactivation of crustal faults during later deformation events, such as the formation of Pangaea at 300Ma, may also be a source of elevated topography in the region. The Lambert Rift extends into the north part of the study region and is marked by much thinner crust and slower shear-wave velocities in the upper mantle.

References

Forsyth, D. W. and A. Li, Array analysis of two-dimensional variations in surface wave phase velocity and azimuthal anisotropy in the presence of multipathing interference, in *Seismic Earth: Array Analysis of Broadband Seismograms*, edited by A. Levander and G. Nolet, AGU, Washington D.C., 81-97, 2005.