EGU21-13984
https://doi.org/10.5194/egusphere-egu21-13984
EGU General Assembly 2021

No mafic layer in 80 km thick Tibetan crust

Gaochun Wang[1], Thybo Hans[2,3,4], and Irina M. Artemieva[4,5,6]
[1]State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China. (gaochun222215@gmail.com)
[2]Eurasia Institute of Earth Sciences, Istanbul Technical University, Turkey. (h.thybo@geo.uio.no)
[3]Center for Earth Evolution and Dynamics (CEED), University of Oslo, Norway.
[4]State Key Laboratory of Geological Processes and Mineral Resources, School of Earth Sciences, China University of Geosciences, Wuhan, China.
[5]Department of Geophysics, Stanford University, CA, USA. (irinageo@stanford.edu)
[6]Marine Geodynamics Section, GEOMAR Helmholtz Center for Ocean Research, Kiel, Germany.

All models of the magmatic and plate tectonic processes that create continental crust predict the presence of a mafic lower crust. It has been suggested that the lower crust does not need to be basaltic, but until now all seismic observations show high P-wave velocity, which requires that the bulk composition of the lower crust must include at least 20-40% of mafic rocks. Earlier proposed crustal doubling in Tibet and the Himalayas by underthrusting of the Indian plate requires the presence of a mafic layer with high seismic P-wave velocity (V_p>7.0 km/s) above the Moho. Our new seismic data demonstrates that some of the thickest crust on Earth in the middle Lhasa Terrane has exceptionally low velocity (V_p<6.7 km/s) throughout the whole 80 km thick crust. Observed deep crustal earthquakes throughout the crustal column and thick lithosphere from seismic tomography imply low temperature crust. The calculated typical velocity versus depth curves for different crustal lithologies and temperature regimes imply the composition of the lower crust is felsic. Therefore, the whole crust must consist of felsic rocks as any mafic layer would have high velocity unless the temperature of the crust were high. Our results form basis for alternative models for the formation of extremely thick juvenile crust with predominantly felsic composition in continental collision zones.