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Boundary layers in the continental upper mantle constrained by geophysical data

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The concepts of the boundary layers are closely related to the concept of the lithosphere. However, they are free from many uncertainties related to practical definitions of the lithospheric base. The definitions of the boundary layers are physically specific and establish complex interrelationships between them and the lithospheric structure. I will use recent seismic tomography models together with thermal modeling of the continental lithosphere and petrologic data from mantle-derived xenoliths to illustrate lateral and vertical correlations between thermal boundary layer ("thermal lithosphere"), rheological boundary layer (illustrated here by "seismic lithosphere"), and chemical boundary layer ("petrological lithosphere"). The results of joint interpretation of seismic velocity and temperature data indicate that the base of TBL and RBL constrained by different geophysical methods may differ significantly and should not correspond to the base of the CBL. Mantle-derived xenoliths provide independent constraints on the thickness of RBL (by changes in xenoliths texture), CBL (by vertical changes in mantle depletion), and TBL (constrained by geothermobarometry). However, petrologically defined boundary layers should not necessarily correspond to their geophysical definitions. This conclusion will be illustrated by comparing geophysical and petrological results from different cratonic regions worldwide.