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Different causes of the delamination on the example of Caucasus and Kyrgyz Tien Shan collision zones.

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The causes of delamination of the mantle lithosphere in collision zones is actively debated in the scientific community. The main discussions are focused on the initiation of sinking of the continental lithosphere into the asthenosphere to a depth. Most scientists believe that such kind of immersion is impossible. However, there are several articles showing that this process is nonetheless taking place. For example Kay and Kay, (1993), Faccenda, Minelli, Gerya, (2009), Ueda et. al., (2012) and others propose various mechanisms of delamination, for example: eclogitization of the mafic layer of the lower crust, the effect of convection in the upper mantle, or gradual transition of the oceanic subduction into continental collision. Does the mantle part of the lithosphere sink into the mantle or spread laterally, as described in [for example, Deep Geodynamics, 2001; Bird, 1991; Schmeling and Marquart, 1991]?

To answer these questions, we study deep structures beneath the Caucasus and Kyrgyz Tien Shan collision zones. The studies were carried out on the basis of multiscale seismic tomography methods: regional and global. This approach made it possible to study heterogeneities both in the crust and in the upper mantle. The obtained 3D models of seismic heteroheneities reveal similar features for the both collision regions. Beneath the mountain areas, in the uppermost mantle and lower crust, we observe prominent low-velocity anomalies that possibly indicate thickening of the crust and missing (or strongly thinned) mantle part of the lithosphere. At the edges of the collision zones, we reveal inclined high-velocity anomalies appearing as continuations of the continental plates sinking underneath the collision zones, which can be interpreted as delaminating mantle parts of the continental lithosphere. Based on joint consideration of the tomography models with the existing models of tectonic evolution, we conclude that the mechanisms of delamination in the considered two regions are different. In Caucasus, the delamination could be gradually transformed from oceanic subduction that ended here approximately ~10-15 Ma. In the case of Tien Shan, the detachment of the mantle lithosphere could be triggered by the plume that existed beneath Central Tien Shan or by the eclogitization of the mafic layer of the lower crust.

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