Surface uplift and rock exhumation of morphotectonic blocks at the active fore-arc of Kamchatka, Russia

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The growth of continental crust by accretion of allochtonous terranes at the active margin of Kamchatka is documented since Mesozoic times. This growth is expressed by differential uplift and exhumation of seismotectonic and morphotectonic blocks of the accretionary wedge along the Kamchatka trench, depending on the accretion of lower plate material. The kinematics of uplift and exhumation can be grasped by analysing the deformation with structural and neotectonic techniques and quantified by thermochronological methods (fission-track dating) up to Lower Pliocene times.
Due to differential uplift of seismotectonic blocks and the interplay with sea level changes, numerous (sub-) recent marine and alluvial terraces have been formed on the Pacific side of Kamchatka. Fission-track dating of the underlying blocks and radiometric dating of the resting terraces by optical stimulated luminescence (OSL) and dating using cosmogenic nuclides, combined with sea level high stands, allows the documentation and quantification of the relative vertical movement of the seismotectonic blocks with very high resolution up to Recent times.
Results from our subproject TP1 in the framework of the integrated german-russian research project KALMAR (*K*urile-Kamchatka and *AL*eutean *MAR*ginal Sea-Island Arc Systems: Geodynamic and Climate Interaction in Space and Time, grant number BMBF 03G0640C) are the following: The mean exhumation rates along the Kamchatka margin varies from about 0.2 up to 1.1 mm/yr. The exhumation rates can be linked to morphotectonic blocks and exhumation is partially separated along discrete trench-orthogonal active faults. These active faults can be structurally mapped onshore Kamchatka and they seam to be related to pre-existing features of the incoming Pacific Plate.
First OSL-ages of the terraces resting on top of the morphotectonic blocks point to recent uplift rates varying from about 2.8 mm/yr up to about 7.5 mm/yr in specific areas during Holocene times. The OSL-ages are generally in a good agreement with the results from dating using the method of cosmogenic nuclides. A good correlation between lower plate convergence, fore-arc geometry, exhumation, elevation and age of marine and alluvial terraces is found.

Two marine expeditions, which where carried out in the framework of the KALMAR project (TP2) during summer 2009 achieved geophysical as well as geological data off Kamchatka. We combine the onshore data with the marine dataset e.g. to extend the onshore mapping of the block-separating active faults through the fore-arc to the lower plate. We might estimate the coherence between lower plate convergence (geometry, direction, velocity, physical properties) and upper plate deformation, in other words the seismical and mechanical coupling between upper and lower plate along the Kamchatka trench trough time.