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Slab detachment modelling: geodynamic regimes, topographic response, and rheological mechanisms

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A set of numerical experiments were carried out to study the effect of slab breakoff on a subduction-collision system. The numerical code I2VIS (Gerya & Yuen, 2003) used for this purpose allows activation of plasticity, viscous creep and Peierls creep.
A two-dimensional systematic study was performed by varying the oceanic slab age and initial plate convergence rate. In this parameter space, four different end-members were observed where breakoff depth can range from 40 to 400 km. Different combinations of rheological mechanisms lead to different breakoff modes. Activation of Peierls mechanism generally allows slabs to break faster and shallower.
Each breakoff end-member has its own topographic signal evolution and always display a sharp breakoff signal. Averaged post-breakoff uplift rates ranges between 0,8 km/My for shallow detachment and 0,2 km/My for deep detachment in foreland and hinterland basins.
Initiation of continental crust subduction was observed when using an oceanic lithosphere older than 30 My. Different exhumation processes such as slab retreat and eduction were observed. Large post-breakoff rebound associated with plate de- coupling occurs if the subducted oceanic slab is old enough.

REFERENCES Gerya, T. V. & Yuen, D. A. 2003: Charaterictics-based marker method with conservative finite-difference schemes for
modeling geological flows with strongly variable transport properties. Physics of the Earth an Planetary Interiors 140 (4), 293–318.