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Numerical modelling of magmatism in active and passive rifting

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We have developed a new, comprehensive thermo-mechanical code for numerical modelling of complex geodynamic processes at high resolution and precision. The code is based on marker in cell technique, it applies realistic visco-elasto-plastic rheology and takes advantage of recent progress in computational power. The algorithm includes the processes of melting, erosion and sedimentation as a comprehensive tool for investigation of geodynamical processes and in particular the role of magmatism in rift formation.

In the present study we model continental rift formation initiated by: 1) a thermal anomaly in the asthenosphere (active rift formation), and 2) passive extension with and without a thermal anomaly in the asthenosphere (passive rift formation). We put special emphasis on the processes of magma intrusion and its influence on the basin development. In the study we aim at explaining recent seismic results from the Baikal Rift Zone and East African Rift Zone, which indicate that sill intrusion in the lower crust can be a significant process in continental active and passive rifting. The results indicate that crustal thinning can be compensated by the intrusion of sills, leading to a flat Moho below rift systems. The modelling emphasises the required rheological state of the crust and lithospheric mantle for the development of such sill structures, and the role of these sills in the further basin evolution.