Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07645, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-07645
EGU General Assembly 2008

Abnormal fault populations in rift transfer sections

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Continental rifts are large extension related structures that form in the crust of the Earth. We model the extension of a heterogeneous crust with a visco-elasto-plastic spring model. Depending on the original nucleation sites of faults, larger rift segments form and propagate towards each other. When the segment tips approach each other, they repel and pass each other with a characteristic distance. The crust piece that is now captured between the two segments starts to rotate while the rift segments open. This rotation leads to a local change of the stress field so that the rift segment tips turn, propagate towards each other and finally capture a small crustal piece completely to create a micro-plate. During the rotation of the micro-plate normal fault populations develop that are oriented parallel or with a small angle to the far-field extension direction. The rotation of the micro-plate leads to a rotation of the stress field of up to 90°. In order to validate the numerical model we study the Albertine rift system in the western branch of the East African rift between Uganda and the Democratic Republic of Congo. Here a large basement block, the Rwenzori mountains, is captured almost completely by rift segments. Only the northern part of the mountains is still attached to the Tanzania craton. According to the numerical model the Rwenzori block is an example of a captured rotating micro-plate and should contain abnormal fault population due to the rotation. The contact of the Rwenzori block with the Tanzania craton should be a normal fault that is oriented almost parallel to the far field extension direction. Indeed in the field we find a brittle fault set in the Rwenzori mountains that has this orientation and shows mainly normal components of slip. In addition we study seismicity in the area with a large seismic network around the Rwenzori mountains. Earthquake focal mechanisms determined from this study show that an active nor-

mal fault system exists between the Rwenzori block and the Tanzania craton with an orientation that is almost parallel to the recent extension of the western rift. Such an active fault system was predicted by our numerical model suggesting that the model is valid. The existence of such large and active abnormal fault populations has major consequences for the determination of the orientation of the stress field using fault slip analysis. Areas where rift segments interact cannot be used to determine the far field stress due to strong local stress field perturbations.