Geophysical Research Abstracts
Vol. 16, EGU2014-15586, 2014
EGU General Assembly 2014

Three-dimensional Distinct Element Method (DEM) modelling of oblique-slip normal faulting

Martin Schöpfer (1), Conrad Childs (2), Tom Manzocchi (2), and John Walsh (2)

(1) Department for Geodynamics and Sedimentology, University of Vienna, Austria (martin.schoepfer@univie.ac.at), (2) Fault Analysis Group, UCD School of Geological Sciences, University College Dublin, Dublin, Ireland

Normal faults frequently exhibit a strike-slip displacement component, which can arise for example from oblique reactivation or from fault strike changes, e.g. along bends. It is well known from both natural examples and analogue experiments that fault zones developing above oblique normal faults are typically comprised of systematically stepping fault segments. However, dependencies of fault segment orientation and segmentation on fault obliquity and mechanical properties during faulting are poorly understood. For example, it is not clear whether systematically stepping fault segments link preferentially via footwall or hanging wall breaching. Moreover, the persistence of fault bends throughout mechanically layered sequences is another yet unexplored topic. Here we use three-dimensional Distinct Element Method (DEM) modelling to elucidate the geometry and kinematics of fault zones developing above oblique normal faults. We systematically vary both fault obliquity and confining pressure. Fault zone structure (e.g. segment orientations, drag, etc.) is quantified from horizon maps generated at different levels within the model. Irrespective of fault obliquity, fault zones become better localised with increasing confining pressure. Analysis of displacement partitioning at branch-points illustrates that neither footwall nor hanging wall breaching is the preferred mode of segment linkage. Fault segment orientations exhibit a systematic fault obliquity dependence, which can be rationalised using infinitesimal strain theory for transtensional shear zones. Our models therefore suggest that the orientation of fault segments developing above oblique normal faults may be used to estimate the extension direction, as suggested nearly 30 years ago by A.M. McCoss [1986, J. Struct. Geol. 8(6), p. 715-718].