Geophysical Research Abstracts
Vol. 19, EGU2017-17002, 2017
EGU General Assembly 2017

Experimental approach to domino-style basement fault systems with evaporites during extension and subsequent inversion

Oriol Ferrer (1) and Ken McClay (2)

(1) Geomodels Research Institute, Departament de Ciències de la Terra i de l'Oceà, Facultat de Ciències de la Terra, Universitat de Barcelona, Barcelona, Spain (joferrer@ub.edu), (2) Fault Dynamics Research Group, Department of Earth Sciences, Royal Holloway University of London, Egham, Surrey, United Kingdom (ken@es.rhul.ac.uk)

Salt is mechanically weaker than other sedimentary rocks in rift basins. During extension it commonly acts as a strain localizer, decoupling supra- and sub-salt deformation. In this scenario the movement of the subsalt faults combined with the salt migration commonly constraint the development of syncline basins. The shape of these synclines is basically controlled by the thickness and strength of the overlying salt section, as well as by the shapes of the extensional faults, and the magnitudes and slip rates along the faults. The inherited extensional structure, and particularly the continuity of the salt section, plays a key role if the rift basin is subsequently inverted.

This research utilizes scaled physical models to analyse the interplay between subsalt structures and suprasalt units during both extension and inversion in domino-style basement fault systems. The experimental program includes twelve analogue models to analyze how the thickness and stratigraphy of the salt unit as well as the thickness of the pre-extensional cover constraint the structural style during extension and subsequent inversion. Different models with the same setup have been used to examine the kinematic evolution. Model kinematics was documented and analyzed combining high-resolution photographs and sub-millimeter resolution scanners. The vertical sections carried out at the end of the experiments have been used to characterize the variations of the structures along strike using new methodologies (3D voxel models in image processing software and 3D seismic).

The experimental results show that after extension, rift systems with salt affected by domino-style basement faults don't show the classical growth stratal wedges. In this case synclinal basins develop above the salt on the hangingwall of the basement faults. The evolution of supra- and subsalt deformation is initially decoupled by the salt layer. Salt migrates from the main depocenters towards the edges of the basin constraining the sinking of this basin. As extension progressed, salt was locally depleted above the basement faults. From this point the structural style changed dramatically evolving to a coupled deformation. Welding produces a variation in the position of the basin depocenter that jumps towards a new formed antithetic fault above the depleted area. During inversion this basins were progressively folded and uplifted. Shortcuts formed on subsalt fault whereas the salt section acts as a contractional detachment transferring part of the deformation out of the basin. Changes in thickness of the salt section during the inversion produced primary welds and these permitted the sub-polymer deformation to propagate upwards into the supra-salt layers. These experimental results are compared with seismic examples from different areas of the Southern North Sea.