AAPG Annual Meeting
March 10-13, 2002
Houston, Texas

Joel H. Le Calvez[1], Bruno C. Vendeville[1], Michael R. Hudec[2] (1) University of Texas at Austin, Austin, TX (2) Bureau of Economic Geology, The University of Texas at Austin, Austin, TX

3-D Visualization and Fault-Slip Analysis of Physical Models of Normal-Fault Relays above Evaporites

We used physical modeling to investigate the 3-D geometry of relay structures linking two parallel but laterally offset grabens detaching above viscous evaporites. In each model, two offset grabens nucleated on two small initial ridges located on top of the source layer. During extension faults could freely propagate along strike and overlap in the relay zone, and fault blocks could freely rotate. In addition to overhead photographs and serial cross sections, we used a quantitative fault-displacement analysis (Allan maps and fault-throw profiles) on most models, and a visualization computer model was generated from one experiment in order for us to better understand the 3-D geometry of strata and fault planes.

We varied the amount of initial offset and underlap between the two trigger ridges. Large offsets led to broad relay zones in which the traces of graben-bounding faults progressively curved toward one another. Smaller initial offsets led to abrupt transitions, where bounding faults from both grabens intersected one another, forming hourglass structures. Even where the trigger ridges initially underlapped, fault propagated along strike and thereby overlapped before they started curving toward one another. Initially overlapping trigger ridges caused relay zones to be longer along strike.

Along strike, fault throw and associated reactive diapiric rise decreased progressively toward the relay zone, whereas strata dipped gently away from the relay zone. Although most fault planes appeared planar in dip sections, the 3-D computer model indicates that fault planes within the relay zone were curved (listric or ramp-flat geometry) in strike sections.