Geophysical Research Abstracts, Vol. 9, 03637, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03637

3D fault development – displacement variation and morphology analysis of faults identified from 3D seismics

T. Lohr (1), C. M. Krawczyk (1), O. Oncken (1), D. C. Tanner (2)

(1) GFZ Potsdam, Germany, (2) GZG Göttingen, Germany, (lohr@gfz-potsdam.de / Fax: +49-331 2881370)

During extension, normal faults grow by the accumulation of slip over time. Thereby, an increase in displacement and fault length is achieved. In addition, during fault-length propagation, the linkage of initially isolated faults dominates. Slip is accumulated in the central part of each fault segment, and the stress concentration at the fault tips is increasing. Therefore, the fault must grow in its lateral dimensions to relax the stress concentrations.

Using a depth-migrated 3D seismic data set from RWE Dea AG we interpreted a c. 13 km-long normal fault of Permian age in great detail and analysed its morphology in 3D. The fault shows a strong undulation in length and depth. With the help of fault attribute analysis (like curvature, cylindricity, dip) we highlighted linear corrugations on the fault surface, which we interpret to represent the areas of fault-segment linkage. Additionally, we calculated the displacement of two horizons along the fault and studied the fault segmentation on a smaller scale. Four generations or orders of segments have been identified on both horizons, getting younger with increasing fault length: (a) Fourth-order with more than 23 small-scale segments (200 - 700 m length), (b) Third-order with at least 6 medium-scale segments (1.5 - 3 km length), (c) Second-order with 2 large-scale segments (5 - 9 km length), and (d) First-order with 1 large-scale final fault (c. 13 km length). Furthermore, the spatial and temporal distribution of displacement, especially the slip-throw-heave relationships of the two horizons, was analysed, in order to quantify their variation and their dependence on the fault morphology.

The analysed fault is characterised by zones of strong curvature which are affected by higher deformation. Thus, these zones include higher amounts of strain and a higher

fracture density. This indicates that large, segmented faults have a variable fracture density along fault-strike. The localisation of such zones of high fracture density is important for the analysis of fluid migration and reservoir characterisation.