Geophysical Research Abstracts
Vol. 14, EGU2012-422, 2012
EGU General Assembly 2012

Genetic approach to reconstruct complex regional geological setting of the Baltic basin in 3D geological model

K. Popovs, T. Saks, J. Ukass, and J. Jatnieks
University of Latvia, Latvia (konrads.popovs@lu.lv)

Interpretation of geological structures in 3D geological models is a relatively new research topic that is already standardized in many geological branches. Due to its wide practical application, these models are indispensable and become one of the dominant interpretation methods in reducing geological uncertainties in many geology fields. Traditionally, geological concepts complement quantitative as much as qualitative data to obtain a model deemed acceptable, however, available data very often is insufficient and modeling methods primarily focus on spatial data but geological history usually is mostly neglected for the modeling of large sedimentary basins. A need to better integrate the long and often complex geological history and geological knowledge into modeling procedure is very acute to gain geological insight and improve the quality of geological models.

During this research, 3D geological model of the Baltic basin (BB) was created. Because of its complex regional geological setting - wide range of the data sources with multiple scales, resolution and density as well as its various source formats, the study area provides a challenge for the 3D geological modeling. In order to create 3D regional geometrical model for the study area algorithmic genetic approach for model geometry reconstruction was applied.

The genetic approach is based on the assumption that post-depositional deformation produce no significant change in sedimentary strata volume, assuming that the strata thickness and its length in a cross sectional plane remains unchanged except as a result of erosion. Assuming that the tectonic deformation occurred in sequential cycles and subsequent tectonic stage strata is separated by regional unconformity as is the case of the BB, there is an opportunity for algorithmic approach in reconstructing these conditions by sequentially reconstructing the layer original thickness. Layer thicknesses were sliced along fault lines, where applicable layer thickness was adjusted by taking into account amount of erosion by the presence of the regional unconformities.

Borehole data and structural maps of some surfaces were used in creating geological model of the BB. Used approach allowed creating geologically sound geometric model. At first borehole logs were used to reconstruct initial thicknesses of different strata in every tectonic stage, where topography of each strata was obtained sequentially summing thickness to the initial reference surface from structural maps. Thereby each layer reflects the topography and amount of slip along the fault of the overlying layer. Overlying tectonic cycle sequence is implemented into the model structure by using unconformity surface as an initial reference surface.

Applied techniques made possible reliably reconstructing and predicting in areas of sparse data layer surface geometry, its thickness distribution and evaluating displacements along the fault planes. Overall results indicate that the used approach has a good potential in development of regional geological models for the sedimentary basins and is valid for spatial interpretation of geological structures, subordinating this process to geological evolution prerequisites.

This study is supported by the European Social Fund project No. 2009/0212/1DP/1.1.1.2.0/09/APIA/VIAA/060.