Geophysical Research Abstracts, Vol. 8, 01295, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01295

Meso-Cenozoic tectonic evolution of Odessa shelf on seismic analysis and 1-D modelling (Ukrainian Black sea)

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The main stages of the tectonic evolution of Odessa shelf were revealed from analysis of regional seismic profiling. A research was based on using a vast amount of regional seismic reflection profiles (more than 20000 km) and well data (35 wells that were drilled in last 30 years). The following 3 stages during the Meso-Cenozoic history can be determined: 1) rifting stage due to extension of the area in the Early Cretaceous and at the beginning of Late Cretaceous, 2) post-rift thermal subsidence since middle of Late Cretaceous till Middle Eocene, 3) inversion stage with 4 compression phases. The first two compression phases occurred simultaneously with continued post-rift thermal subsidence.

The extension processes during rifting stage resulted in a system of half-grabens with mainly south-dipping normal faults. The most extensive faulting, accompanied by volcanic activity, occurred in the Karkinit Trough. It was separated from the southern margin of East-European Platform by Golitcin Fault. The uplifted parts of some half-grabens were uplifted above sea level and were eroded. Sedimentation occurred only in the dipping parts of this half-grabens.

In the beginning of Late Cretaceous the extension gradually became weaker. Upper Cretaceous sediments formed under slowed rift processes and under conditions of the split relief. The gradual weakening of the forces of extension resulted in the formation of typical post-rift depression within Odessa shelf. The maximum sediment thickness is observed within Karkinit rift axis and gradually decreases towards the flanks. Present-day Krayova Step and Kalamit Swell were southern flank of Late Cretaceous

Karkinit depression. Probably they also presented the northern flank of the Western Black Sea Basin. Within Kalamit Swell and Krayova Step the thickness of Cretaceous and Palaeogene sediments is insignificant in comparison with axis part of Karkinit Through.

The post-rift thermal subsidence was interrupted by compressional tectonics in the Middle Eocene. The forces of compression was north-directed and resulted in inversion movements along the major rift faults. High-amplitude inverted structures developed in the post-rift succession above reverse faults during Eocene-Miocene times. The most extensive inversion deformation occurs in the area of the present-day Gubkin Swell. The features of positive structures formation on Odessa shelf confirm to well-known model of inverted structure formation in sedimentary basin under compressional regime by Cooper et al.

Thus, the main stages of the tectonic history of Odessa shelf during Albian-Cenozoic were confirmed and their duration was defined more exactly by 1D backstripping modelling: rifting - K_2sm-sn, post-rift thermal subsidence - K_2cp- Pg_2, inversion - end of Pg_2 - N_1^2. The rifting stage went on with delta factor 1,13, post-rift subsidence – with delta factor of 1,0 and inversion – with 0,9.