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Structural evolution of the Chekurovka thrust area (NE Siberia) based on 2DMove modeling

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The Chekurovka thrust area is located in the frontal northern part of the Verkhoyansk fold belt where it thrust on the foreland basin and Siberian craton. The main deformation event occurred in Cretaceous as a response to collision between the Siberian craton and the Kolyma-Omolon microcontinent. A specific feature of the frontal thrusts of the Verkhoyansk fold belt is small values (about 20-30%) of shortening.

In order to understand the structural evolution of the Chekurovka thrust area, and to update present data concerning the frontal parts of the Verkhoyansk fold belt architecture, three cross-sections through the Chekurovka thrust area were modeled and restored. Cross-sections were compiled orthogonally to the regional structural trend.

The thrust-fold structure of the Chekurovka area contains several structural domains and includes inclined folds related to back thrusts in the western part of the cross-section (Priverkhoyansk foredeep), the slightly overturned Chekurovka anticline fold related to the major Chekurovka thrust, and a gentle syncline in the east, complicated by minor folding related to imbricate thrusts.

Modeling and subsequent restoration of the cross-sections was carried out with software 2DMove 2009.1, developed by Midland Valley, using Move-on-Fault tools. The principle mode of the Move-on-Fault method is a step-by-step deformation of the layers by force of moving them on each of the faults with an assigned value in an assigned direction. The method comprises several algorithms, which allows modeling different types of folds, related to the movement along listric faults (Trishear, Inclined Shear algorithms), as well as on gently dipping regional detachments with ramps (Fault Parallel Flow algorithm).

The complex application of the above-mentioned algorithms with sequential movement of layers along each fault and making corrections in their previously interpreted shape, allowed modeling of the thrust-and-fold belt structure with geometrical features consistent with map data. Cross-section restoration was carried out by sequential back movement of deformed layers along thrusts with restoration to horizontal bedding.

After compilation and restoration of three balanced cross-sections, it was recognized that the structure of study area is characterized by some lateral heterogeneity. The evidence for that is a significant variety of the estimated shortening for each of the cross-sections. For the Priverkhoyansk foredeep the estimated shortening varies from 10 to 16% with highest values for northern and central cross-sections. The shortening of the Chekurovka anticline and the Artyksk syncline varies from 25 to 32% and from 18 to 25% respectively, with highest values for the central cross-section. We interpret structural variations as resulted from variation in the basement topography controlling geometry of the floor thrust.

Kinematic restoration carried out by the 2DMove software allowed restoration of the structural evolution of the area from a stage prior to deformation, all the way to the present structure. Although estimated shortening and compiled cross-section are basically close to those in published papers, new balanced cross-sections show lateral structural heterogeneity not reported previously.