Influence of strength and rheological properties of the medium on the thrust deformation structures

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Fold-and-thrust belt formed as a result of collisional processes on the periphery of the mountain system. They are characterized by thrust structures of great length. Currently, there are a large number of experimental and theoretical exploration, but there is no clarity in the connections between the rheological properties of the medium and the sliding conditions on the basement with the type of deformation and fault structures. In this work, a numerical method was used to study the effect of strength and rheological parameters, as well as friction between the deformable layer and the basement on the formation of faults and general structure of thrusts.

The paper considered the problem of deforming a wedge-shaped layer lying on a rigid basement. It's upper boundary is horizontal and free from tension. The lower boundary is inclined at an angle of the order of 1.5°. Friction acts between the deformable layer and the rigid base. Deformation of the layer occurs due to the displacement of the lateral boundary. Such conditions correspond to the models of a tectonic wedge, whose thickness increases towards the mountain system, and the deformation occurs due to pressure from the mountains.

Numerical modeling was carried out by solving the system of dynamic equations within the framework of the model of an elastic-viscoplastic medium for conditions of plane deformation. The behavior of the medium beyond the limit of elasticity was described by the Drucker – Prager – Nikolaevskii model with the non-associated law of flow.

The results of calculations showed that the area of the fault origin is determined by the strength parameters of the medium, primarily internal friction. The origin and development of localization zones at the bottom of the sediments was observed only at low values of internal friction. At high values of internal friction characteristic of dry rocks, the development of deformation localization bands occurs from the surface.

On the basis of the performed calculations, estimates were obtained of the effect of strength and rheological properties, as well as friction at the base and its changes during deformation on the overall structure of the thrust zone, including the growth of mountain structures and topographic surface.

The work was performed in the framework of the project IX.128.1.1. Programs of fundamental scientific research of state academies of sciences and partial support of the RFBR, grant №19-05-00378.