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The geodynamics of northern part of Sikhote-Alin orogen

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The geodynamics of the Sikhote-Alin orogen is determined by its position in the area where interact the Eurasian and Amurian continental plates, the Pacific oceanic and Okhotsk sub-oceanic lithospheric plates, and two global mobile belts, i.e. Central Asian and Pacific. Compression accompanied by the development of amagmatic structures currently dominates the continental part of the region. Stresses accumulated since the Mesozoic tend to concentrate in gradient zones at the boundaries of rigid blocks with structures still relatively mobile to be forcefully relieved. Structural and paleomagnetic studies were undertaken to restore conditions for the formation of the northern segment of the Sikhote-Alin and to reconstruct the stress field beginning with Cretaceous time.

Paleomagnetic studies [1,2] of the Valanginian-Barremian (Kiselevka Formation), Albian-Cenomanian (Silasa Formation) and Cenomanian-Turonian (Utitsa Formation) rocks yielded the ancient paleomagnetic directions based on which paleolatitudes of formation and rotation of rocks relative to stable Eurasia were calculated. It was found that rocks of the Kiselevka Formation (130 Ma) formed at 19±5°N in the intraplate oceanic environment as petro-geochemical characteristics of the studied volcanic rocks are similar to those of volcanics of the Hawaiian hot spot. Rocks of the Silasa Formation (100 Ma) and Utitsa Formation (95 Ma) formed at 35±4°N and 54±9°N, respectively. Lithology and petro-geochemical characteristics of the last two formations are indicative of their emplacement under conditions of suprasubduction close to the paleocontinental edge. The findings suggest large-amplitude horizontal movements of the Kiselevka and Silasa rocks and the autochthonous position of the Utitsa rocks. This indicates a multi-terrane nature of the Sikhote-Alin orogenic belt, its constituent terranes differing in geodynamic history of their formation.

Stress fields were reconstructed at Northern part of Sikhote –Alin orogenic belt (Lower Priamurie) [3]. The studies were identified 4 types of stress field two of which are the strike-slip type and the other two reverse- and normal-fault types. The reconstructed stress fields are of different age, which made it possible to recognize 4 successive stages of deformation. The sense of direction of two types of near-horizontal axes of stress fields the strike-slip type is: a) near NS with some deviations (in the south – NNW, at the centre – NNE, in the north – NNW); and b) NW. The near-horizontal compression axis of the stress field of the reverse-normal-fault type has NW orientation. The age of deformations associated with near NS-directed compression axis is Paleocene-Eocene. The second-stage deformations (stress fields with NW orientation of compression axes) are Oligocene-Middle Miocene in age. The third stage of reverse-normal-fault type of deformations was in the Late Miocene-Pliocene. It may well be that last deformations occurred in Quaternary time. The youngest stresses of the normal-fault type complete the geodynamic history of the region.

A comparison of paleomagnetic and structural data clearly indicates the pre-Eocene large-amplitude (> 20°) near NS left-lateral strike-slip faults. In the range of 135 to 105 My, was moving on the Izanagi plate north-westward at a rate of 15 cm/year up to the Eurasian eastern edge/ In the range of 105 to 70 My, it was moving northward along the Eurasian transform margin within the accretionary complex fragment

at a rate of 5 cm/year to its current position (Lower Amur) as part of the Sikhote-Alin orogen. Large-scale discrete movements in the Mesozoic-Cenozoic along the Sikhote-Alin segment of the paleocontinental edge were first reported in [4].

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