Possibility to study of deep paleoseismodislocations within faults (the case of the Siberian craton marginal suture)

Ruzhich V.

Institute of the Earth Crust SB RAS, Irkutsk, Russia

e-mail: ruzhich@crust.irk.ru

Notion of the earthquake deep structure is so far quite simplified and ambiguous because initiation and formation of their foci occur within depths of the earth lithospheric mantle. This situation impedes the ascertainment of the preparation conditions, development of the foci models and effective ways of engineering-seismic damage reducing. The paper considers examples of multidisciplinary study of deep paleoseismodislocations within zone of the exposed (exhumed) Primorskii segment of the Siberian craton marginal suture studied with cooperation of specialists of the Institute of Geosphere dynamics. The segment of marginal suture is situated on north-western coast of the Baikal rift. The integrated approach combining geostructural methods and methods of experimental physics, geomechanics, and numerical simulation was used [Ruzhich. Kocharyan, 2017]. In order to identify the ancient coseismic ruptures the particular emphasis along with structural study were put on the reveal of petrochemical indicators of signatures by tectonites from zones of ancient faults: pseudotachylytes and slickensides. These features are considered as reliable evidence of high-speed displacement occurrence within fractured zones. Known minerals considered as "geothermometers" and "geobarometers" were used for estimation of temperature and pressures which resulted in coseismic dislocations in the faults [Ruzhich, Kocharyan, Travin, Savelyeva, 2018]. Calculations using amphibole composition from the pseudotachylyte matrix showed that frictional melts were under pressure to 7-8 kbar (which drops rapidly up to $\leq$ 1.5–2.0 kbar) typical for lithostatic pressure at depths of 5-7 km. In order to absolute age-date of the ancient coseismic ruptures initiation we used 40Ar/39Ar method and tourmaline from slickenside with high stability against superimposed thermal influence during subsequent periods was used as mineral "geochronometer". The absolute age finding of one of deep coseismic ruptures with slickensides was 673±5Ma. Other absolute age of dislocations according to muscovite from compressive rupture was 415.4 ± 4.1 Ma. It is hypothetically in line with 40Ar/39Ar dating of syntectonic micas formed at Middle Paleozoic stage of shear deformations within marginal suture [Ruzhich, Kocharyan, Travin et al., 2018]. When taken into account that the most expected geothermal gradient in the Neoproterozoic was about 30o/km, the depth of coseismic ruptures occurrence was approximately in line with levels of 18-12 km during Neoproterozoic and Middle Paleozoic stages of the marginal suture activation, respectively.

Given examples show the possibilities and prospects of further development of multidisciplinary approach. It allows detail studying of the ancient earthquakes foci structure within exhumed zones of long-living faults and tectonophysical conditions of their initiation when passing from the creep regime to the coseismic slip. This information is necessary to development of new suitable model of the crust earthquake foci, that can promote the perfecting of the earthquake prediction methods as well as the development of more effective strategy of reduction of the next seismic catastrophe damages.