Geomechanics and tectonophysics status of the fault before earthquake

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From the point of view of the Tectonophysics, the problem of the mechanism of mega-earthquakes is considered. It is shown that the data obtained by Tectonophysics on the magnitude of natural stresses in regions with the strongest earthquakes of the XXI century, are key in the main discussion of the XX century on the problem of forecasting catastrophic earthquakes and, in particular, in the answer to the question "If a large earthquake occurs when the stresses exceeds the strength of rocks, why small earthquakes occur over the seismogenic zone constantly ?"[1].

The analysis of the state in the field of earthquake prediction and modern views of geomechanics on the origin of foci of strong earthquakes. In the framework of the theory of friction is dependent on the Rate&State [2,3], with 90-ies in the works Mory,Rice,Rubin,Reches,Uenishi, etc. are actively researched the possibility of transformation of slow slip in the dynamic (seismic events), due to a decrease in strength in the process aseismic slip. The possibility of destruction of an extended "locked"section of the fault in the subduction zones was considered. It was found that the zone of asperity can not be destroyed without a preliminary decrease in strength. It begins to form a localized portion of the aseismic slip, slowly increasing in size. Then, in a short time in comparison with seismic sliding, there is a transition from very slow sliding speeds to seismic [4,5]. The duration of the phase of gradual rooted slip can take quite a long time, because the maximum level of displacement can reach 20-30% of the seismic. Thus, for a certain time before the earthquake, the roughness turns into its opposition - the zone of aseismic slip with a reduced level of stresses.

The results of tectonophysical stress inversion determine the main area of the mega-earthquake source as an extended area of low and medium stresses, which corresponds to modern physical concepts, indicating that the earthquake source depends on the speed and state of the theory of friction. In real rocks, the processes of strength reduction due to increasing aseismic displacement can take years, many decades, and maybe centuries. For an observer who lives in the final stage of earthquake preparation, this actually means that strong earthquakes in subduction zones are not associated with asperity, but those areas where the fracture strength decreases over a large area.

The results of stress analysis in the foci of the strongest earthquakes of the 21st century made it possible to fill the term «metastable state» of faults, which came to seismology from the physics of phase states, with physical meaning.

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