

# **Hydro-seismic-acoustical monitoring of submarine earthquakes preparation: observations and analysis.**

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It is well known, that the 80% of the earthquakes (EQ) on the Earth occur in the Pacific region and that the epicenters of these EQs as a rule are located under ocean (sea) floor. The EQ preparation zones specify by increase of the mechanical stress in the Earth's crust and the process of the micro-crack appearance. Partial destruction of solid rocks leads to the acoustic wave generation, which periods depend on the size of destruction zones and are relatively small in comparison with the EQ destruction zone.

Seismic-acoustic emission radiated from the crust quake source, which is located under the sea floor, generates an acoustic signal in water layer. The high-frequency seismic-acoustic signal (SAS) decay fast in solid medium, but in an ocean these signals propagate far due to weak attenuation of the signal in incompressible water. It was shown [Alekseev et al, 2001] that two specifically dilatant zones occurred in the EQ preparation stage. The first one is located around the source and the second one represents the near-surface dilatant zone, whose horizontal extension may be up to 200 km and its depth is estimated about 5 km. The process of micro-crack generation in critical stage of the EQ preparation occurs and evolves in these dilatant zones. The exactly SAS radiated from near-surface dilatant zone don't be attenuated completely on passage through a solid medium. They may reach the water/bottom boundary and then propagate in water layer up to hydro-acoustic receivers. It was shown that acoustic receivers located in water layer may register seismic events with very wide spectrum of the energy ranges (from large EQ to micro-earthquakes and up to micro-rupture).

It was discussed the observation data obtained from several series of the hydro-acoustic observations in which researchers are succeeded to register the signals from surface dilatant zone in the critical stage of the EQ preparation. Parameters of SAS signals observed before the destruction process such as the depth of the signal source under ocean floor, maximum of signal frequency, which determines linear size of the source and the power level of SAS signal were estimated. The conditions of SAS radiation and propagation were considered. It was shown that the critical stage of the EQ preparation continues several tens hours and this process has hierarchical nature. For the first time the micro-ruptures with signal duration less than 100 milliseconds are originated on a big area. Then the high frequency radiation from micro-ruptures

begins to decrease, the SAS emission area begin to shrink and the micro-earthquakes with duration less then 10 seconds starts to be registered up to the main shock. The micro-earthquakes originated on the area surrounded the epicenter of prepared EQ.

The obtained results are in close agreement with theoretical conception about the appearance and the evolution of SAS in surface dilatant zone and with results of numerous laboratory experiments on rock sample destruction.