SPATIO-TEMPORAL VARIATIONS OF S WAVE ATTENUATION FIELD IN SOURCE ZONES OF LARGE AND GREAT EARTHQUAKES: EVIDENCES OF MANTLE FLUIDS ASCENDING INTO THE EARTH'S CRUST

YURI KOPNICHEV 1, Dmitry Gordienko 2, Inna Sokolova 2

1. Institute of the Physics of the Earth, Russian Academy of Sciences, Kamo 8a, Talgar, Almaty reg., 483310 Kazakhstan.
2. Institute of Geophysical Research, National Nuclear Center Republic of Kazakhstan

We have been studying variations of short-period shear wave attenuation in source zones of large and great earthquakes (M=7.0-9.0) in the regions of Central and South-East Asia, and also of North, Central and South America. We have been using recordings of digital (GSN) and analog seismic stations at distances of ~300-600 km. We carried out frequency filtering of seismograms (narrow-band filter with central frequency of 1.25 Hz was used). We were determining effective Qs values by coda decay in two time intervals: first one - directly after Lg group (Q180, usually t = 180-250 s), and second one - t=250-400 s (Q250, t is the lapse time). It has been shown earlier, that Lg coda is being formed by S waves, reflected from multiple subhorizontal boundaries in the upper mantle. In this case time increase in coda corresponds to S wave penetration to larger depths. An analysis shows, that Q180/Q250 values change usually within the narrow band of 0.37-0.57 in the regions, where earthquakes with M>6.5 did not occur since 1900. We were studying a dependence of Q180/Q250 values from time after large earthquakes (T, years). When T<15 years, these values are usually within the above band. Considerably higher Q180/Q250 values are observed for T>15 years (from 0.65 to 3.20). The maximum values of this parameter (1.60-3.20) correspond to the source zones of Hayuan (1920), Assam (1950), Muya (1957) and Sumba (1977) earthquakes. When T>15 years, much higher Q180/Q250 values are observed usually for normal faulting and strike-slip events in comparison with thrust and reverse faulting events. The data obtained show, that after large and great earthquakes juvenile fluids are ascending into the earth's crust from the upper mantle (depths of ~50-200 km). This correlates with very high Lg amplitude attenuation in the earth's crust within the source zone of the giant Chile earthquake of 1960 and also with data on temporal variations of S wave attenuation field in source zones of large earthquakes in the Tien Shan region [Kopnichev et al., 2000; Kopnichev and Sokolova, 2003] and on variations of S wave velocities in the source zone of the great Antofagasta (1995) earthquake in the Nothern Chile [Husen and Kissling, 2001]. Abnormally high Q180/Q250 values for the largest normal faulting and strike-slip events are connected possibly with relatively high permeability of rocks in such areas.