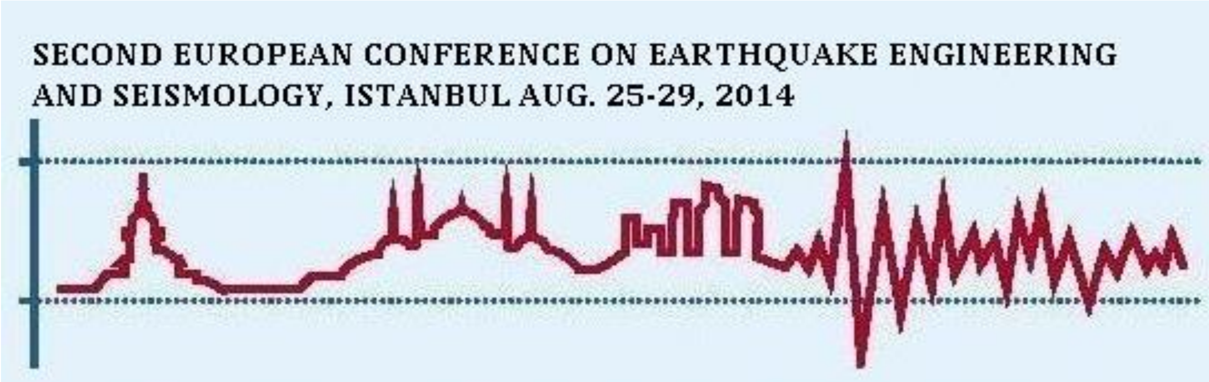

A MODIFIED EXPERIMENTAL APPROACH TO STUDY OF 3D VELOCITY DISTRIBUTION OF P- AND S-WAVES ON SPHERICAL ROCK SAMPLES

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In order to interpret and to understand the nature of seismic anisotropy observed in the earth's crust and upper mantle, laboratory investigations of elastic wave velocities on relevant crustal and mantle rocks are of great importance. A substantial innovation of the measuring equipment made to improve experimental equipment has been used to study of elastic anisotropy of P-waves on sample spheres of crustal and mantle rocks at the Institute of Geology of the Academy of Sciences in Prague. (Pros et al, 2003; Kern et al, 2008). In the past, measurements were done at room temperature in a pressure vessel up to 400 MPa with oil as the pressure medium. Up to now, measurements of S-wave velocities were not possible with this device, because the transducers and the 3D positioning system were placed in oil, and fluids do not transmit S-waves. The modification provided by the transducer/sample assembly and the installation of a new mechanical system allowed simultaneous measurements of P- and S-wave velocities in 132 directions of the sphere.

Ultrasonic measurements of the 3D velocity distribution of P- and S-waves were performed on a spherical sample of biotite gneiss from the Outokumpu scientific drill hole. The results obtained on the spherical sample are compared with data measured on a cube-shaped specimen of the same rock in a multi-anvil pressure apparatus at the Institute of Earth Sciences, University of Kiel (Germany) in order to verify that the system works properly. The comparison of the experimental data obtained by the two different techniques gives evidence that the configuration of the sample/transducer assembly is important to assess what kind of velocities (phase vs group velocities) are measured in pulse transmission experiments.

The velocity data measured on cube-shaped and spherical samples are compared with texture-derived 3D velocity distributions, which can be calculated from the textures of the main rock-forming minerals (biotite, plagioclase and quartz), its volume fractions and the mineral elastic constants. The texture measurements were performed at the neutron time-of-flight texture diffractometer SKAT at the pulsed reactor IBR-2, Dubna, Russia. Both the experimentally-derived and texture-based calculated velocity surfaces of the bulk rock compare reasonably well with respect to symmetry and position of P-wave velocity maxima and minima and their relation to the foliation plane.

Ultrasonic data of biotite gneiss obtained by the modified measuring approach confirmed the realistic seismic laboratory measurements of 3D velocity distribution of P- and S-waves on natural rock samples.

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