Geophysical Research Abstracts, Vol. 7, 06121, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06121

Texture-controlled elastic Anisotropy of Rocks from the TRANSALP seismic Traverse, Eastern Alps

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A representative suite of deformed rocks from the TRANSALP reflection seismic traverse in the Eastern Alps was studied with respect to whole-rock texture and P-wave propagation velocities. Here 'texture' refers to crystallographic preferred orientations (CPOs), which were determined by TOF neutron diffraction at FLNP/JINR, Dubna, Russia /1/. Mostly, the mineral textures of gneisses and schists are weak and, therefore, have only minor influence on P-wave anisotropy. Experimentally determined P-wave anisotropies at confining pressure of 200 MPa in the order of 5 to 15 percent may be explained by the microcrack fabric. In marbles (˜100% calcite) and amphibolites (> 80% hornblende) the degree of anisotropy is between 5 and 10 percent and largely controlled by the mineral CPOs, whereas the contribution of microcracks to bulk rock anisotropy is much smaller compared to the gneisses. Summarizing, only more or less monophase rocks display well-pronounced CPOs leading to significant textural influence on elastic anisotropy /2/.

Since in addition to missing textures density contrasts are small, very small reflection coefficients are observed for lithological interfaces between various types of gneisses ($Rc < 0.02$). The maximum reflection coefficient of a marble-gneiss contact is about $Rc = 0.06$ and partly related to the calcite texture. In contrast to a gneiss-gneiss contact, such an interface produces a clear signal in a seismic experiment. The maximum reflection coefficient of an amphibolite-gneiss contact is $Rc = 0.12$ and largely caused by the density contrast between both units, with some influence of the hornblende texture. Consequences regarding the origin of seismic reflections in the Alpine crust are that strong reflections are probably due to marble-gneiss and metabasite-gneiss contacts.

References

/1/ Ullemeyer, K., Spalthoff, P., Heinitz, J., Isakov, N.N., Nikitin, A.N., Weber, K., 1998. The SKAT texture diffractometer at the pulsed reactor IBR-2 at Dubna: experimental layout and first measurements. Nucl. Instr. Meth. Phys. Res. A412, 80-88.

/2/ Ullemeyer, K., Siegesmund, S., Rasolofosaon, P.N.J., Behrmann, J.H., 2005. Experimental and texture-derived P-wave anisotropy of principal rocks from the TRANSALP seismic traverse: An aid for the interpretation of seismic field data. Tectonophysics (in press).