LARGE-SCALE SEISMIC ANISOTROPY UNDER THE ALPS

BOKELMANN, Götz*; QORBANI, Ehsan; BIANCHI, Irene

Universität Wien, Austria

Goetz.Bokelmann@univie.ac.at

Seismology, Tectonics, Deformation, Orogeny, Extrusion

Preferred alignment in upper mantle structure develops in response to past and present-day tectonic deformation. Such an alignment causes directionally-dependent differences in seismic wave velocities, which we call "seismic anisotropy". The effect of anisotropy due to upper mantle fabrics can be easily seen in seismological observations. This is of particular interest, since it is the main tool for constraining in-situ deformation within the deeper Earth.

We have evaluated upper mantle anisotropy beneath the Alps by analyzing the splitting of shear-wave phases (i.p. SKS). Using data collected at permanent broadband stations, we have measured fast polarization azimuths and delay times all along the Alps, and we observe a clear trend, with fast orientations more or less aligned with the strike of the mountain chain.

While the western and central Alps are apparently associated with a relatively simple one-layer anisotropic structure, this is not the case for the easternmost Alps, where the data require the presence of two anisotropic layers. We discuss what this might mean, in light of existing tomographic models of the upper mantle under the Alps.

We will further discuss the major assumptions in the study of seismic anisotropy, and why particular care needs to be taken, if seismic anisotropy is to be interpreted correctly. Among others, this concerns the still-existing ambiguity between plate-motion-induced flow and "coherent fossil deformation", the Vinnik-Silver debate. This debate has divided the international seismic anisotropy community for the last 25 years, and we have only very recently understood that seismic body-wave data actually allow resolving this issue. We will discuss this and some other open questions - and what we might be able to say about the Alps, using the data from the AlpArray that are currently collected.