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Deformation fabrics of phyllite in Gunsan, South Korea and implications for seismic anisotropy in continental crust

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Muscovite is a major constituent mineral in the continental crust that exhibits very strong seismic anisotropy. Muscovite alignment in rocks can significantly affect the magnitude and symmetry of seismic anisotropy. Thus, it is necessary to analyze natural mica-rich rocks to investigate the origin of seismic anisotropy observed in the crust. In this study, deformation microstructures of muscovite-quartz phyllites from the Geumseongri Formation in Gunsan, South Korea were studied using the electron backscattered diffraction technique to investigate the relationship between muscovite and chlorite fabrics in strongly deformed rocks and the seismic anisotropy observed in the continental crust. The [001] axes of muscovite and chlorite were strongly aligned subnormal to the foliation, while the [100] and [010] axes were aligned subparallel to the foliation. The distribution of quartz c-axes indicates activation of the basal<a>, rhomb<a> and prism<a> slip systems. For albite, most samples showed (001) or (010) poles aligned subnormal to the foliation. The calculated seismic anisotropies based on the lattice preferred orientation and modal compositions were in the range of 9.0–21.7% for the P-wave anisotropy and 9.6–24.2% for the maximum S-wave anisotropy. Our results indicate that the modal composition and alignment of muscovite and chlorite significantly affect the magnitude and symmetry of seismic anisotropy. It was found that the coexistence of muscovite and chlorite contributes to seismic anisotropy constructively when their [001] axes are aligned in the same direction.