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A plagioclase fabric database: Characterization of CPO and seismic properties in the oceanic lower crust

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This study presents a unique database of almost 200 plagioclase Crystallographic Preferred Orientations (CPOs) of variously deformed gabbroic rocks. Plagioclase is the dominant mineral phase in most of the studied samples. The CPOs characteristics as a function of deformation regime (magmatic and crystal-plastic) are outlined and discussed. CPOs of principal mineral phases are also used to calculate the seismic properties of variously deformed gabbroic rocks from the oceanic lithosphere. The studied samples are from slow- and fast-spread present-day ocean crust, as well as ophiolites. Plagioclase CPO is grouped in three main categories: type B is a strong alignment of (010) with a girdle distribution of [100], type A is a strong point maximum concentration of [100] with parallel girdle distributions of (010) and (001), and type P is point maxima of [100], (010), and (001). A majority of CPO patterns are type B as well as type P, in which both magmatic and crystal-plastic deformation textures occur. Type A CPOs are less common; they represent 24 % of the samples deformed by crystal-plastic flow. Calculated seismic properties (P-wave and S-wave velocities and anisotropies) show that anisotropy (up to 10% for P-wave and 15% for S-wave) tends to increase as a function of fabric strength. Despite of a large variation of fabric patterns and geodynamic setting, seismic properties of plagioclase-rich rocks have similar anisotropies in magnitude. The J-index does not show any consistent variation as a function of the CPO patterns. However, the [100] concentration has an influence on the seismic anisotropies in crystal-plastic deformed samples, whereas the (010) plane alignment has a strong influence on seismic anisotropies in samples deformed by magmatic flow.

Keywords: plagioclase, fabric, seismic anisotropy, oceanic crust, lower crust, gabbro