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# Transmission electron microscopy characterization of dislocations and slip systems in KAlSi3O8 Lingunite: implications for seismic anisotropy in subducting slabs

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Lingunite (KAlSi3O8 hollandite) is likely to be a major phase in continental crust and marine sediment lithologies, as well as in some basalts, at depths equivalent to the deeper part of the upper mantle and throughout the mantle transition zone. This mineral may be a host phase for K in the mantle.

Lingunite exhibits an interesting crystal structure which may have strong implications on its plastic deformation properties. Cell parameters exhibit very different moduli (9.315 and 2.723 Å). [001] is thus, from the elastic point of view, the most likely shear direction (Burgers vectors with the shortest modulus). The space group of lingunite being I 4/m, ½<111> are other translation vectors in the structure and hence can be potential Burgers vectors.

We have performed deformation experiments on lingunite with the multianvil apparatus. Lingunite was synthesized from a KAlSi3O8 glass at 17 GPa, 1400-1600°C. Specimens containing the high-pressure phase were recovered and placed in a second high-pressure cell designed to induce deviatoric stresses during compression. The deformation conditions corresponding to this second run were 17 GPa / 1300°C. Lingunite being extremely sensitive to beam damage, observations were conducted at liquid nitrogen temperature in a Gatan cold stage and under low illuminating conditions.

The deformation microstructure is dominated by [001] screw dislocations. These dislocations have been found to glide in {100}. The second easiest slip system is ½<111>{110}. We also observed a significant number of subgrain boundaries showing that atomic diffusion and climb are active at 1300°C in lingunite.

Seismic properties are deduced from visco-plastic self-consistent modeling based on these slip systems.