

A possible link between ice lenses and gabbroic bands in peridotite complex

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Gabbroic bands in peridotite complex such as Horoman is one of the peculiar features, which provide indispensable information about state and process of partially melting in the upper mantle. They are found in well-developed layered structure of peridotites to exist sandwiched by harzburgite layers. Based on the geochemical relation between surrounding rocks several petrological models have been proposed (e.g., Obata and Nagahara 1987, Ozawa and Takazawa 1995), which mostly argue infiltration/segregation of melt in the partial molten state. Focused on the layering structure Toramaru et al. (2001) propose a fluid dynamical model for the formation of repeated banding structure. One of the complicated situations that have not yet clarified clearly is how this once-partially molten structure has been preserved during the emplacement to the crust. During the course to the surface retrograde processes including temperature decrease may have easily destroyed such a soft structure. In this presentation we would like to draw attention to morphological similarity between ice lenses in the periglacial situations and the gabbroic bands and propose a formation model.

Ice lenses are segregated ice layers horizontally lying in the subsurface of cm to hundreds meters depth. The typical thickness is several millimeter or centimeter. They are found to exist as multiple layers and their spacing and thickness are variable according to the environmental conditions. Starting from homogeneous mixture of water and solid grains the system transforms to be a heterogeneous structure upon gradual freezing. The segregated ice phase is considered to grow by the migration and solidification of water in partially frozen state during the advancement of freezing front (e.g., Rempel et al. 2004). This layered ice structure is similar to gabbroic bands in peridotite complex. We have performed systematic cooling experiments in water-particle system to observe the spacing and thickness of layered structure. Based on our experimental results that demonstrate the relationships between the behavior of layered structures and particle size, cooling rate and force balance, we consider possible formational analogy between ice lenses and gabbroic bands. Here we report the results of our cooling experiment and the implication for the layered structure in Horoman peridotite complex.