[EJ] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG57]Dynamics in mobile belts

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The dynamic behaviours of mobile belts are expressed across a wide range of time scales, from the seismic and volcanic events that impact society during our lifetimes, to orogeny and the formation of large-scale fault systems which can take place over millions of years. Deformation occurs on length scales from microscopic fracture and flow to macroscopic deformation to plate-scale tectonics. To gain a physical understanding of the dynamics of mobile belts, we must determine the relationships between deformation and the driving stresses due to plate motion and other causes, which are connected through the rheological properties of the materials. To understand the full physical system, an integration of geophysics, geomorphology, and geology is necessary, as is the integration of observational, theoretical and experimental approaches. In addition, because rheological properties are greatly affected by fluids in the crust and fluid chemical reactions, petrological and geochemical approaches are also important. After the 2011 great Tohoku-oki earthquake, large-scale changes in seismic activity and regional scale crustal deformation were observed, making present-day Japan a unique natural laboratory for the study of the dynamics of mobile belts. This session welcomes presentations from different disciplines, such as seismology, geodesy, tectonic geomorphology, structural geology, petrology, and geofluids, as well as interdisciplinary studies, that relate to the dynamic behaviour of mobile belts.

[SCG57-P31]Elastic wave velocity change caused lawsonite decomposition in blueschist at 1.0GPa and up to 550℃

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In the subduction zone, dehydration of blueschists is thought to play an essential role in dehydration embrittlement and water transportation. Seismic tomographic studies of subduction zones demonstrate high Vp/Vs ratio layers in the subducting slab. Such high Vp/Vs ratio layers are interpreted as existence of H_2O released by dehydration reaction. However, experimental study to evaluate the effect of dehydration on the elastic wave velocities of blueschists is not carried out well.

Here we investigated compressional (Vp) and shear (Vs) wave velocities in lawsonite blueschist to evaluate the effect of lawsonite dehydration on Vp and Vs under the condition of high pressure and temperature. Experiments were carried out at 1.0 GPa up to 550°C with piston-cylinder apparatus having 34mm bore hole. Talc, pyrophyllite, boron nitride and NaCl were used as the pressure-transmitting media. An Al_2O_3 buffer rod was placed between rock sample and transducer. Temperature was monitored with the alumel-chromel thermocouple placed upon the NaCl (about 2mm above top end of rock sample). P and S-wave signals were generated by a $LiNbO_3$ transducer (10°Y-cut) simultaneously. Vp and Vs measurements were carried out using pulse reflection method.

Vp and Vs markedly dropped over 350°C during temperature ramping while Vp/Vs ratio stayed constant. After the experiment, about 11 vol.% of lawsonite broke down and the sample contained newly

formed anorthite which interpreted as breakdown products of lawsonite. In the run product, many spherical pores were present in the breaking lawsonite and near anorthite. We inferred that released H_2O was trapped as spherical fluid inclusion in these pores. Then we conducted another experiment at 1.0GPa up to 500°C to estimate the temperature lawsonite broke down and we could not get any clues of lawsonite breakdown. As a result of these experiments, it could be inferred that lawsonite breakdown reaction occurred between 500 and 550°C by the following reaction.

Lawsonite [$CaAl_2Si_2O_8(2H_2O)$]→Anorthite [$CaAl_2Si_2O_8$]+ $2H_2O$

Furthermore, the amount of H_2O released by this reaction is estimated 0.26 wt.% against the Bulk composition of the sample.

Though H_2O was released between 500 and 550°C, Vp/Vs ratio stayed constant. For the reason of constant Vp/Vs ratio, we inferred that released H_2O was trapped as spherical fluid inclusion. So it is thought that dehydration reaction proceeded without Vp/Vs ratio changes.