MLF Experimental Report	提出日 Date of Report 8/22/2012
課題番号 Project No. 2012A0072 実験課題名 Title of experiment muSR study on the behavior of trace hydrogen in high-pressure silicate minerals 実験責任者名 Name of principal investigator Nobumasa Funamori 所属 Affiliation Department of Earth and Planetary Science, University of Tokyo	装置責任者 Name of responsible person Yasuhiro Miyake 装置名 Name of Instrument/(BL No.) D1 実施日 Date of Experiment 5/5/2012-5/9/2012

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

Quartz, Powder in aluminum capsule, SiO_2

Coesite, Powder in aluminum capsule, SiO_2

Stishovite, Powder in aluminum capsule, SiO_2

Basalt, Plate of natural rock, SiO_2 50% MgO 10% FeO 10% CaO 10% Al_2O_3 15% Na_2O 5%

Gabrro, Plate of natural rock, SiO_2 50% MgO 10% FeO 10% CaO 10% Al_2O_3 15% Na_2O 5%

Peridotite, Plate of natural rock, SiO_2 40% MgO 40% FeO 10% CaO 5% Al_2O_3 5%

Chondrite, Plate of natural meteorolite, SiO_2 35% MgO 35% FeO 20% CaO5% Al_2O_3 5%

2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。)
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

The purpose of our study is to clarify the behavior of hydrogen atoms in mantle silicates. As the first step, we have measured the yield of muonium, an isotope of hydrogen, in the silicate samples irradiated by muon beam.

First, we conducted measurements on silver and holmium to estimate the full asymmetry of muSR signal for the sample having a diameter of about 20 mm, the size of our samples. The full asymmetry has been estimated to be 0.175. Then, we measured the asymmetry (the magnitude of diamagnetic oscillation) for our samples to determine the missing fraction, which may correspond to the yield of muonium in the materials. We also tried to measure the missing fraction for smaller samples having a diameter of about 5 mm but we could not make it (the S/N was too bad). The measurements were conducted at TF = 20 G at room temperature. Experimental results are given in Table 1.

2. 実験方法及び結果（つづき） Experimental method and results (continued)

Two major conclusions are obtained:

(1) The yield of muonium in a six-fold coordinated SiO2 crystal, stishovite, may be comparable to those in four-fold coordinated SiO2 crystals, quartz and coesite. This means that large interstitial voids in structure may not be required for high yields.

(2) The yield of muonium may increase with increasing SiO2 content in silicates.

To confirm the conclusions and understand the physical background for them, we have to conduct more detailed experiments and/or first principles theoretical calculations.

Table 1. Missing fraction of muSR signal in silicates.

Material	Form	SiO2 content	Asymmetry	Missing fraction
Silver	Plate	N.A.	0.175	0
Quartz	Powder in aluminum capsule	100%	0.044	0.75
Coesite	Powder in aluminum capsule	100%	0.016	0.91
Stishovite	Powder in aluminum capsule	100%	0.036	0.79
Basalt	Natural rock plate	50%	0.075	0.57
Gabbro	Natural rock plate	50%	0.098	0.44
Peridotite	Natural rock plate	40%	0.145	0.17
Chondrite[A]	Natural meteorolite plate	35%	0.134	0.33

[A] having a larger size. The full asymmetry was measured to be 0.200.