THE PLAGIOCLASE-MASKELYNITE TRANSITION IN AN EXTERNAL HEATED DIAMOND ANVIL CELL. N. Tomioka[1], H. Kondo[2], A. Kunikata[2], T. Nagai[3]. [1]PML, ISEI, Okayama University, Misasa 682-0193, Japan, [2]Department of Earth and Planetary Sciences, Kobe University, Kobe 657-8501, Japan, [3]Department of Earth Sciences, Hokkaido University, Sapporo 060-0810, Japan, e-mail: nao@misasa.okayama-u.ac.jp

Introduction: In heavily shocked stony meteorites, plagioclase in the host rock has transformed into glass (maskelynite) in a solid-state reaction. So far, the formation pressure of maskelynite has been estimated only based on dynamic high-pressure experiments [1]. However, duration of pressure in laboratory shock experiments is significantly smaller (10^{-6} sec) than that in meteorite parent bodies (10^{0} sec) estimated by the mineralogy of shock veins [2-3]. Therefore, there is a possibility that shock pressures of heavily shocked meteorites are overestimated due to kinetic effect on the plagioclase amorphization. In this study, amorphization pressure of plagioclase was investigated based on static high-pressure and -temperature experiments that can produce longer pressure duration (10^{3-4} sec) than dynamic compression.

Experimental Methods: Fine-grained powders (~5-30 micron) of natural Ab_{99} plagioclase were compressed by an external heated diamond anvil cell in pressure ranges of 20-39, 21-41 and 24-32 GPa at room temperature, 170 and 270 °C, respectively. The samples were kept at elevated pressures and temperatures for ~30 minutes and then decompressed after cooling. Recovered samples were examined by laser-Raman spectroscopy and transmission electron microscopy.

Results and Discussion: In the sample compressed at 20 GPa at room temperature, strong Raman peaks of plagioclase (mainly at ~290, 480, 510, 760, 820, 1100 cm^{-1}) were observed. These peaks became weaker with increasing pressure. At 32 GPa, broad Raman peaks of maskelynite appeared at ~470, 580, 790, 990 and 1090 cm^{-1} in addition to those of plagioclase. The sample compressed at 39 GPa only showed Raman peaks of maskelynite. In TEM observation of the sample compressed at 33 GPa, some of grains showed powder diffraction rings from extremely fine grains, but most of grains in this sample showed diffuse scattering in electron diffraction that suggest an amorphous nature. In the sample compressed at 37 GPa, all grains are amorphous in electron diffraction. The above results suggest that amorphization of Ab_{99} plagioclase completed at ~37 GPa. In compression of the plagioclase at 170 °C, amorphization pressure is nearly the same (~38 GPa) with that at room temperature. In contrast, at 270 °C, the pressure largely decreased to ~31 GPa.

In comparison with amorphization pressure of albitic plagioclase in laboratory shock experiments [4], that in the present static experiments is significantly lower (>10 GPa) even at room temperature. This suggests that shorter pressure duration results in smaller amorphization rate of plagioclase. The formation of maskelynite in shocked meteorites would not necessarily require very high shock pressure (30-55 GPa) that was previously estimated by shock recovery experiments [1].

References: [1] Stöffler D. et al. 1991. *Geochim. Cosmoshim. Acta* 55:3845-3867. [2] Xie X. et al. 2001. *Eur. J. Mineral.* 13: 1177-1190. [3] Ohtani E. et al. 2004. *Earth Planetary Sci. Lett.* 227: 505-515. [4] Velde B. et al. 1989. *Phys. Chem. Minerals*, 16: 436-441.