Magma of the Haruna-Caldera forming eruption in view of Shirakawa pyroclastic flow deposits-

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Haruna Volcano is a composite volcano which is located in the southern end of the NE Japan arc. Geshi and Takeuchi (2012) divided its whole activity into older activity (-240ka), and newer activity (45ka-). Newer activity began with the Haruna-caldera forming eruption that produced pumice flow (1.0km^3 DRE) and pumice fall (0.2km^3 DRE)(volumes after Yamamoto (2013)). Oishi *et al.* (2011) classified the flow deposits into "Shirakawa" and "Satomi" based on the reflactive indices of plagioclase. The purpose of this study is to clarify the eruption triggering process and magma behavior in the reservoir prior to the caldera eruption in view of Shirakawa pyroclastic flow deposits. We also compared our data with those of Satomi pyroclastic flow deposits (Okano and Suzuki, 2019; JpGU).
Referring to preceding studies (e.g. Oishi *et al.*, 2011), we surveyed 12 outcrops of summit, northern foot and southeastern to southern foot. We could observe the basal part along with upper part only in Koujin outcrop. We sampled juvenile pumice clasts at 8 outcrops. The pumices were classified into white pumice and gray pumice. The gray pumices were typically observed in the basal part of the Koujin outcrop along with white ones. The whole rock SiO_2 contents of pumices varied between 61.9 and 65.4 wt.% (N=44), indicating that they are dacite. The composition does not vary with pumice color and the horizon in the Koujin outcrop. We also note the pumice clasts of Shirakawa pyroclastic flow deposits and Satomi pyroclastic flow deposits (62.8-66.3 wt.% in SiO_2) are not indistinguishable.
Pumice clasts have Pl + Qt + Hb + Opx + Cum + Fe-Ti oxides as phenocrysts, all of which form aggregates. This means that these crystallized in equilibrium. Some phenocrysts have disequilibrium texture such as dissolution of Qt, dusty zone of Pl, aggregates of small Opx (after dehydrogenation decomposition of Hb). Change of melt composition to less-fractionated direction can be the cause for the disequilibrium textures. Decompression can be the additional case for the decomposition of Hb (Rutherford and Hill, 1993). However, we deny the decompression origin, because magmas seem to have ascended very rapidly in conduit judging from absence of groundmass microlites in most pumices. Less-fractionated melt can be generated by either heating by hotter magma or mixing with hotter magma. For the magma mixing, we propose the hotter magma was aphyric since we have not observed phenocrysts derived from the hotter magma. On the other hand, Hb margin on Opx (both ordinary phenocryst, and small-orthopyroxene aggregates) recorded decrease of temperature, although some phenocrysts and aggregates lack in the Hb margin. Appearance of above texture does not vary with pumice color. Above textures are also found in pumices of Satomi pyroclastic flow deposits. Based on above, we propose the magmatic processes in the reservoir just prior to the caldera eruption. First, temperature of felsic magma reservoir rose due to the hotter magma. The change of melt composition due to heating or mixing occurred inhomogeneously (less-influenced zone and more-influenced zone). The crystals in the more-influenced zone came to have reaction rims. In the last, crystals from two zones came to coexist in a pumice due to syneruptive mixing of the two zones. We infer that Hb margin on small-orthopyroxene aggregates formed when magmas of two zones mixed.
We lastly clarify the difference between white and gray pumices. Groundmass microlites are absent in white pumices, whereas microlites are present in gray pumices. We thus judge the difference in color is due to different groundmass crystallinity (Gardner *et al.*,1998). Since gray pumices occur in basal part of

the deposits, we propose that slow ascending of magma along with conduit formation, that probably occurred before the onset of the caldera-forming eruption, led to formation of gray pumices.

Keywords: Haruna volcano, Pyroclastic flow, Magma mixing, Heating from hotter magma, Eruption trigger