Variable N_2/He ratio of non-atmospheric end member found in fumarolic gas at Kusatsu-Shirane volcano, Japan

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The magma degassing beneath the volcanoes at subduction zone is one of the important step in the volatile cycling between earth's hydrosphere and upper mantle with crust. It is well known that volcanic gas discharging at volcanoes on subduction zone, such as Japanese islands arc, contains the component originating in the recycled material [1], [2]. We have repeatedly sampled and analyzed fumarolic gases at Kusatsu-Shirane volcano on Honshu island Japan in 2014 to 2017. The volcano has resumed the eruptive activity about 100 years ago after a dormant period. The style of eruption at the volcano is almost phreatic or steam explosion. On the top of volcano, a crater lake, Yugama is developed. On the north flank of the crater, a geothermal area is distributed where the fumarolic gas was sampled. As shown in Fig.1, a significant change was found in the He-N_2-Ar-CO_2-CH_4 composition during the period of observation. The change can be explained by the transition between He enriched end member (EM1) and CH_4 enriched end member (EM2). EM1 and EM2, respectively, represent the component originating in degassing magma and the component evolved in hydrothermal system prevailing between magma and ground surface.

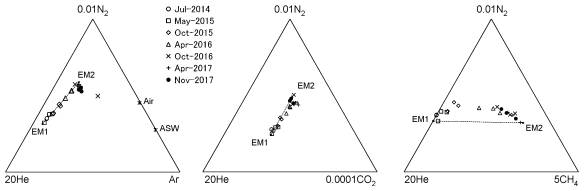

Fig.1. He-N_2-Ar-CO_2-CH_4 composition of fumarolic gas at Kusatsu-Shirane volcano, Japan in 2014 to 2017.

[1] Kita et al. (1993) Geology 21, 391-394.
[2] Giggenbach (1997) Geochemistry of Hydrothermal Ore Deposits, 737-796.