



Low to negligible BrO/SO₂ ratios at two subduction-zone volcanoes

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In July 2013 a measurement campaign took place on Kyushu, Japan, investigating the BrO/SO₂ ratio in the plume of Sakurajima and Aso. Multi-Axis-Differential Optical Absorption Spectroscopy (MAX-DOAS) measurements were carried out at four sides on Sakurajima Island, with a maximum distance of about 5 km downwind, and assuming a wind speed of 5 m/s (corresponding to a plume age of about 15 minutes). At Aso measurements took place on the western slope of the active crater and at the crater rim. The MAX-DOAS data of both sites were evaluated for BrO and SO₂ slant column densities (SCDs). In the following, BrO/SO₂ ratios were calculated to overcome dilution effects and to investigate the BrO formation processes in the ash-laden plume of Sakurajima and the volcanic plume of Aso which is characterized by emissions from a fumarolic area and a mud pool.

The BrO/SO₂ ratios of the measurement have been below the detection limit for Aso as well as during most of the measurement days at Sakurajima with the only exception on 15th July 2013, when a BrO/SO₂ ratio of $\sim 1 \times 10^{-5}$ could be determined.

After very high BrO/SO₂ ratios at Sakurajima that were reported by C. Lee et al. (2005) our results seem to be unexpected but nevertheless match the general geological settings at both volcanoes. In a recent paper, Shinohara (2013) summarized and compared chlorine emissions from the Japanese volcanic arc with global chlorine emissions from arc volcanoes and pointed out that the volcanic gas emissions in Japan are quite Cl-poor compared to those at other subduction zones. In the recent past it has been found that low chlorine emissions can occur together with nevertheless high bromine emissions (Nyrigongo, Bobrowski et al., 2013). However, looking up Br/Cl ratios (of condensate measurements at fumaroles) of the Japanese arc volcanism summarized in Gerlach, 2004 a comparatively low Br/Cl ratio is added with $6-7 \times 10^{-4}$ (global arc mean 2×10^{-3}) to the already poor chlorine emissions.

We will present upper limits of BrO/SO₂ ratios and give an estimate on bromine emissions of Aso and Sakurajima for July 2013. To our knowledge these are the so far lowest bromine emission from an arc volcano. Possible reasons will be discussed in the light of today's available literature – pointing out the geological particularities on Eurasian-Philippine plate subduction zone.