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Compositions of fumarolic gases and the H-O isotopic ratios of the condensed water in Tatun volcanic area, North Taiwan

H.F. Lee, T.F. Yang, T.F. Lan and Y.G. Chen

Dept. of Geosciences, National Taiwan University, Taipei, Taiwan (r90224106@ntu.edu.tw / Fax: 886-2-23636095 / Phone: 886-2-33665876)

Geochemists have being utilizing the technique of Giggenbach bottle to collect and analyze volcanic gases for a long time. Given that, different areas will require their own sampling time and volume of alkali solution due to the variation of gas flux and composition. In this study, we selected Hsiao-you-keng and Liou-huang-ku as testing sites to discuss the control factors of weather and sampling time which may affect fumarolic gas compositions. The results show that the de-gassing system in Tatun volcanic area is quite steady and generates no significant variation in gas compositions. The gas composition of fumaroles does not seem to be affected by weather factors. Our results also show that the length of sampling time in this area mainly depends on the saturation of alkali solution. These testing results show that current sampling and analytical procedures are suitable for volcanic gas study in the Tatun volcanic area.

In addition, we have also improved the procedures of iodine method in order to get the accurate H_2S/SO_2 ratio in volcanic gases. The results show that the H_2S/SO_2 ratio correlates with the length of glass tube during sampling. Because H_2S will react with iodine solution and produce elemental sulfur, consequently, sulfur would adheres to the glass tube and induce significant errors. Hence, we can obtain consistent results by controlling the length of glass tube and bringing it back with iodine solution.

With the improved sampling procedure, we have identified the composition of the gas from Tatun volcanic area mainly contains steam water and CO_2 dominates after de-watering. The minor components are sulfurous, N_2 and CH_4. Compared with other fumarolic gases in the world, the composition here resembles the typical composition of low temperature fumaroles.

Many H and O isotopic data from the Tatun Volcano Group have been reported. However, those samples were collected from rain fall, stream and spring water. No condensing water from fumaroles has been analyzed. Hence, we collected the condensing water from major fumaroles for H-O isotopic analysis. The results show that the data of Da-you-keng and Hsiao-you-keng fall in the range far away from the meteoric water line of H-O isotopic plot. Besides evaporation, they may be affected by the process of rock-water reaction or mixed with formation water. The rest of data are similar with previous published data of hot springs. They are clearly derived from meteoric water in origin. Samples from Ma-tsao and Liu-haung-ku exhibit much lighter H and O isotopic composition, although they also fall on the range of meteoric water line. It indicates that there might have two different groundwater sources for the steaming gases in this area.