# Geochemical monitoring of acitivity at Tavurvur volcano, Papua New Guinea

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Volcanic eruption is one of the most destructive natural disasters comparable to earthquake and typhoon. It is an uncontrollable event and causes serious damage to things and human beings and success in prediction of eruptions will decrease damage from volcanic disasters.

As an eruption becomes imminent, some extraordinary phenomena such as earthquake swarm, ground deformation, increase in gas flux are frequently observed in and around volcanoes. Change of chemical compositions of fumarolic gases frequently observed prior to an eruption is one of the remarkableness. Volatile components are the mobilemost materials in magma and monitoring composition and flux of volcanic gases can provide information on subsurface conditions and contribute to prediction of volcanic eruption.

Monitoring temperature and compositions of volcanic gases near active craters will provide us with authentic information on volcanic activity, however, approach to an erupting volcano considerably involves danger. Spectroscopic analyzer enables remote monitoring of compositions of volcanic gases from inaccessible fields. COSPEC is widely utilized for observation of SO2 flux from volcanoes. Recently, FT-IR spectroscopy is available for synchronous measurement of chemical spices in volcanic gases. Analysis of water-leachates of pristine ashes is also available for estimating composition of volcanic gases discharged from volcano that is erupting. It is a kind of remote sensor of volcanic gases discharged from active crater without particular equipment and it can reduce the inherent hazards.

Rabaul caldera, 15 km x 9 km, is located at the eastern end of New Britain Island, Papua New Guinea and its eruptive activity has been repeated for tens of thousands of years. Tavulvul and Vulcan volcanoes, which are situated on the rim of the caldera, synchronously erupted on September 19, 1994. Rabaul town suffered from huge amounts of ash fall and two thirds of the town was under a heavy ash cover. While the eruptive activity at Vulcan volcano ceased in about two weeks, eruption at Tavurvur volcano has lasted so far. Vulcanian eruption and small-scale explosion occurred every 5 or 10 minutes during our surveillance in 2002 and 2003 and frequently ejected volcanic bombs into the foot of the volcano. Further, the eruptions have emitted tremendous amounts of ash and have escalated damage to natural environment.

Intermittently violent explosions disabled us to access to the vicinity of fumarolic area at the summit of Tavurvur volcano and chemical analysis of water leachates of the ash is adequate for monitoring of composition of volcanic gases.

The concentration of chloride and sulfate in the water-leachates of the ash collected in 2002 and 2003 ranged widely from 100 to 10000 mg/kg due to effects of time spent in the volcanic plume, surface area of volcanic ash particles and other factors. Range of molar ratios of chloride to sulfate in the water leachates in 2002 and 2003 was from 0.31 to 2.13 (average:0.71) and from 0.73 to 2.12 (average:1.34), respectively. The Cl/S molar ratios of the water leachates of ash are equivalent to HCl/SO2 molar ratios of volcanic gases. Steam explosions attributed to relatively low-temperature volcanic gases have low Cl/S values of water leachates of ash, while explosions caused by high temperature volcanic gases have high Cl/S values. The Cl/S molar ratios of the ash collected in 2002 and 2003 were relatively high and nearly equal to those of the ash from Sakurajima volcano.