

High-frequency auto-sampling of hot spring waters for volcanic activity monitoring at Hakone volcano, Japan

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Temporal changes in volcanic hot spring water chemistry are good indicators for monitoring volcanic activities and have been conventionally obtained by repetitive samplings and subsequent laboratory analyses. Time intervals of the repetitive samplings have been usually about a week to a year due to relying on man-power samplings. The sampling intervals were usually insufficient for quantitative discussion for related volcanic activity changes. To overcome the low frequency sampling, we developed a field auto-sampling tool for collecting hot spring water at crater area.

A commercially available XY-plotter, a drawing robot, which move a pen to an arbitrary coordinate to draw digital artworks was utilized as the base of the developed auto-sampling tool. We replaced the pen of the XY-plotter by a plastic pipe connected to a small peristaltic pump to automatically drip water into arranged sampling bottles in turn.

A field test using the developed sampling tool was carried out for a hot spring at crater area of Hakone volcano, Japan, at 3-hour sampling interval for 40 consecutive days from February 7 to March 19, 2019. The sampling tool automatically collected 332 hot spring samples with the high frequency of 8 samples a day without stopping for the entire observation period. With our samples obtained by the sampling tool, we detected short-term significant positive SO_4^{2-} peaks having duration of about a day, which have not been detected by repetitive man-power samplings in previous studies at this hot spring. Although the peak was not related to the change of the volcanic activities, our observation showed an importance of understanding the characteristic of the observing hot spring. The sampling tool can probably improve geochemical monitoring of hot spring waters, especially in crater areas, by high-frequency sampling.
