

# Temporal change of sea water composition around Nishinoshima Island accompanying the volcanic activity of Nishinoshima

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Nishinoshima, one of the active insular volcanoes on Izu-Mariana arc, restarted its eruptive activity on November 20, 2013 after 40 years dormancy. A small island was newly appeared at SSE offshore of original Nishinoshima on that day and first lava flowed out from the top of the new island on November 22. Effusion of huge amount of lava continued for two years and original Nishinoshima was merged into the huge amount of new lava flow.

The Japan Coast Guard conducted several investigations around Nishinoshima by survey vessel “Shoyo” and unmanned survey vehicle (USV) “Manbo II” from June 24 to July 7, 2015 and by survey vessel “Shoyo” from May 4 to May 6, 2016, and October 25 to November 3, 2016. Seawater sampling in 2015 was carried out at 21sites 200-875m away from the coast by USV “Manbo II” due to the navigational warning to ships within a radius of 4 km from the new crater of Nishinoshima, while that in 2016 was performed at 8sites by survey vessel “Shoyo” owing to shrinking of the warning area. Measurement of pH and dissolved CO<sub>2</sub> was performed on the survey vessel in the same day. Determination of fluoride, chloride and sulfate was carried out at Kusatsu-Shirane Volcano Observatory.

In a term of investigation in 2015, the volcanic activity of Nishinoshima was very active with lava flow and intermittent strombolian eruption. After December 21, 2015 any eruptive activity hasn’t been observed.

There are no remarkable azimuthal dependence of variation in pH and the concentration of F, Cl and SO<sub>4</sub> of the seawater samples collected in 2015 and 2016. The pH values of seawater samples collected in 2015 were mostly about 8.0 and significantly lower than pH of reference seawater. On the other hand, those of all seawater samples collected in 2016 is about the same value as pH of reference point. This suggests that influence by hydrothermal water appeared in the wide area around Nishinoshima in 2015 and that the influence in 2016 was reduced.

Fluoride concentration of seawater samples collected by 2015 survey was comparable with that of reference sample in 2015, whereas that of seawater samples in 2016 was slightly higher than that of reference sample in 2016. Chloride concentration of seawater samples in 2015 was lower than that of reference sample collected in 2015, whereas that of seawater samples in 2016 was almost same as that of reference sample in 2016. Sulfate concentration of seawater samples in 2015 was higher than that of reference sample collected in 2015, whereas that of seawater samples in 2016 was almost same as that of reference sample in 2016. These results indicate that the F/Cl molar ratio of seawater samples in 2015 was higher than that of reference sample in 2015 and that the Cl/SO<sub>4</sub> molar ratio of seawater samples in 2015 was determinately lower than that of reference sample in 2015. The F/Cl molar ratio of seawater samples in 2016 was higher than that of reference sample in 2016 and Cl/SO<sub>4</sub> molar ratio of seawater samples in 2016 was comparable with that of reference sample in 2016. It was inferred from these results that huge amount of thermal water discharged from the volcanic edifice was affected by high temperature volcanic gas. While the influence of high temperature volcanic gas to the thermal water was lessened in

2016. Discolored water generated by reaction between hydrothermal water and seawater is often distributed around volcanic islands and submarine volcanoes. Around Nishinoshima Island, discolored water has been observed all the time of investigation by Japan Coast Guard. Greenish-yellow discolored water was distributed around Nishinoshima in 2015 and bluish-white discolored water was distributed in 2016 according to repeated observation by Japan Coast Guard. The change in the color of discolored water around the island indicates the decline of the hydrothermal activity around Nishinoshima Island.

Keywords: Volcanic islands and submarine volcanoes, Nishinoshima volcano, Discolored water