Study on Comparative Assessment of Water Environment around Volcanoes Focusing on Surface Water Quality —Case studies in volcanic areas around Japan—

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1. Introduction (Motivation and Purpose of the Study)

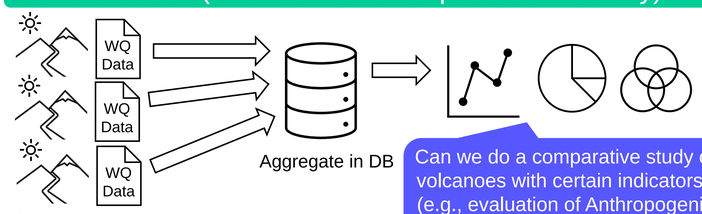

Fig.1 Image of Research Motivation

- Our laboratory (Hydrogeography Laboratory, Hosei University) has been conducting water quality surveys of active volcanoes around Japan for many years.
- For each volcano, We presented examples of studies on the spatial distribution of water quality and its formation factors, respectively.

➢ Now that we have data for each volcano, can we do a comparative study of volcanoes?

➢ Few studies have summarized the water environment around volcanoes. First, we attempted to make comparisons among volcanoes using simple water quality parameters (preliminary study).

2.Target Areas and Research Methodology

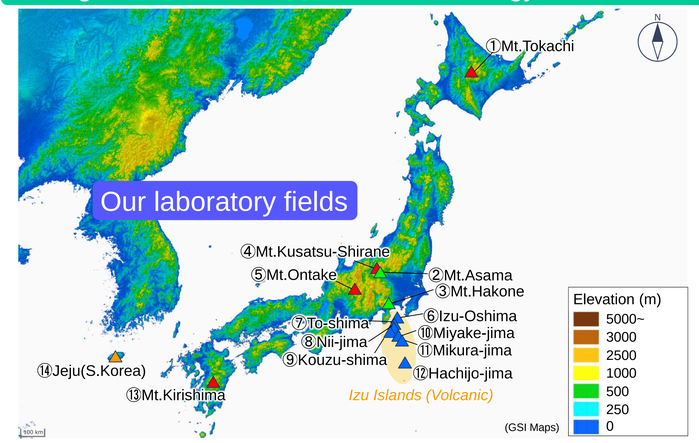

Fig.2 Target Volcanoes

- Research (field surveys and water quality analysis) is ongoing for several volcanoes and volcanic islands around the Japanese archipelago.
- Since around 2000, We have been conducting monthly field surveys at most of the volcanoes for more than 3 years.
- The main target for water sampling is river water. In addition, some fields also collect water from lakes, rainwater, and springs.
- In the field, basic items such as water temperature, flow rate, pH, EC (Electrical Conductivity), and COD (Chemical Oxygen Demand) are measured.
- After water sampling, the major dissolved constituents and TOC (Total Organic Carbon) of each sample are measured.

4. Summary of Research Results (Results of Water Quality Comparison between Volcanoes)

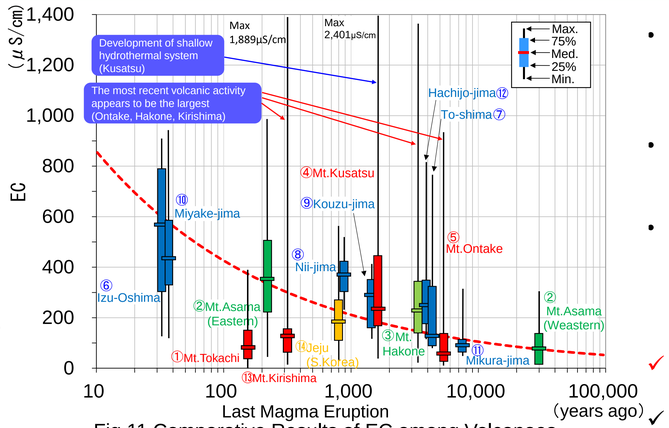

Fig.11 Comparative Results of EC among Volcanoes (in order of Magmatic Eruption)

- In representing the water quality of each volcano, sites with an average EC of 500 μS/cm or higher were excluded (hot spring water and mine drainage water with extreme water quality were excluded).
- All sites and monthly data were compiled and statistically processed (graphs, etc., were prepared using all data after exclusion).
- To confirm the correlation between the age of volcanic eruptions and water quality, the volcanoes were sorted in the order of the last magmatic eruption (phreatomagmatic eruptions did not show a long-term contribution to water quality).

✓ A correlation trend between EC and the last magmatic eruption was confirmed.

✓ The correlation was not as clear as with EC for composition ratios such as Cl/SO4.

➢ The influence of anthropogenic and wind-blown salt (noise) may also be considered. In the future, we would like to process the data considering these factors to confirm the balance between natural and anthropogenic influences.

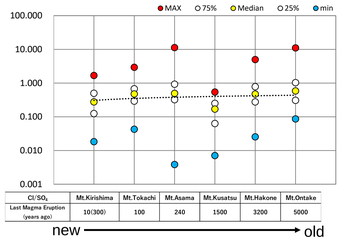

Fig.12 Comparison of Cl/SO_4 Ratios among Volcanoes

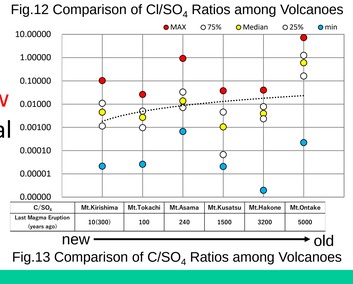

Fig.13 Comparison of C/SO_4 Ratios among Volcanoes

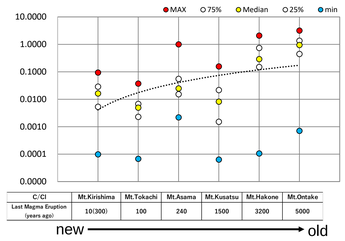

Fig.14 Comparison of C/Cl Ratios among Volcanoes

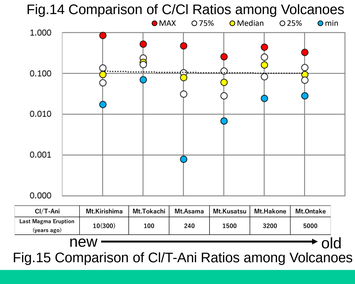

Fig.15 Comparison of Cl/T-Ani Ratios among Volcanoes

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3. Summary of Research Results at Each Volcano (Mainly on Water Quality of rivers, Lakes, etc.)

- We have published the results of our research on each of the volcanoes to date in papers and at conferences.
- In Japan, because of human activities near volcanoes, both anthropogenic (urban and agricultural lands, etc.) and natural (volcanic gases and hot spring water) influences are often present in the surrounding water environment.
- On volcanic islands and near the ocean, the effects of windblown salt from the sea are also showing up.
- For some volcanoes, changes in water quality before and after recent eruptions (mainly phreatic eruptions) were also observed.

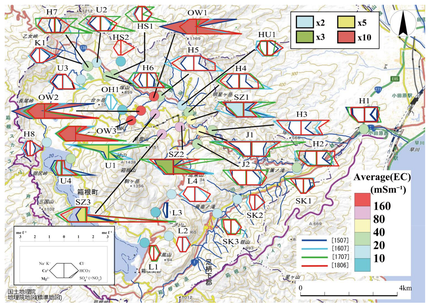

Fig.3 Case Study of Water Quality Measurements at ③Mt.Hakone (2015-2018, Horiuchi et al.2020)

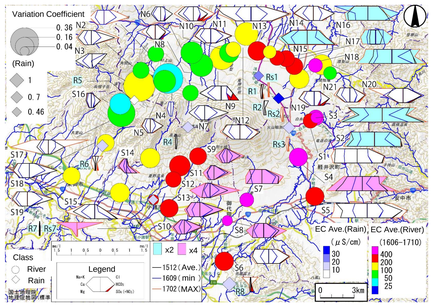

Fig.4 Case Study of Water Quality Measurements at ②Mt.Asama (2015-2017, Igari et al.2018)

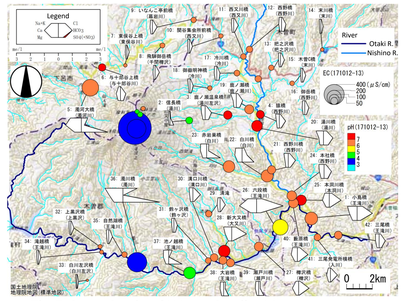

Fig.5 Case Study of Water Quality Measurements at ⑤Mt.Ontake (2017, Asami et al.2019)

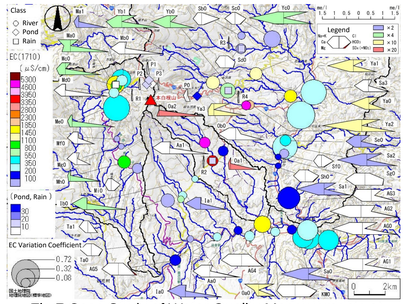

Fig.7 Case Study of Water Quality Measurements at ④Mt.Kusatsu-Shirane (2017, Igari et al.2020)

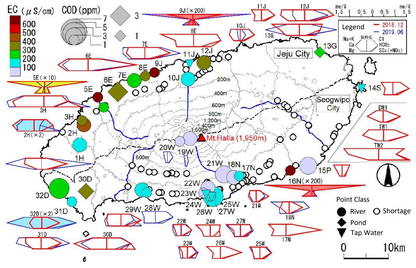

Fig.6 Case Study of Water Quality Measurements at ⑭Jeju-island ((2018-2019, Kodera 2019)

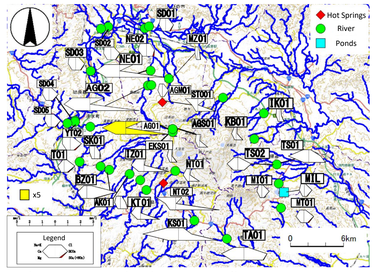

Fig.8 Case Study of Water Quality Measurements at ⑬Mt.Kirishima (2019, Kitahara et al. 2020)

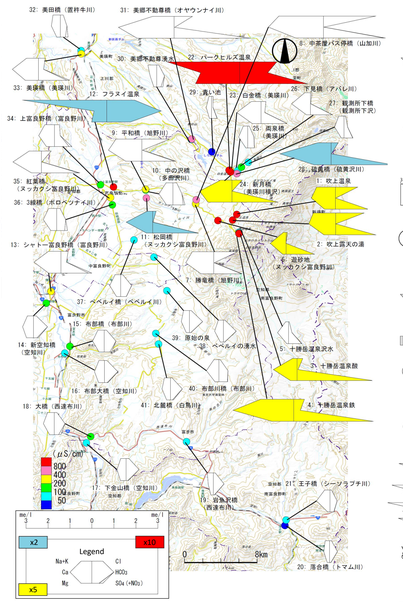

Fig.9 Case Study of Water Quality Measurements at ①Mt.Tokachi (2016, Moroboshi et al. 2017)

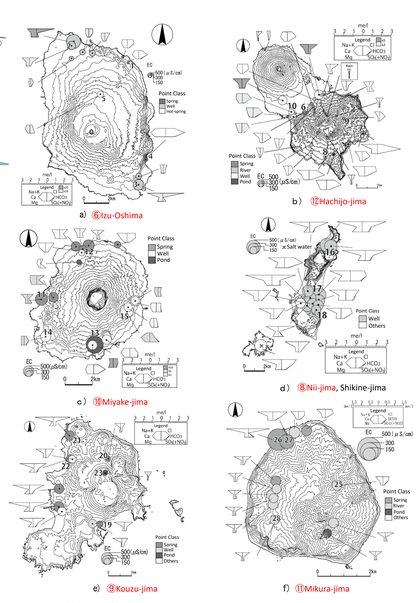

Fig.10 Case Study of Water Quality Measurements at ⑥～⑫Izu-islands (2012-2013, Kodera et al. 2014)

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