The Effect of Temperature on the Trace Metal Dissolution of Volcanic Ashes

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Introduction

Carbon dioxide in the atmosphere may be taken up by phytoplankton in the ocean. Some trace metals are limiting micronutrients for marine phytoplankton. The input of the trace metals may influence material cycling in the ocean. The deposition of volcanic ashes can be a major trace metal source in the surface ocean.

It is well known that sea surface temperature in the surface ocean varies significantly seasonally and spatially (Fig. 1). In this project, we plan to evaluate the impact of temperature on the dissolution of trace metals from volcanic ashes.

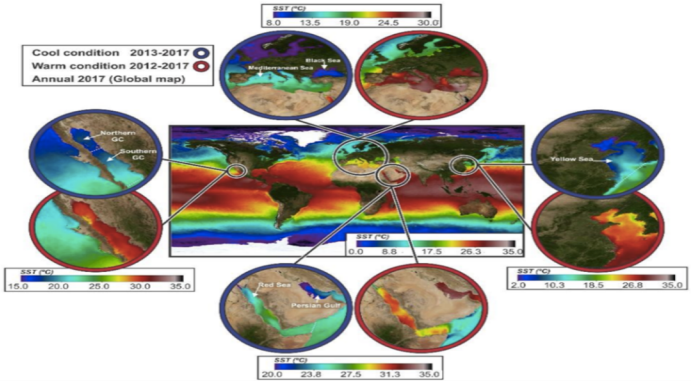

Figure 1. The variations of Sea surface temperature (ΔT) in the global ocean and marginal seas adjacent to the main desert regions[1].

Methodology

- Three temperatures: 10, 20, and 30°C.
- Ash concentration: 200 mL seawater+ 10mg volcanic ashes
- Samples were collected at 3, 6, 24, 48, 72, 96 and 120 hours by auto pipette and were filtered for further process.
- Seawater samples were pretreated by *Seafast* and were then measured by ICPMS.

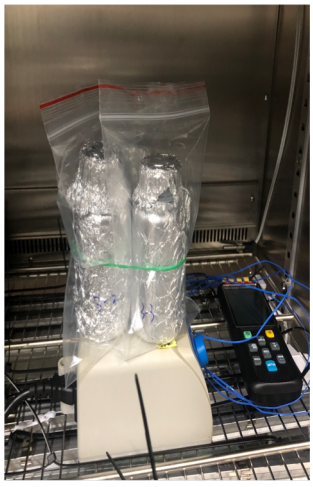

Figure 2. Experimental setup

Results and Conclusion

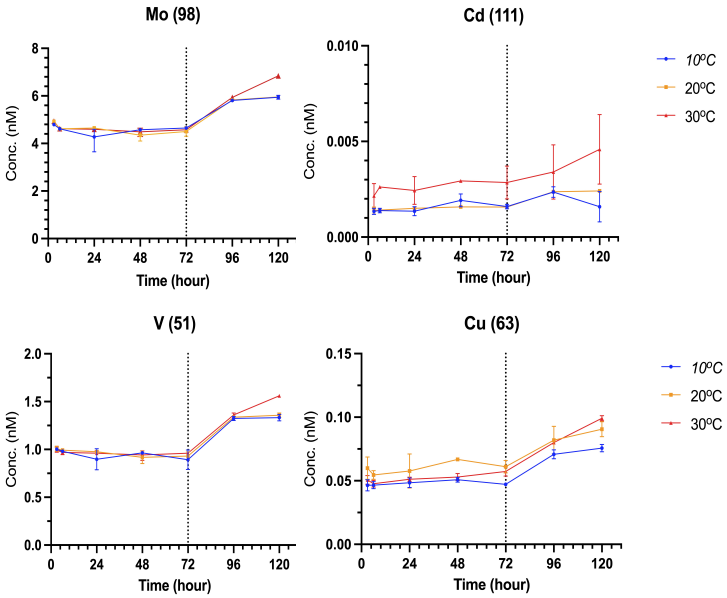

Figure 3. The results of trace metals dissolving in seawater samples.

- The higher the temperature, the greater amount of trace metals in the ashes were dissolved in seawater after 120 hours.
- We found that the contact time is an important factor for the trace metal dissolution. Before 120 hours, the temperature effect is insignificant.
- The higher the temperature; the more active the Brownian motion. In other words, high temperature would increase the diffusion. Thus, the increasing molecule movement in relatively high temperature would promote the dissolution of trace metal of the ashes in seawater[1].

Acknowledgment

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Reference

1. Félix-Bermúdez, A., Delgadillo-Hinojosa, F., Torres-Delgado, E. V., & Muñoz-Barbosa, A. (2020). sea surface temperature affect solubility of iron in mineral dust? The Gulf of California as a case study. Journal of Geophysical Research: Oceans, 125(9), e2019JC015999.