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Introduction

Dissolvable trace metals in aerosols are believed to be an important factor controlling phytoplankton growth in the ocean. After deposition into the surface water, aerosols may suspend in the euphotic zone for several days to months (Wu et al., 2023). In this study, we plan to investigate the impact of different radiation fluxes and an organic ligand (desferrioxamine B, DFB) on the solubility of aerosol trace metals in seawater with time.

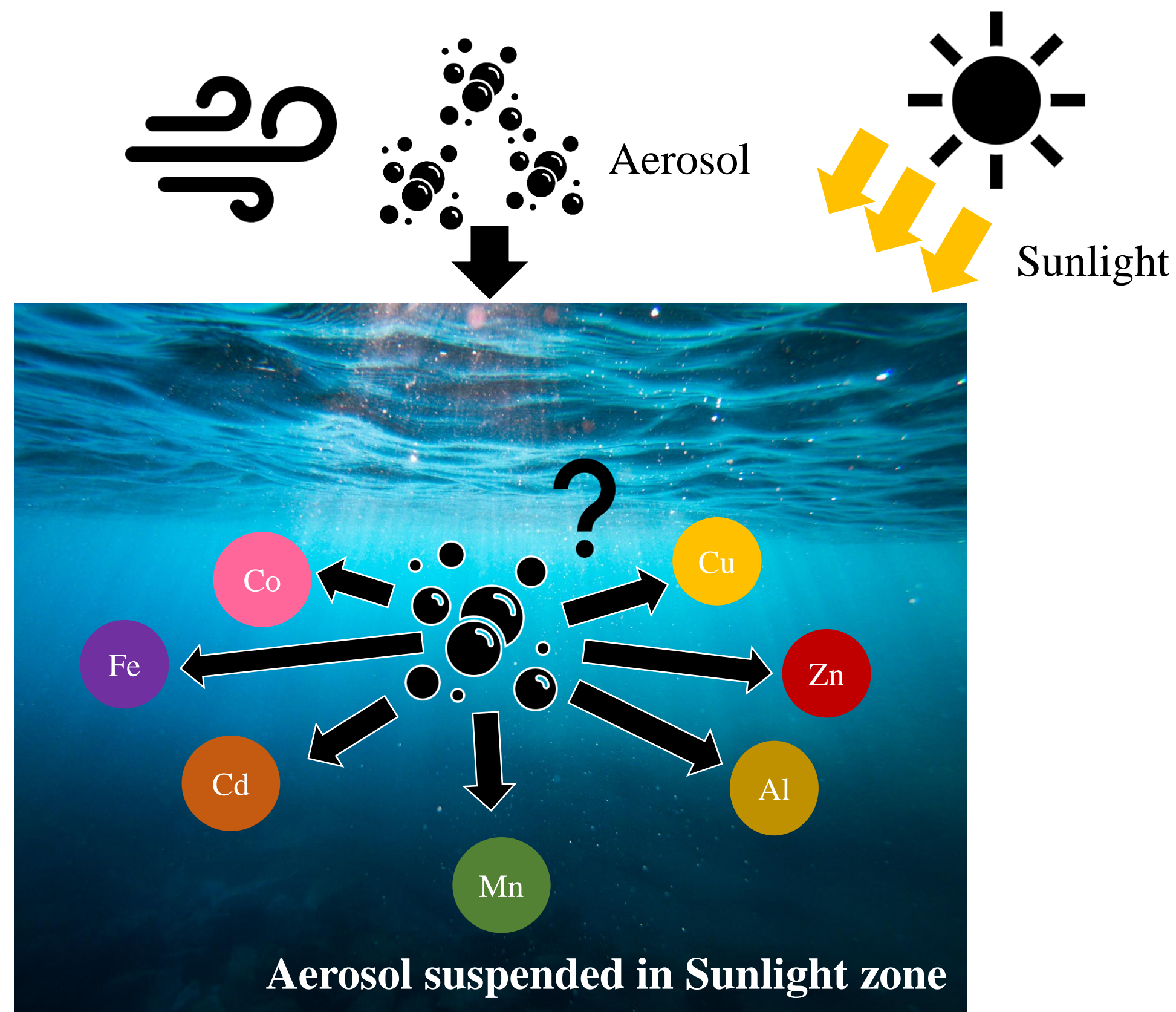


Figure 1. Aerosol Deposition in the Ocean's Sunlit Layer. (Taiwan institute for Sustainable Energy).

Method

The concentrations of ten trace metals, Al, Fe, Mn, Co, Ni, Zn, Cr, Mo, V, Ti, Pb, and Cu, were measured by ICPMS after the following treatments.

- Aerosol**
 - Pengjia Islet
 - Sample collect at June. 17, 2020
 - Using particle size large to aerosol (3~8 μ m)
- Sample and Time**
 - Guam Seawater
 - 0hr · 3hr · 6hr · 9hr · 24hr · 48hr · 96hr
 - Environment Temperature: 25°C

- DFB stock solution**
 - 1mg desferrioxamine mesylate: 1mL milli-Q
 - Final concentration: 1 μ M
- Coral lamp**
 - E(mWm⁻²): 122056
 - E(μ Em⁻²s⁻¹): 800



Figure 2. Self-designed experiment setup.

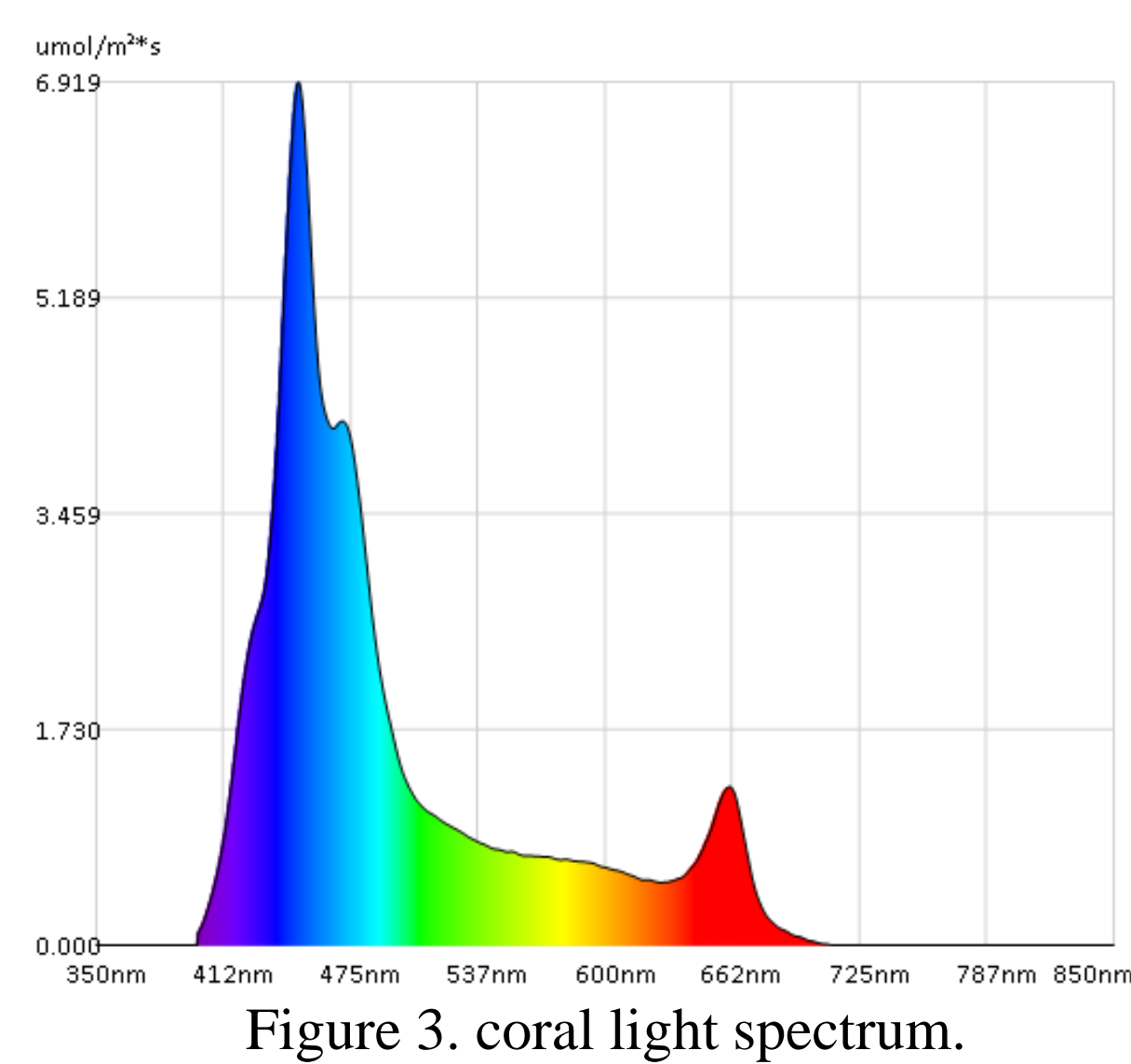


Figure 3. coral light spectrum.



Figure 4. Illuminated (Light) and non-illuminated (Right) PFA bottles.

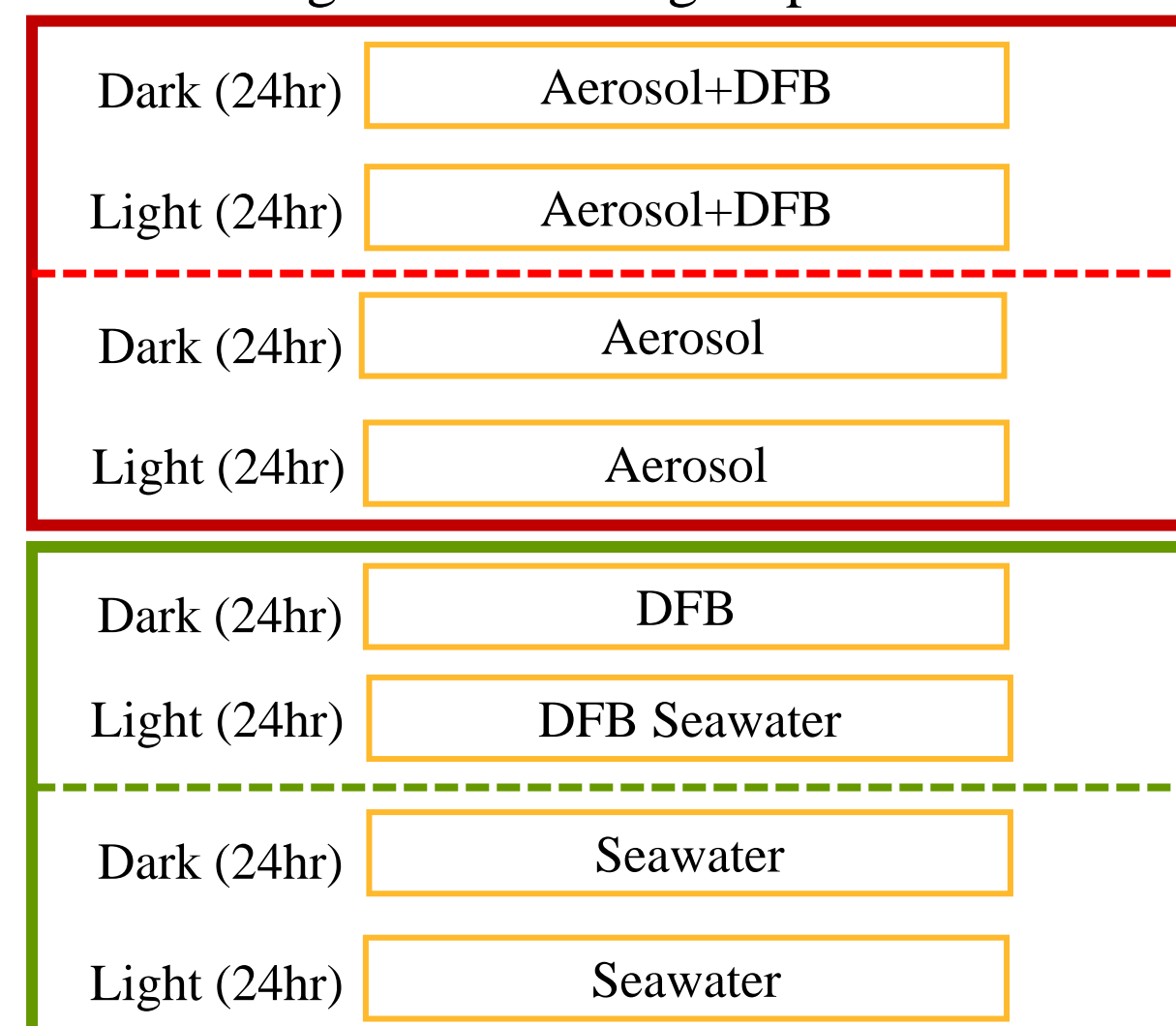


Figure 5. experimental design diagram

Result

Sample ▲ Add Aerosol in seawater and continue Light (Aerosol L) ■ Add Aerosol and DFB in seawater and continue Light (Aerosol DFB L)

Line ▲ Add Aerosol in seawater and continue Dark (Aerosol D) ■ Add Aerosol and DFB in seawater and continue Dark (Aerosol DFB D)

Other metal: Iron concentrations are still under calculation, while chromium concentrations from this measurement were not satisfactory

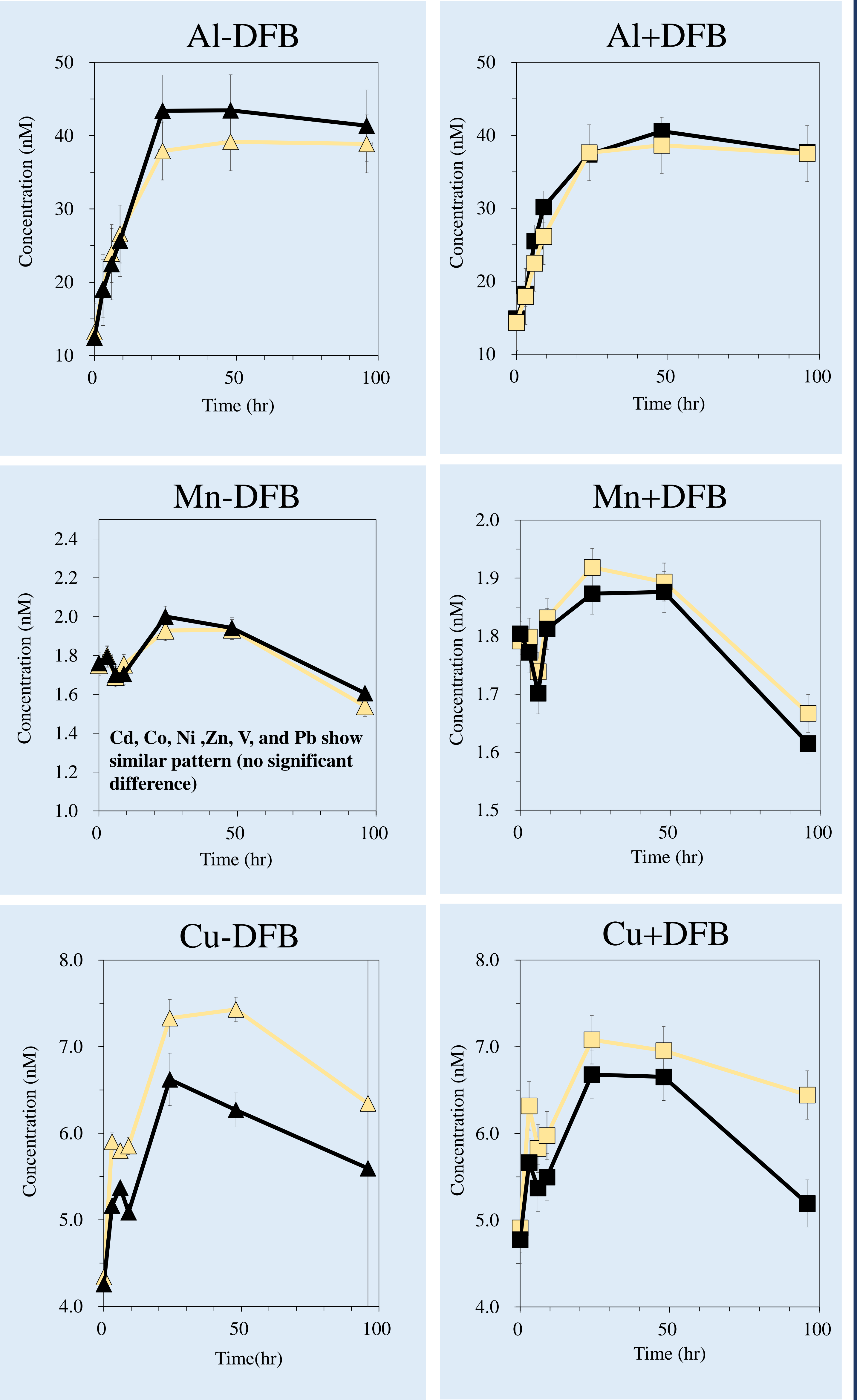


Figure 6. aerosol soluble trace metal concentration

Discussion

The difference in metal concentrations released by aerosols in seawater under light treated and non-treated conditions is insignificant for most of the metals. Due to the heightened illumination and the presence of organic acids in the atmosphere, future experiments could consider subjecting aerosols to light exposure prior to dissolution in seawater. Alternatively, varying the pH of the sample seawater could be explored to examine how illumination impacts the solubility of aerosol metals under diverse environmental conditions.

Conclusion

Under both illuminated and non-illuminated conditions, there is a minimal variation in the concentration of trace metals released by aerosols. Consequently, it can be inferred that the solubility of trace metals from aerosols and siderophore retained within the ocean's sunlit layer is scarcely influenced by illumination.

Reference and Acknowledgement

Hsieh, C. C., You, C. F., & Ho, T. Y. (2023).
Wu, H. Y., Hsieh, C. C., & Ho, T. Y. (2023).
Taiwan institute for Sustainable Energy. Source from: <https://taise.org.tw/post-view.php?ID=391>(Aug. 23, 2023)

I would like to thank the lab members in Marine Biogeochemistry and other summer intern.

Laboratory assistance in the experiment: Chih-Chiang Hsieh, Chia-Jung Lu.