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Hydrogeochemistry of Submarine Groundwater Discharge in A Volcanic Coastal Area: Mabini Peninsula, The Philippines

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Submarine Groundwater Discharge (SGD) delivers water and transports chemicals to the ocean. It has an essential role in the global geochemical cycle and coastal water quality. There is an increasing number of studies exploring SGD in different parts of the globe, but very few have been done in volcanic coastal areas. It is important to study SGD in this setting because volcanic coastal areas are common and these areas host environmentally and economically vital coastal ecosystems. This study examined SGD in a volcanic coastal region of the Mabini Peninsula in the Philippines, which has been noted as the center of the world's reef biodiversity. We aim to understand the hydrogeochemistry of SGD and identify the processes behind it. We collected SGD samples at various depths, ranging from the intertidal zone to ~200 ft underwater. Our field measurements show that the springs emit warm (~50°C) acidic waters (pH ~5.5-6.5) with high dissolved CO_2 (pCO_2 ~14,000-54,000 ppm). This suggests that thermal convection driven by a volcanic heat source is a major driver of SGD in the area. The hydrogen and oxygen isotope composition of the springs, supported by chloride concentration, indicate that the spring waters are a mixture of terrestrial groundwater and recirculated seawater. Intertidal and shallow springs have a higher proportion of terrestrial groundwater (45-35%) compared to deeper springs (<10%). Major ions were analyzed and plotted on a binary mixing line of the two endmembers. The plots reveal that all the spring waters show a significant shift away from the mixing line, which might imply water-rock interaction. Further investigation on the water-rock interactions will be simulated in PHREEQC and will complete the analysis of this study. Due to the similarity in geology, tectonic setting, and hydro-climatology, this study might represent many other areas in South East Asia within the Coral Triangle.