The distribution of bioactive trace elements (Al, Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb) over the Juan de Fuca Ridge

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There are many hydrothermal activities in the Juan de Fuca Ridge[1-3], such as the high-temperature hydrothermal vents found in the Middle Valley (128.67°W, 48.45°N, 2460 m depth)[2] of the northern Juan de Fuca Ridge and the low-temperature hydrothermal plume (2800 m depth) near the western Blanco Transform Fault Zone[3]. Seawater samples were collected from the subarctic North Pacific during the R/V Hakuho-Maru KH-12-4 cruise (August-October, 2012). Stations BD17, BD18, BD19, and BD21 were arranged across the ridge with the purpose of observing hydrothermal plumes. In particular, BD 21 was only 4 km away from the Middle Valley high-temperature hydrothermal site and BD19 was located at the western foothill of the ridge.

Trace elements that are highly toxic or essential to organisms are called bioactive trace metals. This study reports the vertical distribution of dissolved and total dissolvable bioactive trace elements (Al, Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb) at the 4 stations. Dissolved Mn and Fe presented maxima at 2953 m depth of BD19 and 2268 m depth of BD21. The maximum of BD21 was 2.5-6.1 times higer than that of BD19. Dissolved Co and Pb showed lower concentrations in the layer of >2100 m at BD21 than other stations, while both elements showed maximum at 2953 m of BD19. It is considered that the hydrothermal plumes at the two stations were from different origins: low-temperature and high-temperature hydrothermal vents. The hydrothermal plume of BD21 was from the Middle Valley high-temperature hydrothermal site and loaded with large amounts of Mn and Fe. Co and Pb were scavenged by ferromanganese oxide particles formed in the high-temperature hydrothermal plume, resulting in the lower concentrations of dissolved species in deep water.

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