

Measurement of Fe(II) and Total Iron in Seawater Contaminated with Red Soil

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Introduction

Iron is a micronutrient required by microorganisms in the sea. Iron also plays an important role in the formation of OH radical which is known to be the most potent oxidant in the environment. Fe(II) is thought to be formed by photochemical reduction of Fe(III) species, but because of the small concentration in the ocean, there are only a few reports on the concentrations. Fe(II) forms a stable complex compound with Ferrozine reagent. With HPLC system, detection limit of Fe(II)-Ferozine has been reported to be about 10 nM without pre-concentration.

Northern part of Okinawa Main Island's ocean suffers from red soil pollution, which was caused mainly by the developments. The red soil contains about 3.5 to 5.3% iron. Because of the high iron content in red soil, it is expected that the ocean contaminated with red soil would contain higher concentrations of iron species (Fe(II) and total Fe) than that of clean ocean.

Objectives of this study are; 1) to measure Fe(II) and total iron concentrations in the seawater contaminated with red soil, 2) to compare iron concentrations between red soil polluted seawater and clean seawater to determine the effects of red soil pollution, and 3) to understand diurnal variation of Fe(II) species and total Fe concentrations.

Experimental

Twenty-four-hour seawater samplings were conducted during November 19 - 20 (2002) and January 9 - 10 (2003) in Taira bay, Higashi village (North-East of Okinawa main island) for red soil polluted seawaters. Clean seawater samples were collected at Sesoko Island (North-West of Okinawa main island) during January 19 - 20 (2003).

Immediately after filtering seawater samples, Fe(II) was fixed at the sampling site with Ferrozine reagent and kept in the dark in a cooler box. For total iron measurement, all the iron species were first reduced by adding hydroxylammonium chloride, then Fe(II) was fixed with Ferrozine reagent in the laboratory. The Fe(II)-Ferozine complex was measured using HPLC system with UV-VIS detector (295 nm).

Results and Discussion

Figures 1 and 2 show diurnal variation of iron species in Taira bay (red soil polluted sea) and Sesoko Island (un-polluted sea). Fe(II) concentrations ranged from 6 - 13 nM in Taira bay samples and the total Fe was about 20 nM without significant variation. On the other hand, Fe(II) concentrations in Sesoko Island ranged from 3 - 6 nM, and total Fe concentrations were about 15 nM throughout the sampling period. The higher concentrations of Iron species in Taira bay are probably due to the red soil pollution.

Figure 1 also shows clear diurnal variation for Fe(II) in Taira bay samples, i.e., higher during day time and lower at night. The higher Fe(II) concentrations could be due to the photochemical reduction of Fe(III) species in the ocean. For total iron, concentrations were relatively constant for the sampling periods in both Taira bay and Sesoko Island.

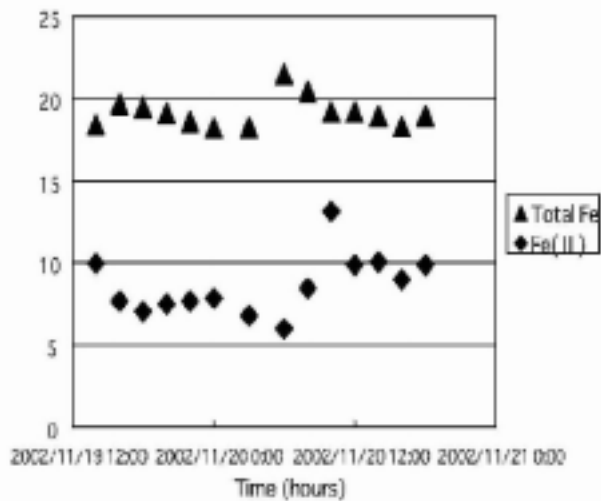


Fig.1 Diurnal variation of Fe(II) and total Fe, Taira Bay

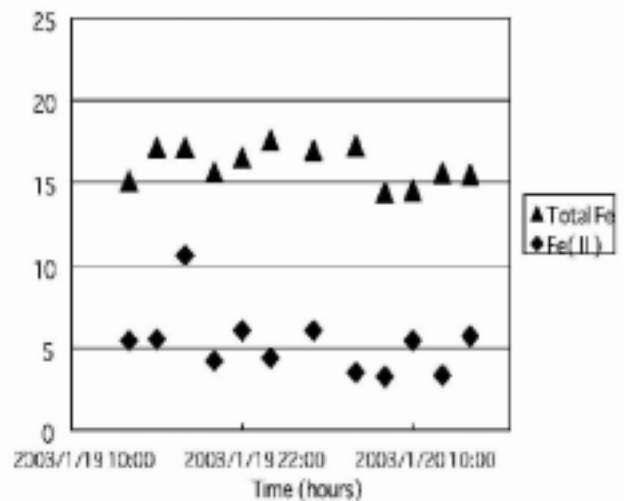


Fig.2 Diurnal variation of Fe(II) and total Fe, Sesoko