

南極海の酸性化が植物プランクトン(珪藻類)におよぼす影響

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Impact estimation of Southern Ocean acidification on phytoplankton (diatoms)

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Southern Ocean is one of high biological productive areas in the whole ocean because large amount of primary production is successively occurred in the seasonal sea-ice zone. Predicted acidification in the seawater would affect on the marine food web particularly on the phytoplankton such as diatoms. In the present study, samplings were carried out along 110°E and 140°E in the Indian Sector of the Southern Ocean to represent the diatoms biomass and to estimate the acidification effects on the phytoplankton communities during the T/V Umitaka-maru cruise in Austral summer of 2011/2012. This study is made as a part of the 53th Japanese Antarctic Research Expedition (JARE-53).

Ocean acidification experiment was carried out 4 times during the cruise. Phytoplankton collected by a clean pump method at 45°S (Stn C02) and 60°S (Stn C07) of 110°E and 50°S (Stn D13) and 64°S (Stn D07) of 140°E were replaced in around 750 μatm of $p\text{CO}_2$ water to compare the non-acidified natural condition (Fig. 1). Each experiment was done for three days. About cell density of diatoms, Stn C02 is not presented in this report because density of this station is low ($0.04 \times 10^3 \text{ cellsL}^{-1}$). The Initial densities of *Fragilariopsis kerguelensis* and *Thalassiosira oestrupii* and the other diatoms at Stn C07 were reaching to $3.94 \times 10^3 \text{ cellsL}^{-1}$ (39%), $2.22 \times 10^3 \text{ cellsL}^{-1}$ (22%) and $3.66 \times 10^3 \text{ cellsL}^{-1}$ (39%), respectively. At Stn D07, the Initial densities of *F. kerguelensis* and *Chaetoceros* sp. and the other diatoms were $0.18 \times 10^3 \text{ cellsL}^{-1}$ (18%), $0.48 \times 10^3 \text{ cellsL}^{-1}$ (44%) and $0.44 \times 10^3 \text{ cellsL}^{-1}$ (40%), respectively. At Stn D13, the Initial densities of *F. kerguelensis* and *T. oestrupii* and the other diatoms were $1.64 \times 10^3 \text{ cellsL}^{-1}$ (71%), $0.34 \times 10^3 \text{ cellsL}^{-1}$ (15%) and $0.34 \times 10^3 \text{ cellsL}^{-1}$ (15%), respectively.

After the three days experiments, in comparing to the Control, cell densities of major diatoms in the Fe enriched condition (+Fe) were increased 360% for *F. kerguelensis* and 280% for *T. oestrupii* at Stn C07 and 220% for *F. kerguelensis* and 172% for *Chaetoceros* sp. at Stn D07 as well as 290% for *F. kerguelensis* and 296% for *T. oestrupii* at Stn D13. On the other hand, cell density of diatoms in the Fe enriched with high CO_2 water (+Fe+ CO_2) in comparing to the Fe enriched (+Fe), *F. kerguelensis* and *T. oestrupii* decreased to 47% and 67%, respectively at Stn C07. In case of Stn D07, only *F. kerguelensis* increased to 126% whereas *Chaetoceros* sp. reduced to 81%. *F. kerguelensis* and *T. oestrupii* were declined to 63% and 43% at Stn D13. These results reveal that many diatom species were affected by the ocean acidification under the Fe enrich conditions. However, negative biological effects of acidified water was less obvious in the diatom species comparing to the small haptophytes such as coccolithopholids.

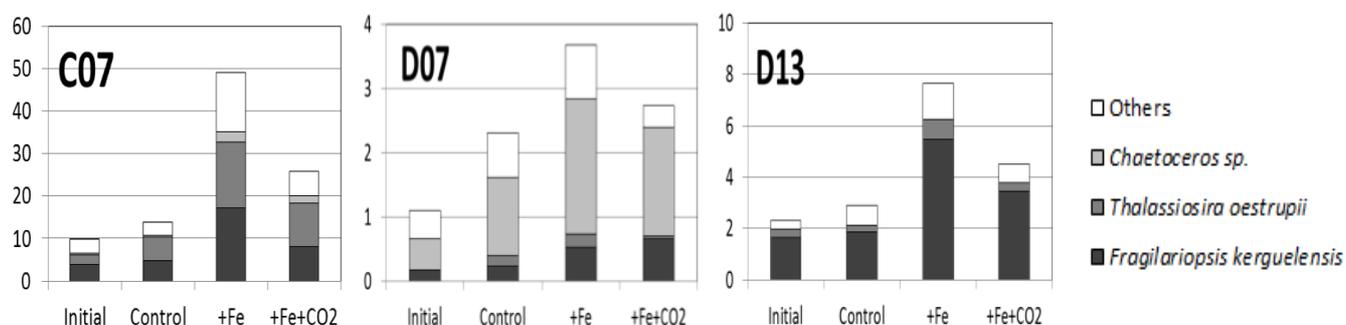


Figure 1. Changes in cell density of diatoms ($\times 10^3 \text{ cellsL}^{-1}$) at the beginning (Initial) and after the incubations of non-enriched (Control), Fe enriched (+Fe) and Fe enriched with high CO_2 (+Fe+ CO_2) at Stn C07 (60°S, 110°E) and Stn D07 (64°S, 140°E) and Stn D13 (50°S, 140°E) in the Southern Ocean.