

Island mass effect and nitrogen fixation

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Most of the tropical and subtropical ocean is well stratified almost throughout the year, restricting upward nutrient supply from deeper water and making the surface environment oligotrophic. In the oligotrophic ocean, biological production has been recognized to be enhanced around islands where unique nutrient supply occurs, and that is referred to as the island mass effect (Doty and Oguri, 1956). Sufficiently strong and steady current results upwelling in the lee of island (Hasegawa et al., 2004, 2009). Hasegawa et al. (2009) demonstrated that Karman vortex streets in the lee develop phytoplankton blooms on a scale of several hundred kilometers. Other mechanisms for the enhanced productivity are nutrient supply from land drainage (Dandonneau and Charpy, 1985) and volcanic dust deposition (Lin et al., 2011).

Among phytoplankton assemblage, diatoms dominate in the local upwelling by the island mass effect (Furuya et al., 1986) because diatoms grow more rapidly than other algae under light-saturated and nutrient-replete conditions. Hence, the diatoms bloom is considered to link high fish production around oceanic islands. On the other hand, recent studies showed another aspect of the island mass effect (Shiozaki et al., 2010, 2013). Shiozaki et al. (2010) demonstrated that high abundance of *Trichodesmium* occurred mainly around oceanic islands and the nitrogen fixation activities enhanced comparing with in the open ocean. Diazotrophs utilize dinitrogen gas as a nitrogen source, and thus their growth are not limited by nitrogen as with other algae. However, diazotrophs require much more iron than nondiazotrophs because nitrogenase, a key enzyme of nitrogen fixation contains iron in its reactive center. Iron concentration in the water around islands is higher than in the open ocean, and hence diazotrophs would be abundant. Besides, Shiozaki et al. (2013) recently found that high abundance of diazotrophs not only occur around islands, but also in areas far remote from oceanic islands owing to advective transport of diazotrophs. The diazotrophs distribution is different from diatoms which are locally abundant around islands. In this presentation, we discuss influences of the island mass effect to diazotrophs activity and its importance in biogeochemical cycling in the oligotrophic ocean.

Keywords: island mass effect, nitrogen fixation, oligotrophic ocean, new production