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Spatial Distribution of Surface Microplanktonic Diatoms in the Central Equatorial Pacific

Lee, Hak Young*, In Sook Cho, Greta A. Fryxell*
Dept. of Biological Sciences, Chonnam National University
*Dept. of Botany, The University of Texas, TX78713, U.S.A.

1. INTRODUCTION

The equatorial Pacific Ocean is a unique ecosystem that has characteristic trophic structure, material cycles, physically dynamic oceanic circulation pattern, and recognizable boundaries (Barber, 1988; Philander, 1990). Until recently the primary production in the eqPac was thought to be fully supported by the upwelling of nutrients (Chavez and Barber, 1987). However, the phytoplankton biomass and productivity in the eqPac are not as high as the flux of nutrients could potentially support. Cullen et al. (1992) showed anomalously low primary and new production from the central eqPac compared with the nutrient levels present. Iron limitation has received most attention for the deficit of primary production from the eqPac (Martin et al., 1989). Recent works, however, have shown that the problem is not so simple (Murray et al., 1992). US-JGOFS set one of the main goals to understand the basic controls and master variables that determine the spatial heterogeneity and magnitude of primary and new productivity (Murray et al., 1992).

Diatoms are the major group of the phytoplankton and important primary producer in the eqPac. Therefore, it is necessary to know the dynamics of diatoms for understanding the ecosystem of the eqPac.

The objective of this study is to compare the flora, relative abundance, and relative biomass of diatoms across the central eqPac. We also compared our results with the equatorial Atlantic Ocean, the Atlantic counterpart of our study site.

2. MATERIALS AND METHODS

Samples for this study was collected from the equator on 140 °W with 26 μm meshed net. Net samples were preserved with formalin and examined in water mounts or rinsed of seawater and mounted in Hyrax medium for permanent light microscope (LM) mounts. Aliquots were also rinsed and cleaned of organic matter and mounted for SEM or in Hyrax medium for LM. The relative abundance of diatoms was calculated after counting more than 200 valves, and cell volumes were calculated from the mean cell dimensions of the nearest geometric shapes.

3. RESULTS AND DISCUSSION

Throughout the cruise, a total of 64 diatoms was identified as microplanktonic diatom flora (40 Centricae and 24 Pennatae). The ratio of centric taxa to pennate taxa (1.7:1) were similar with previous data from the eqPac.

Though the centric diatoms have more diverse flora, the cell numbers are predominated by pennate diatoms. Pennate diatoms occupied more than 70 % of total cells. They were the genera of *Nitzschia, Pseudo-Nitzschia*, and *Pseudoeunotia*.

The most significant group was bicapitate *Nitzschia* complex with the length of 6-30 μm (mostly less than 20 μm) . They predominated throughout the transect with 62.5 (±3.8) % relative abundance. Maximum bicapitate *Nitzschia* species were found from the equator with 68.0 % of total diatoms counted.

Pseudo-Nitzschia spp. which were predominated species of the Southern Ocean (Lee and Greene, 1998), were second dominant diatoms from 6 stations. They occurred with 14.8 (±10.8) % of relative abundance throughout the surveyed transect.

Pseudoeunotia doliolus, inhabiting in high nutrient concentration ocean (Semina and Leveshova, 1993), occurred a noticeable amount from all the stations except 1 °N.

Thalassiosira oestrupii, which is known as an indigenous species to the eqPac Ocean and temperature tolerance species, was absent from our samples.

Several species showed patch distribution pattern. *Mastogloia rostrata* and *Chaetoceros conicus* were found only from the north of 5 °N. *Nitzschia interruptestriata*, a tropical/subtropical diatom species, was observed from north of the equator and maximum relative abundance at 9 °N.

High relative abundance of nanoplanktonic bicapitate *Nitzschia* species was associated with planktonic substrates such as detritus, membranous structures, and fecal pellets (Lee and Fryxell, 1996).

The relative biomass of diatoms were determined by larger diatoms rather than small abundant diatoms. Three centric diatom genera, *Roperia, Azpeitia* and *Planktoniella*, in total showed less than 20 % of relative cell number, occupied more than 20 % of relative biomass by their high unit biomass, i.e., large cells. They showed increasing trends toward south of study area.

The distributions of diatoms are not symmetrical to north and south across the equator. Pennate diatoms showed higher biomass from north of equator.

From this study, we found not much variation of flora, relative abundance, and relative biomass of diatoms throughout the eqPac transect. This results suggest that the environments in the eqPac is nearly constant condition for diatom dynamics. For more clear understanding of diatom dynamics across the equator of the eqPac Ocean, the vertical net and sediment samples should be analyzed, and a later study will deal with those samples.

4. SUMMARY

As a part of the United States-Joint Global Ocean Flux Studies (US-JGOFS) TT013 cruise, surface microplanktonic diatoms of the eqPac were sampled, and 64 diatom taxa were identified. The flora of centric diatoms were more diverse than pennate diatoms with the ratio of 1.7:1. The relative abundance, however, was predominated by pennate diatoms. The most common diatoms were nanoplanktonic bicapitate *Nitzschia* species. The high relative abundance of nanoplanktonic bicapitate *Nitzschia* species was associated with planktonic substrates. *Pseudo-Nitzschia* spp. were observed less than 20 % of total diatom cells. The relative biomass of diatoms was determined by Centricae. Three genera of centric diatoms, *Azpeitia*, *Planktoniella*, and *Roperia*, summed more than 30 % of total biomass. The species composition, abundance, and biomass of diatoms of the eqPac Ocean were constant throughout the surveyed transect. The distributions of diatoms from both the eqPac and Atlantic Oceans showed quite similar pattern.

REFERENCES

Barber, R.T. 1988. Ocean basin ecosystems. *In*: Concepts of Ecosystem Ecology. P L.R. and J.J. Alberts (eds.) Springer-Verlag, New York, pp.409-440.

Chavez, F.P. and R.T. Barber. 1987. An estimate of new production in the equatorial *Deep-Sea Res.* 34: 1229-1243.

Cullen, J.J., M.R. Lewis, C.O. Davis, and R.T. Barber. 1992. Photosynthetic characteris estimated growth rates indicate grazing is the proximate control of primary produ the equatorial Pacific. *J. Geophys. Res.* 97: 630-654.

Lee, H.Y. and G.A. Fryxell. 1996. Bicapitate *Nitzschia* species:abundant nanoplan aggregates during November-December (1992) in the equatorial Pacific. *J. of P Res.* 18: 1271-1294.

Lee, H.Y. and R.M. Greene. 1998. Variation of the phytoplankton community acr Subtropical Convergence Zone in the west Pacific Sector of the Southern Ocean early austral summer 1995/6. *J. of Plant Biol.* 41: 125-134.

Murray, J.W., M.W. Leinen, R.A. Feely, J.R. Toggweiler, and R. Wanninkhof. 1992. E process study in the central equatorial Pacific. *Oceanography* 5: 134-142.

Philander, S.G.H., W.J. Hurlin and A.D. Seigel. 1987. Simulation of the seasonal cycl tropical Pacific Ocean. *J. Phys. Oceanogr.* 17: 1986-2002.

Semina, H.J. and S.S. Levashova. 1993. The biogeography of tropical phytoplankton Pacific Ocean. *Int. Rev. ges. Hydrobiol.* 78: 243-262.