ゲルセジメントトラップを用いた夏季南大洋インド洋区における沈降粒子組成の解析

佐野雅美[1]、山本あゆ[2]、影沢歩友子[3]、真壁竜介[1,2,3]、茂木正人[1,2]、小達恒夫[1,3]

[1] *国立極地研究所*
[2] *東京海洋大学*
[3] *総合研究大学院大学*

Composition analysis of sinking particles by using gel sediment traps in the Indian sector of the Southern Ocean during austral summer

Masayoshi Sano[1], Ayu Yamamoto[2], Ayuko Kagesawa[3], Ryusuke Makabe[1, 2, 3], Masato Moteki[1, 2] and Tsuneo Odate[1, 3]
[1]National Institute of Polar Research
[2]Tokyo University of Marine Science and Technology
[3]The Graduate University for Advanced Studies

Sinking particles, an important contributor to biological carbon pump, consist of various types of particles. Export efficiencies and sinking speeds are different among types of sinking particles, for example, phytodetritus and fecal pellets. However, our knowledge on the contribution of each particle type is still limited because of difficulty in collecting fragile aggregates. In the Southern Ocean, the contribution of fecal pellets to carbon flux is expected to be high because of the high abundance of the large zooplankton, such as salps and krills, which excrete fast-sinking large fecal pellets. However, in the Indian sector of the Southern Ocean, the krill-independent ecosystem is expected to be important. This study aims at estimating the relative contribution of each sinking particle type to the carbon flux in the Indian sector of the Southern Ocean by using gel-filled sediment traps which are able to collect the fragile particles without collapse of them.

Sinking particle samples were collected from a station (63.5°S, 110°E) during the Southern Ocean cruise of the T/V *Umitaka Maru* of Tokyo University of Marine Science and Technology. The trap system consisted of gel-filled sediment traps deployed at 50, 200 and 500 m depths, and twin-type sediment traps deployed at 60, 210 and 510 m depths. Traps were left to drift for 24h (17 January 2019 to 8 January 2019). After recovery, each gel was photographed immediately on board. Samples collected by twin-type sediment traps were filtered on Whatman GF/F filters after removing swimmers, and used for analyzing the concentration of particulate organic carbon (POC). Images of the gel sediment trap samples were analyzed according to the method of Laurenceau-Cornec et al. (2015) with partial modification. Sinking particles were classified into six groups, aggregates, cylindrical fecal pellets, oval fecal pellets, phytoplankton, fecal aggregates, and others (Fig.1). After binarization of the images, projection areas and perimeters of particles were analyzed with the image-processing software ImageJ (National Institute of Health). Volumes of the particles were calculated based on projection areas and perimeters. The conversion from volume to carbon content was done by using formulas of González and Smetacek (1994) and Alldredge (1998). Then, the relative contributions of the six particle types to the total POC flux were calculated.

The contributions of cylindrical fecal pellets were gradually decreased from 50 m (55%) to 500m (10%), and those of aggregates were gradually increased from 50 m (27%) to 500 m (80%). The contributions of fecal aggregates were increased from 50 m (13%) to 200 m (28%) and decreased from 200 m to 500 m (8%). The contributions of phytoplankton, oval fecal pellets and others were lower than 4% in all of the depth. The reason of the high contribution of fecal pellets in 50 m may be because the aggregates and phytoplankton were consumed and packed into fecal pellets by suspended feeder in a pycnocline. Decreasing of fecal pellets and increasing of aggregates with depths may indicate the degradation of fecal pellets with depths. Additionally, because the sizes and shapes of cylindrical fecal pellets were different among the depths, fecal pellets were considered to be consumed and repacked by sinking particle feeder in each depth at least once.

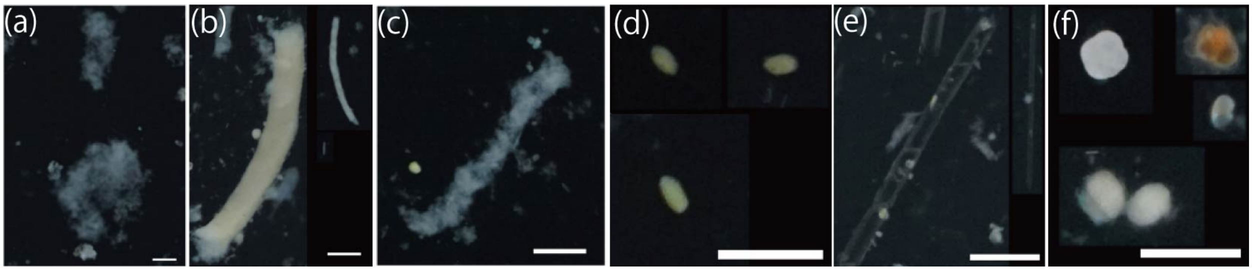

Fig.1 Examples of each particle types. (a) aggregates, (b) cylindrical fecal pellets, (c) fecal aggregates, (d) oval fecal pellets, (e) phytoplankton, (f) others.

References

Laurenceau-Cornec, E.C., T.W. Trull, D.M. Davies, S.G. Bray, J.Doran, F. Planchon, F. Carlotti, M.-P. Jouandet, A.-J. Cavagna, A.M. Waite, and S. Blain. 2015. The relative importance of phytoplankton aggregates and zooplankton fecal pellets to carbon export: insights from free-drifting sediment trap deployments in naturally iron-fertilised waters near the Kerguelen Plateau Biogeosci., 12, 1007–1027.

González, H.E., and V. Smetacek. 1994. The possible role of the cyclopoid copepod *Oithona* in retarding vertical flux of zooplankton faecal material, Mar. Ecol.-Prog. Ser., 113, 233–246.

Alldredge, A. 1998. The carbon, nitrogen and mass content of marine snow as a function of aggregate size. Deep-Sea Res. Pt. I, 45, 529–541.