

The Plankton Ice as Basic Factor of the Primary Production in the Antarctic Ocean

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南氷洋の1次生産の基本的構造としてのプランクトン氷

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要 旨

この報告でプランクトン氷か南氷洋の1次生産に与える影響について、主として水中と氷中とのプランクトンの種類組成と量の比較から検討を行なった

底型プランクトン氷域——この海域のプランクトンは底型プランクトン氷で生産され、それが海中に放出されたものが大きい比重をしめており、海水中の生産はさほど大きい比重をしめていない

表面型プランクトン氷域——春夏の植物プラ

ンクトンは表面型プランクトン氷から放出されたケイ藻が優勢であったが、秋では優占種が異なっていた。この優占種の遷移には *Euphysa* の捕食が大きい役割をしていると考えられる

冬期結氷域——この海域ではまだプランクトン氷を見出していないが、12月にはプランクトンが多く、3月にいちじるしく減少していることや、種類組成から、この海域でも海氷による生産があったのかもしれない

The primary production of Antarctic Ocean depends mainly on the following:

1. formation of plankton ice,
2. multiplication of plankton in sea-ice, and
3. release of plankton into the sea by melting ice.

The secondary multiplication of plankton in the sea and multiplication of plankton in sea water, never forming plankton ice, also occur. A decrease of phytoplankton is ascribed mainly to zooplankton which prey upon phytoplankton.

Bottom type plankton ice area

In 10l liquid made by melting the bottom type plankton ice, a maximum of 78.3 ml of diatoms were found. This was 100 times as much the 0.8 ml of diatoms found in the surface type plankton ice, and since the quantity of plankton in sea

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water around this area is 0.14 ml, is was actually 560 times as much. This observation reveals the great productivity of plankton in sea ice.

The diatoms which were found in the bottom type plankton ice are *Amphipleura rutilans* v. *antarctica*, *Amphiprora kufferathii*, *Charcotia australis*, *Coscinodiscus furcatus*, *Eucampia balaustium*, *Fragilariopsis antarctica*, *F. cylindrus*, *F. obliquecostata*, *F. rhombica*, *Nitzschia grundleri*, *N. stellata*, *Pinnularia quadratarea* v. *biqueneata* and *Pleurosigma* sp., among which *Amphipleura rutilans* v. *antarctica*, *Amphiprora kufferathii*, *Nitzschia stellata*, *Pleurosigma* sp., are abundant, constituting the *Amphipleura rutilans* v. *antarctica*-*Amphiprora kufferathii*-*Nitzschia stellata*-*Pleurosigma* sp. association. Composition of this type resembles the one which BUNT reported in 1963 from the bottom type plankton ice collected around McMurdo, but since BUNT recorded no data concerning the dominant species, no comparison can be made.

The phytoplanktons which were found in this ocean area are *Amphiprora kufferathii*, *Charcotia australis*, *Eucampia balaustium*, *Fragilariopsis curta*, *Nitzschia stellata* and *Pleurosigma* sp., among *Amphiprora kufferathii* and *Nitzschia stellata* are the dominant species. The composition of this type and that of the dominant species are similar to those in plankton ice. It seems, therefore, that the larger part of the planktons in this ocean area are those from the bottom type plankton ice and those which are released into the sea, whereas the quantity produced in the sea is not so large.

Surface type plankton ice area

This area largely extends from 65° S to 68° S in Lutzow-Holm Bay. In the surface type plankton ice, phytoplankton with *Fragilariopsis cylindrus* as the dominant species was found in abundance. In a previous paper, the surface type plankton ice was described (1960, 1966). However BULKHOLDER (1965), also recorded facts concerning this type of plankton ice in the Antarctica around the Antarctic Peninsula (1965). In his paper, he wrote "The microalgae present in the ice included large numbers of a very small diatom . . ." and this "very small diatom" seems to be *Fragilariopsis cylindrus*.

The dominant species of net plankton in this ocean area from spring to summer were *Thalassiothrix longissima* v. *antarctica*, *Corethron criophilum* and *Fragilariopsis curta*, and those of the precipitated sea ice were *Nitzschia stellata* and *Fragilariopsis curta*. The dominant species of the phytoplankton in sea water in the autumn was *Corethron criophilum* both in net plankton and that of precipitated sea water. In the latter, *Fragilariopsis curta* was found once, as the subdominant species.

According to the facts mentioned above, the phytoplankton of this ocean area from spring to summer is significant for its release from the surface type plankton ice. However, *Fragilariopsis cylindrus*, is the dominant species in the surface type

plankton ice, was not found so much in the precipitated sea water. This may be due to *Euphasia*, which is abundant in this area and preys upon the species.

In the period from spring to summer, *Fragilaropsis cylindrus* was dominant among the diatoms released from surface type plankton ice near this ocean area, but in autumn *Corethron criophurum* is believed to be the dominant species. The latter diatom is large and has many long spines, and so it is not an important prey for *Euphasia*.

The area frozen in winter

In the ocean area from 62–65° S which is covered with sea ice from winter to spring, the sea ice retreats quite early and an almost open sea is formed by the end of December. Remarkably colored ice has not been found yet in this ocean area, and whether diatoms grow in this sea ice area or not has not been determined.

The quantity of plankton in this ocean area is larger in December but decreases considerably in March. Among the plankton collected from precipitated sea water, *Fragilaropsis antarctica* was the dominant species in the summer time. This species can also be found in great numbers in the surface type plankton ice, but in autumn this species is smaller in number and *Arteromphalus* sp. becomes the dominant species, with *Fragilariopsis curta* as the subdominant species. Judging from these facts, it can possibly be presumed that production by sea ice occurs in this ocean area, also. This problem will be considered in the future studies of sea ice.

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