西部北極海チュクチ陸棚域における溶存態結合・遊離アミノ酸の動態：秋季の植物プランクトンブルーム発生下における定点観測

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Temporal variations in concentrations of dissolved combined and free amino acids during an autumnal phytoplankton bloom in the Chukchi Shelf, western Arctic Ocean

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Dissolved amino acids represent a major fraction of chemically identifiable component of dissolved organic matter (DOM) in seawater. Although dissolved amino acids can potentially support a large fraction of bacterial carbon and nitrogen demand, concentrations of dissolved amino acids, especially those of dissolved free amino acids (DFAA), are generally low (on the order of 10–100 nmol L^{-1}) in open waters, because DFAA production, via release from phytoplankton and heterotrophic organisms, is tightly coupled with bacterial consumption. Data are limited on dissolved amino acid dynamics in perennially cold surface waters of the Arctic Ocean, where bacterial uptake of dissolve amino acids could be strongly suppressed, thereby DOM-bacteria couplings might be disrupted, by low seawater temperatures. In order to gain insights into the mode of DOM-bacteria interactions in the Arctic Ocean, we investigated whether dissolved amino acid concentrations and compositions change during an autumnal phytoplankton bloom in the Chukchi Shelf. Seawater samples were collected at a fixed-point observation station (depth, 56 m) during September 2013 to analyze DFAA and dissolved combined amino acid (DCAA) by HPLC. During the investigation period, surface seawater temperature decreased from 3.2 to 1.5^{o}C and phytoplankton biomass increased from 0.26 to 0.97 μg L^{-1}, which was accompanied by increasing bacterial production from 0.40 to 0.79 μg C L^{-1} d^{-1}. Both DFAA and DCAA concentrations varied little during the investigation period, with average concentrations being 12 ± 4.9 nmol L^{-1} (n = 71) and 240 ± 27 nmol L^{-1} (n = 97), respectively, in the upper 30 m. Low DFAA concentrations, even during the bloom period, suggested that bacteria took up DFAA highly efficiently, despite low temperature, to keep DFAA concentrations low, although the possibility that DFAA was not produced or produced only in low quantity during this particular bloom could not be excluded. For both the DCAA and DFAA pools, amino acid compositions (molar percentages of individual amino acids) differed little between the pre-bloom and the bloom period, although, on average, DFAA and DCAA were distinct compositionally, as indicated by principal component analyses. Compared to the DCAA composition, the DFAA pool was more enriched with glutamic acid, arginine, and tyrosine, especially in the upper water.