南極雪鳥沢およびやつで沢の溶存有機物の特性

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Characterization of dissolved organic matter in the Yukidori and Yatsude Valleys, Antarctica

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Dissolved organic matter (DOM) exists ubiquitously in the aquatic environment and is involved in various biogeochemical processes. In Langhovde ice-free area in East Antarctica, Yukidori and Yatsude Valleys are adjacent each other, so they share the same weather, base rock, and a glacier which supplies freshwater. However, Lake Heito is located in the upstream area of Yatsude Valley, which is dammed by a glacier breaking once in about 30 years, resetting vegetation in the lake and the downstream area. Consequently, abundant vegetation develops only in Yukidori Valley, but only a few patched vegetation is recognized in Yatsude Valley. This feature perhaps makes differences in DOM and nutrients conditions in the stream water between Yukidori and Yatsude Valleys. In this study, we aimed to reveal the differences between the two streams by investigating chemical characteristics of the DOM and the nutrients. Water samples were collected at nine points from the upstream area to the downstream area in both the streams (including 5th point is from Lake Yukidori, and 2nd point is from Lake Heito), and the samples were filtered with a glass fiber filter (0.3 μm) within a few days after collection, then, were immediately analyzed by a UV-Vis absorption spectroscopy and an excitation-emission matrix spectroscopy (EEM). After the samples were transported to Japan, DOM was fractionated into hydrophobic and hydrophilic fractions using DAX-8 resin and were quantified by a TOC analyzer. In addition, total dissolved nitrogen (TDN) concentrations and several inorganic dissolved nutrients (NO_3-N, NO_2-N, NH_4-N, PO_4-P, and SiO_2-Si) were measured colorimetrically by a continuous flow analysis. Significant differences in dissolved organic carbon (DOC) and TDN concentrations in the two streams were not detected, and the proportion of a microbially-derived DOM tended to increase. In Yukidori Valley, the inorganic nitrogen concentration, aromaticity, and average molecular weight were shown to decrease in Lake Yukidori. In Yatsude Valley, such the trend was not observed in Lake Heito because the biological activities may be lower than in Yukidori Valley. These results suggest that the two streams receive inputs of the microbially-derived DOM, while the aromaticity and the average molecular weight of DOM were affected by microbial activities and photodegradations in Lake Yukidori where the water residence time is longer than Lake Heito.

溶存有機物（DOM）はあらゆる水系に存在し、種々の生物地球化学的過程に関与する。東南極ラングホブデの雪鳥沢およびやつで沢は互いに隣接しており、気候・母岩材・淡水供給源（氷河）が同一である。しかし、やつで沢のみ約 30 年に一度、沢の上流部で氷河によって堰き止められている平頭池が決壊し、湖内と下流域の植生がリセットされる。その結果、雪鳥沢には東南極には珍しく豊かな植生が発達しているが、やつで沢には乏しい植生がパッチ状に認められるだけである。この違いは、雪鳥沢とやつで沢の沢水に含まれる DOM と栄養塩の環境にも違いをもたらしていると考えられる。本研究では、DOM の化学的特性と形態別の栄養塩濃度を調査することで、これらの沢の環境の違いを明らかにすることを目的とした。2 沢の上流から下流にかけてそれぞれ 9 地点ずつ採水し（内、雪鳥沢の 5 地点目とやつで沢の 2 地点目はそれぞれ雪鳥池と平頭池から採取）、採水後数日以内にガラス繊維ろ紙（孔径 0.3 μm）を用いてろ過した。その日のうちに、ろ過試料の紫外・可視吸収スペクトルおよび 3 次元励起蛍光スペクトル（EEM）を測定し、DOM の起源や組成の指標となるパラメーターを算出した。また、試料を日本に持ち帰り、DAX-8 樹脂を用いて DOM を疎水性画分と親水性画分とに分画定量した。さらに、溶存態全窒素（TDN）濃度、およびオートアナライザーによって各種無機溶存栄養塩（NO_3-N，NO_2-N，NH_4-N、PO_4-P、SiO_2-Si）を比色測定した。2 沢における溶存有機炭素（DOC）と TDN 濃度に有意な差はみられず、微生物由来と推定される DOM の割合が増加していく傾向にあった。雪鳥沢では雪鳥池において無機態窒素と DOM の芳香族性・平均分子量の低下が認められた。やつで沢では平頭池の生物活動が低いためか、そのような傾向はみられなかった。これらの結果から、

2 沢において微生物由来の DOM が供給されつつ、滞留時間の長い雪鳥池においては DOM が微生物活動、および光分解による芳香族性・平均分子量の変動の影響を受けることが考えられた。