

日本海内部における腐植様蛍光物質の蓄積 Accumulation of humic-like fluorescent dissolved organic matter in the Japan Sea interior

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Marine dissolved organic matter (DOM) is the largest reduced carbon reservoir in ocean. Most marine DOM is produced by marine biota and is resistant to rapid microbial degradation. Thus, it is crucial to know the dynamics of recalcitrant DOM for determining whether the marine DOM reservoir is stable or not. Even though there have been several hypotheses regarding with the recalcitrant mechanism of marine DOM, the microbial production of recalcitrant DOM (defined as microbial carbon pump) has been considered as the main process. Humic-like fluorescent DOM (FDOM_H) has found to produce during microbial incubation. Even though FDOM_H has known to easily degrade by sunlight, linear relationships between fluorescence intensity of FDOM_H and indicators of microbial remineralization, e.g., apparent oxygen utilization (AOU), have been observed throughout the ocean. These experimental and observational results imply that FDOM_H is a product of microbial carbon pump. Another important source of FDOM_H, especially in coastal environments and marginal seas, is riverine supply. Even though the major fractions of FDOM_H have been considered to be photo-degraded in coastal environments, substantial contribution of terrestrial FDOM_H into ocean interior has been suggested. Thus, in addition to accumulation of in situ produced FDOM_H, recalcitrant terrestrial FDOM_H might occur in deep ocean, especially in marginal seas. However, it is not clear whether recalcitrant autochthonous and/or terrestrial FDOM_H is accumulated in deep ocean of marginal seas or not.

We determined vertical profiles of FDOM_H at 5 stations in the Japan Sea and 5 stations in the western North Pacific using excitation emission matrix fluorescence with parallel factor analysis (EEM-PARAFAC). Seawater samples from surface to bottom waters of the Japan Sea and the western North Pacific were collected during T/S Oshoro-maru (C184) and R/V Tansei-Maru (KT-11-17) cruises, respectively. Two FDOM_H were obtained after EEM-PARAFAC and assigned as traditional terrestrial and marine (microbial) FDOM_H, respectively. In the Japan Sea, levels of both FDOM_H were lowest in surface waters, gradually increased with depth below surface waters, and were highest in waters distributed depths greater than 2000 m that were corresponding to the lower part of Japan Sea Proper Water (JSPW), i.e., lower part of the Japan Sea Deep Water (JSDW) and the Japan Sea Bottom Water (JSBW). Levels of both FDOM_H were linearly correlated with AOU in the JSPW, suggesting that both FDOM_H were produced in situ in the JSPW. Interestingly, levels of both FDOM_H in the JSPW were similar or slightly higher compared with those in deep waters of the western North Pacific, even though AOU in the JSPW were significantly lower than those in deep waters of the western North Pacific. Such distributional characteristics of FDOM_H in the JSPW imply that FDOM_H is accumulated in the interior of the Japan Sea. We will discuss possible origin and accumulation mechanism of FDOM_H in the Japan Sea interior.

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