

# ***In situ* production of fluorescent dissolved organic matter in the ocean interior.**

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Dissolved organic matter (DOM) in the ocean mainly comprises molecularly-uncharacterized components (MUC). Marine humic-like fluorophore, recently called fluorescent dissolved organic matter (FDOM), has been considered to be typical of MUC, and shows unique vertical distributions in open ocean. The level of FDOM is low in the surface layer and increases with depth. Such a profile has been interpreted as the consequence of two processes. One is the photodegradation of FDOM in the surface layer, a well-documented process. Another is its production accompanied with remineralization of biogenic sinking particles. However, the production of FDOM is hypothesized based on a few observations in oceanic regions where analogous vertical profiles were found between FDOM and nutrients in the mesopelagic layer and *in vitro* formation of FDOM in the laboratory experiments. Hence, the dynamics of FDOM in the ocean have been uncertain.

To evaluate the dynamics of FDOM in the ocean, we clarified the basin scale distribution of FDOM fluorescence intensity from the Southern Ocean to the subarctic region of the North Pacific. Fluorescence intensity at 320-nm excitation and 420-nm emission, which are typical wavelengths of marine humic-like fluorophore, were measured onboard ship.

Throughout the Pacific, vertical profiles of fluorescence intensity were qualitatively the same of the previous snapshot observations, indicating that photodegradation is major controlling factor of FDOM levels in the surface layer. In addition to vertical gradients, we found the meridional gradient of fluorescence intensity in the mesopelagic (200-1000 m) and abyssal (1000 m-bottom) layers, namely, levels of fluorescence intensity in the northern hemisphere were higher than those in the southern hemisphere. Such meridional gradient was similar to that of apparent oxygen utilization (AOU), and fluorescence intensity was positively correlated with the value of AOU in the mesopelagic and abyssal layers throughout the Pacific. Since AOU is an estimate of the oxygen used in various biological processes in the ocean interior, it can be concluded that FDOM is produced universally *in situ* in the ocean interior along with biological oxidation of organic matter.