DIC and $\delta^{13}C$ controlls in lake water during the summer stagnant period

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A combination of carbon stable isotopic ($\delta^{13}C_{DIC}$) and chemical compositions of the water in Lake Haruna (LH) was used to investigate origins and supply processes of dissolved inorganic carbon (DIC) during the summer stagnant period in the LH, located in the central part of Gunma Prefecture. The temperature depth profile illustrated that the lake water could be divided into two main layers: an epilimnion and a hypolimnion, and the boundary was 7 to 8 m deep as thermocrine. Higher values of pH and dissolved oxygen (DO) were observed to be associated with lower values of DIC, partial CO_2 pressure ($logP_{CO_2}$), and $\delta^{13}C_{DIC}$ in the epilimnion than those in the hypolimnion. This can be attributed to photosynthesis occurring in the epilimnion, since it is the euphotic zone. A Rayleigh model with −16.6‰ as the isotopic enrichment factor (ε) demonstrated that a photosynthesis process, which consumed up to approximately 30% of DIC, sufficiently accounts for the decreases in the DIC concentrations and the increases in the $\delta^{13}C_{DIC}$ values, upon moving upwards from the hypolimnion to the epilimnion. Moreover, $\delta^{13}C$ value for the CO_2 gas, which initially equilibrated with DIC in the LH, was calculated to be approximately −21‰, which indicated that DIC in the LH originated entirely from the decomposition of organic materials through a respiration process and was not likely to be derived from atmospheric CO_2 as illustrated in Fig. 1.

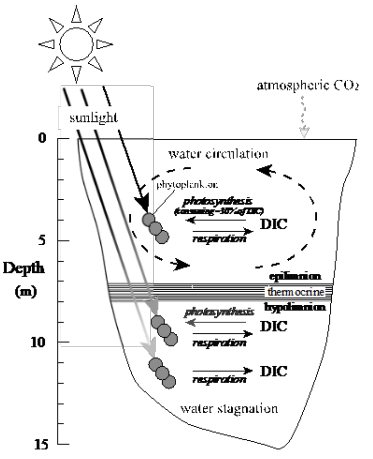

Fig.1 Schematic image in the Haruna Lake