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Topography-affected Deep and Abyssal Water Mixing in the Western Pacific Ocean Revealed by Radiocarbon

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In the deep/abyssal layers, water-masses from the Southern Ocean and the Northwestern Pacific spill into the Philippine Sea and upwell into the intermediate layers, which is considered to play a significant role in modulating the regional water-mass properties and overturning circulation. The unique submarine topographic structure of the Philippine Sea also adds complexity to the circulation of the deep water masses. Using the seawater samples collected during the GEOTRACES-China Expedition (KK1903) from May to June 2019 and the NORC 2020-581 Expedition from November 2020 to January 2021, we measured $\delta^{14}C$ of the dissolved inorganic carbon (DIC) to characterise the middle and deep water masses in the Philippine Sea and Mariana Basin. Our results show that the Upper Circumpolar Deep Water (UCDW) and the Lower Circumpolar Deep Water (LCDW) are the dominant components of the deep and bottom water masses. They enter the Western Mariana Basin through the channel of Mariana- Yapu trench. The vastly contrasted local topography causes the higher $\delta^{14}C$ LCDW water mass mixing with the overlying lower $\delta^{14}C$ UCDW water mass at the channel. As a result, the mean seawater $\delta^{14}C$ in the Philippine Sea decreases from east to west following the basal terrain, showing the gradual diminishing influence of the LCDW. For the Philippine Basin to the west of Kyushu Palau ridge, the deep water mass is relatively uniform vertically. This is in contrast to the east of the ridge where the water masses are more structured possibly due to the topography-affected mixing in the deep and abyssal layers within the basin.