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Synchronous evolution of surface and bottom waters in the Conrad Rise of the Southern Ocean during the last 43,000 years

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In this study, we analyzed the multi-proxy (biogenic opal, $CaCO_3$, total organic carbon (TOC), total nitrogen (TN), C/N ratio, and carbon isotope ($\delta^{13}C$) of sediment organic matter) to reconstruct the paleoceanographic evolution in the Conrad Rise of the Southern Ocean, using a 10.47 m long COR-1bPC (54° 16’ S, 39° 46’ E; water depth 2828 m). The AMS ^{14}C dating of planktonic foraminifera (*N. pachyderma*) refined the estimated age of COR-1bPC to be about 43 ka at the core bottom. Variation of multi-proxy was divided into the three intervals, representing the synchronous evolution of surface and bottom water properties. In terms of biogenic opal content, the diatom productivity in the surface water was low during the last glacial period, increased abruptly during the deglacial period, and remained high during the Holocene. In terms of $CaCO_3$ content, the variation of carbonate productivity was similar to that of biogenic opal content, but the dissolution effect was incredibly strong during the last glacial period. In contrast to the surface water productivity, TOC and TN contents, representing the marine organic matter, was high during the last glacial period and low during the Holocene with an abrupt decrease during the deglacial periods. Such variation implies that the preservation of TOC and TN contents was influenced more by the degradation rather than the production, which was supported by the relationship with C/N ratio and $\delta^{13}C$ value. It indicates the change of dissolved oxygen concentration of the bottom water from the last glacial period to the Holocene. Core COR-1bPC records the synchronous evolution of surface water and bottom water properties in the Conrad Rise of the Southern Ocean was