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Vertical distribution of triple oxygen isotopic composition of dissolved oxygen in the northwestern Pacific

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Oxygen-17 excess of dissolved oxygen calculated from δ^{18}O and δ^{17}O is not affected by oxygen consumption process but controlled only by processes of primary production and air-water gas transfer. Evaluating gross primary productivity using the ^{17}O-excess in ocean surface water are one of the most advanced geochemical researches for last 10 years. Oxygen-17 excess below ocean mixed/photic layer has not been much investigated because it might be out of focus for estimating present primary productivity, except for the purpose to correct diapycnal mixing effect on surface water. In principle, water mass which has not been affected both by photosynthesis and gas transfer after its separation from ocean surface could preserve ^{17}O-excess value where the water mass was at the surface.

The purpose of this study is to determine the vertical distribution of ^{17}O-excess from the surface to the bottom of northwestern Pacific to know whether ^{17}O-excess could really preserve its “original” value after the long and dark travel. Near stations K2 and KNOT, water mass which has a density of 26.8 σ_θ is observed at depth between 100 and 300 m. This water mass is mainly originated from bottom water in the Okhotsk Sea and spreading widely to entire northwestern Pacific, which is called North Pacific Intermediate Water (NPIW). NPIW is found at depth of 700 m at station S1. Samplings were conducted by two R/V Mirai cruises (MR10-06, Oct-Nov 2010; MR11-02, Feb-Mar 2011). Dissolved oxygen gas was purified by the method of Sarma et al. (2003) and its isotopic composition was determined by dual-inlet isotope ratio mass spectrometer (Thermo Scientific Delta Plus). Gross primary productivities at mixed layer estimated by ^{17}O-excess were well consistent with those by conventional light and dark bottle incubations for stations K2 and S1.