Intermediate water ventilation shifts in the NE Pacific drove extreme low-oxygen conditions in the early- to mid-Holocene

YI WANG[1], INGRID HENDY[2]

[1]Room 2534, 1100 N. University Ave. Ann Arbor, MI, USA, 48105, ellawang@umich.edu

[2][3]Room 2534, 1100 N. University Ave. Ann Arbor, MI, USA, 48105, ihendy@umich.edu

Impacts of oceanic deoxygenation observed since 1950s have drawn increasing attention as dissolved oxygen regulates biodiversity and biogeochemical cycles. Yet duration of current instrumental records (several decades) is insufficient to constrain natural variability on centennial to millennial time scales. Here we present a redox-sensitive metal (Re, U, and Mo) record of MV0811-14JC (34°16.906'N, 120° 02.162'W, 582 m water depth) retrieved from the Santa Barbara Basin (SBB), California to reconstruct oxygenation shifts in Holocene. Enhanced authigenic trace metal fluxes and coherent benthic foraminifera faunal responses along the depth transect in the oxygen minimum zone (ODP 893A, MV0502-2503, -2504, ODP 1017E) reveal significantly intensified deoxygenation on the California Margin during the early- to mid-Holocene (EMH, before ~6 ka) relative to the post-Industrial Revolution average (~1870-2007 CE), highlighting the magnitude of natural oxygenation variability under climate control. Inconsistencies between authigenic metal fluxes and local oxygen control (water-column stratification and export productivity) indicate remote forcing of intermediate water ventilation. We suggest that less ventilated North Pacific Intermediate Water (NPIW) during the EMH may have led to basin-wide oxygenation responses in the North Pacific, implying a role of NPIW in large-scale carbon storage and nutrient cycling. A comparison of Holocene marine and lake records reveals a mid-Holocene transition (~6-7 ka) toward more ventilated intermediate water masses coinciding with insolation-forced, southward migration of the Intertropical Convergence Zone, leading to deepened/eastward Aleutian Low and intensified/more zonally symmetrical Southern Westerly Winds. Thus interhemispheric oceanic responses were closely coupled through atmospheric teleconnections in Holocene.