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Deglacial 14C reservoir ages of surface waters at the northern boundary of Peruvian coastal upwelling

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To constrain the accurate age of a marine sediment record, the radiocarbon (^{14}C) ages need to be corrected for short-term and small-scale changes in planktic ^{14}C reservoir ages (R_{plank}). Nevertheless, accurate records of past changes in R_{plank} are scarce. Here we present a high-resolution record of deglacial ^{14}C ages measured on *Globigerina bulloides* in sediment core M77/2-59-1 from the northern boundary (~4°S, 997 m) of the Peruvian upwelling zone. The fine structure of jumps and plateau boundaries in the ^{14}C record were tuned to synchronous, thus global structures in the atmospheric ^{14}C record of Lake Suigetsu (Bronk Ramsey et al., 2012) and used as tie points for an age model with semi-millennial resolution, moreover to reconstruct deglacial changes in R_{plank} from 17 to 11 cal. ka. In our record, R_{plank} drops from 1250 ^{14}C yr prior to 14 cal. ka to ~600 – 450 ^{14}C yr until the plateau named Top of Younger Dryas. The drop suggests a major decrease in coastal upwelling, possibly the result of a southward (poleward) expansion of the Intertropical Convergence Zone and related shift in the southeastern trade wind belt during the Bølling-Allerød. Subsequent to 14 cal. ka our R_{plank} values are roughly similar to values obtained for thermocline waters near the equator from the age difference between ^{14}C ages of wood chunks and ^{14}C of *G. ruber* (Zhao & Keigwin, 2018). Prior to 14 cal. ka our R_{plank} are ~800 ^{14}C yr higher, which corroborates the presumed latitudinal shift of coastal upwelling. Our ^{14}C ages measured on G. bulloides differ in part from paired ^{14}C ages of *Neogloboquadrina dutertrei*, indicating their habitat in different water masses prior to 14 cal. ka, in support of the upwelling affinity of *G. bulloides*. In addition, we used our R_{plank} values to accurately derive past ventilation ages of intermediate waters near 1000 m depth based on the difference of paired benthic and planktic ^{14}C ages, which is important to constrain centennial to millennial scale changes in circulation influencing the extent of the Peruvian oxygen minimum zone.

References:

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