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Changes of the Pacific deep water circulation during the Pliocene-Pleistocene transition: Evidence from in-situ Neodymium isotope analyses on ferromanganese crust

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The earth's climate had experienced a big change during the Pliocene-Pleistocene transition, which was considered to be associated or accompanied with a vital transition of the global ocean circulation both on the surface and in the deep. The isotopic composition of neodymium (εNd) in marine precipitates (e.g. ferromanganese crust and nodules) has considerable promise as a recorder of past circulation patterns, but such records from the North Pacific all provided insufficient resolution to quantify the deep circulation change of the Pliocene-Pleistocene transition. We show here, using in situ, high temporal resolution analyses of ferromanganese crust from a water depth of 3018 m in the Northern central Pacific, that the radiogenic Nd isotopic composition of the North Pacific deep-water was most enriched from 3 Ma to 1.4 Ma after the transition, when the deep water was less ventilated due to the cease of Pliocene north Pacific deep water formation and weak circumpolar deep water intrusion. After 1.4 Ma, the decreased εNd values evidenced the increased proportion of the south component water, which may indicate the start of the present-day Pacific deep water circulation pattern.