Constant iron isotopic composition of Pacific deep water over the last 20 Ma

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Iron isotopic compositions (δ^{56}Fe relative to IRMM-14) of 10 ferromanganese deposits from the central and northwestern Pacific Ocean (1400–6000 m water depth) were determined. The hydrogenetic nodules and crusts showed a consistent average iron isotopic composition (–0.32 ± 0.12‰, 2σ), which is slightly lower than the value of igneous rocks (+0.09 ± 0.1‰, [1]). Our study contrasts with the previous study that demonstrated large variations in the δ^{56}Fe values of ferromanganese crusts in the Pacific (–0.59 ± 0.36‰) and the Atlantic (–0.27 ± 0.36‰) [2]. The consistent δ^{56}Fe values imply homogenous iron isotopic composition of modern deep water in the central to northwestern Pacific. Despite differences in mineralogy and chemistry, the average δ^{56}Fe value of diagenetic nodules (–0.28 ± 0.11‰) was indistinguishable from that of hydrogenetic ferromanganese deposits. These observations are consistent with that iron is not reduced during early diagenetic processes while manganese is reduced and dissolved. We also reconstructed the temporal variations for iron isotopic compositions in three hydrogenetic ferromanganese crusts from different water depths (1440, 2239, 2987 m) in the northwest Pacific. Regardless of water depth, the δ^{56}Fe values of these crusts were essentially constant (–0.31 ± 0.13‰) throughout the past ~20 Ma. Our results are remarkably consistent with previously reported iron isotopic compositions for ferromanganese crust (–0.31 ± 0.10‰) from ~3000 m water depth in the central Pacific over the last 10 Ma [3]. Thus, it is suggested that Pacific deep water has remained constant in iron isotopic composition for at least 20 Ma.

[1] Beard *et al*. (2003) *Chem. Geol*., [2] Levasseur *et al*. (2004) *EPSL*, [3] Chu *et al*. (2006) *EPSL*