

Re-Os dating of Matsumine-mine, a largest Kuroko-type deposit in the Hokuroku district, Northeast Japan

YUTARO TAKAYA¹, TATSUO NOZAKI² AND RYOICHI YAMADA³

¹The University of Tokyo

²Submarine Resources Research Center, Research Institute for Marine Resources Utilization, Japan Agency for Marine-Earth Science and Technology

³Graduate School of Environmental Studies, Tohoku University

Presenting Author: y-takaya@g.ecc.u-tokyo.ac.jp

Most of the Kuroko-type volcanogenic massive sulfide (VMS) deposits in Northeast Japan Arc are embedded in the Kuroko rift that was formed at the end of back-arc basin activity of Japan Sea. The age of these deposits is estimated to be around 16-14 Ma based on the ages of related igneous rocks and microfossil ages. However, there are only a few cases in which direct formation ages have been determined, and the Re-Os isochron age of 14.32 ± 0.51 Ma has been obtained for Kuroko deposits in the Hokuroku district by using sulfide ore samples collected from four Kuroko mines (Fukazawa, Kosaka, Shakanai and Hanaoka Mines) (Terakado, 2001). In this study, we tried to determine the age of Matsumine Mine, one of the largest Kuroko-type VMS deposits in the Hokuroku district, using the Re-Os isotope of sulfide ore samples. As a result, we obtained a well-defined isochron yielding an age of 14.99 ± 0.64 Ma. This formation age agrees with the previously reported age of the Kuroko deposits in the Hokuroku district, which strongly suggests that most of Kuroko deposits in the Hokuroku district formed at approximately the same timing. On the other hand, the initial value of $^{187}\text{Os}/^{188}\text{Os}$ of our isochron is 0.774 ± 0.021 , which is almost equivalent to that of seawater $^{187}\text{Os}/^{188}\text{Os}$ value at that time. Our result is constituent with that many chimney samples of modern seafloor hydrothermal deposit have similar $^{187}\text{Os}/^{188}\text{Os}$ ratio with seawater value as reported by Zeng et al. (2014). We also analyzed the whole-rock chemistry of mudstones (M1 - M3 horizons) alternately layered with related igneous rocks from the lower to upper stratigraphic positions of the Kuroko orebody. The results show that the compositional changes at the boundary of Nishikurosawa and Onnagawa formations (13.5 Ma) in the M2 horizon suggest a shift to a more oxidizing environment. This also shows that a reducing environment continued for about 1.5 My after the formation of Kuroko ore and possibly contributed to the preservation of constituent sulfide minerals in the Kuroko ore.