A Case Study of Mining Seafloor Massive Sulfides in Japanese EEZ

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ABSTRACT

The Kuroko-type seafloor massive sulfide deposits found in the western Pacific have been considered to have potentials for economic recovery of Au, Ag, Cu, Zn, and Pb. The technical and economic feasibility of mining is preliminary evaluated in this case study. The Sunrise Deposit of Myojin Knoll on Izu-Ogasawara Arc in the Japanese EEZ is selected as the target. Some important technical factors to affect the economic feasibility are clarified through the evaluation. It is concluded that commercial mining may have a chance, if a smaller production scale is applied to the development. Quantitative information necessary for a more accurate evaluation is discussed.

KEYWORDS: Customer smelter; desalting; feasibility study; Kuroko; metallurgical processing; mining system; ore dressing; seafloor massive sulfide.

INTRODUCTION

The Kuroko-type seafloor massive sulfides (SMS) in the western Pacific have received much attention as sources for economic recovery of gold (Au), silver (Ag), copper (Cu), zinc (Zn), and lead (Pb). Since the end of the 1980s, the Kuroko-type SMS have been found in the back-arc basin and on oceanic island-arc areas. In the Okinawa Trough and on the Izu-Ogasawara Arc near Japan (Halbach et al., 1989; Kato et al., 1988; Iizasa et al., 1999), in the Lau Basin and the North Fiji Basin near Fiji (Fouquet et al., 1991; Bendel et al., 1993), and in the East Manus Basin near Papua New Guinea (Kia and Lasark, 1999) typical representatives are found. They yield a higher concentration in Au and Ag than the SMS found in ocean ridge areas (Haymon and Kastner, 1981; Malahof, 1981; Hekinian et al., 1983; Rona et al., 1984; Hekinian and Bideau, 1985; Rona, 1985). Similar formation processes with the Kuroko ore deposits on-land in Japan have been expected and outlined by many researchers (Sillitoe, 1982; Scott, 1985; Halbach et al., 1989; Iizasa et al., 1999). The higher Au and Ag contents in one of the areas have increased the chances for profitable mining operation, which is under consideration by a private company (Malnic, 2001).

Information about the resource potential of the targeted Kuroko-type SMS deposit, such as
- the amount of SMS ore body,
- the inside structure,
- the mean metal yields,
- the geographical details

are necessary for a technical and economic feasibility study for this development. During the feasibility study for the development of the Red Sea sulfide mud (Amman, 1985; Nawab, 2001), much information was gathered. Further, some technical R&D and a mining test in-situ were conducted to back up the technical and economic evaluation. However, in case of the Kuroko-type SMS deposits, less information for the evaluation is available.

The Sunrise Deposit of Myojin Knoll on Izu-Ogasawara Arc in the Japanese EEZ is selected as target for a technical and economic case study of Kuroko-type SMS development. The relatively higher amount of information on its resource potential is the reason why the deposit is selected. With some important technical and economic assumptions made for the missing information, it is still possible to build a technical model for the development and the economic background is examined. Though the figures are only preliminary, this paper introduces some very attractive results for the commercial development of the site.

BASIC MODEL FOR EVALUATION

Outline

The location of the Sunrise Deposit is approximately 500 km to the south of Tokyo and the amount of SMS ore body is estimated to be approximately 9,000,000 metric tons (Iizasa et al., 1999). Information regarding the inside structure and the mean metal yields have however not yet been obtained sufficiently.

A preliminary technical model and economic evaluation for a cobalt-rich manganese crust development was presented by the authors...