Fundamental Study of UV-fluorescence Sensing System for Seafloor Massive Sulfides

Hirokazu Nagano, Daisuke Okanishi, Naoki Nakatani, Rei Arai, Tetsuo Yamazaki
Osaka Prefecture University
Sakai, Japan

ABSTRACT

Kuroko-type seafloor massive sulfides including gold, silver, copper, zinc, and lead exist in the EEZs of the Pacific island countries. The ones in Japan’s EEZ are expected to be the largest and very much attractive for the future resources. However, there are many problems to be solved for the commercial development. The effective method for finding ore bodies in the survey on seafloor and the location and method of the ore selection are the examples of the problems. A fundamental study of ultra-violet fluorescence sensing indicates the possibilities of applications on seafloor. The time, energy, and cost saving effects of the earlier ore selection are considered.

Keywords: Economy; Kuroko; Ore selection; Seafloor massive sulfide; Survey; Ultra-violet fluorescence.

INTRODUCTION

Kuroko-type seafloor massive sulfides (SMS) in the western Pacific have received much attention as resources for gold, silver, copper, zinc, and lead (Lenoble, 2000). Since the end of the 1980s, the Kuroko-type SMS have been found in the back-arc basin and on oceanic island-arc areas. The typical representatives found are in the Okinawa Trough and on the Izu-Ogasawara Arc near Japan (Halbach et al., 1989; 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 (PNG) (Kia and Lasark, 1999). The higher gold, silver, and copper contents in one of the areas increased the chance for profitable mining operation, which was considered by a private company (Malnic, 2001). The company gathered investment money and announced to start the commercial mining from 2010 (http://www.nautilusminerals.com).

On the basis of geological information of the Sunrise Deposit of the Myojin Knoll on the Izu-Ogasawara Arc (Iizasa et al., 1999) and geotechnical characteristics of the Kuroko-type SMS (Yamazaki and Park, 2003), some preliminary economic validation analyses of the SMS mining in small production scale were reported by one of the authors (Yamazaki et al., 2003; Yamazaki and Park, 2005; Yamazaki 2007). The results showed high profitability of the SMS mining.

UPDATED INFORMATION FOR SMS MINING

In the East Manus Basin near PNG, because of the higher gold, silver, and copper contents, and the ideal SMS site location, an immediate commercial mining project has been progressive by a private company. (http://www.nautilusminerals.com; Malnic, 2001; Smith, 2010). The company started a mining system construction in 2007. However, because of the economic crisis in 2008, the construction contracts were canceled at the end of 2008.

The recovery rate of metal market, however, has been very quick and the copper price in the London Metal Exchange has reached the historical record breaking level at the begging of 2011 (http://www.lme.co.uk). The environmental permit for the development of the PNG project was received in December 2009 from the government. The mining lease for the development of the project has been granted in January 2011. The Government of PNG has confirmed that it intends to take up a 30% stake in the project in March 2011 (http://www.nautilusminerals.com). The money supply is roughly estimated 200 million US dollars. Nothing to disturb the system construction and to accelerate the activity is there.

The other private company surveyed mainly in New Zealand EEZ and provided an SMS mining system design concept for open ocean conditions in April 2008 (http://www.neptuneminerals.com). Because of the economic crisis in 2008, the company stopped the activity in November 2009, but it has announced the discussion with a new investor for re-starting the activity in February 2011 (http://www.neptuneminerals.com).

In Japan, the Ministry of Economy, Trade and Industry (METI) commenced a research and development (R&D) project for SMS in Japan’s EEZ in 2008. The project aims to establish the plan and method for the commercial development of SMS in ten years (http://www.meti.go.jp/committee/materials2/downloadfiles/g81031a05j.pdf). The possible site locations such as the Okinawa Trough and the Izu-Ogasawara Arc (Toyohara et al., 2011), however, are quite severe sea conditions like the riser design parameters generally used for oil and gas, for example the maximum wave height 20 m and current speed 4.5 kt (Stanton and Yu, 2010) compared with the gentle and mild ones in the East Manus Basin, such as the maximum wave height 6 m and current speed 3 kt (Stanton and Yu, 2010). A mining system with new concepts.