Challenges and approaches to flotation of seafloor massive sulfide ores

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ABSTRACT

The demand for base and precious metals (e.g., copper (Cu), lead (Pb), zinc (Zn), gold (Au), silver (Ag), etc.) is projected to be continuously increased in the future. To keep up with the demand, the development of new metal resources is an urgent issue for the future. Seafloor massive sulfide (SMS) deposits have gained increasing attention as one of the new metal resources. To develop SMS deposits, studies on mining technologies and environmental impacts for deep sea mining have been conducted by many researchers and in some projects (e.g., solwara 1 project in Papua New Guinea). However, few studies have investigated mineral processing, especially flotation of SMS ores.

SMS ores are referred to as modern analogues of volcanogenic massive sulfide (VMS) ores on land (e.g., Kuroko (black ore)). However, some SMS ores have distinct features different from terrestrial ores. SMS ores obtained from around Japan contain soluble minerals like anglesite, which release metal ions (e.g., Cu²⁺, Pb²⁺, Zn²⁺, Fe^{2+/3+}) during flotation. Also, dissolution of metal ions was observed in SMS ores obtained from Trans-Atlantic Geotraverse active mound on the Mid-Atlantic Ridge. These soluble minerals and metal ions would affect and complicate the flotation separation of Cu-Pb-Zn sulfide minerals in SMS ores. Because of these distinct characteristics of SMS ores, the conventional flotation processes for terrestrial ores would not be applicable to SMS ores. Therefore, flotation of SMS ores is more challenging and the development of appropriate flotation processes for SMS ores, the upcoming operation of SMS ores, features of SMS ores that would affect flotation separation were reviewed and the possible flotation processes for SMS ores were discussed.