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Understanding Cu release into environment from Kure massive sulfide ore deposits, Kastamonu, NW Turkey

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Covering a wide range on the earth's crust, oxidation of metal sulfide minerals have vital environmental impacts on the aquatic environment, causing one of the major environmental problems known as acid mine drainage (AMD).

Located in the Kastamonu province of the Western Black Sea region, Kure district is one of the major copper mining sites in Turkey. Mining activities in the area heads back to ancient times, such that operation is thought to be started with the Roman Empire. Currently, only the underground mining tunnels of Bakibaba and Asikoy are being operated. Thus, mining heaps and ores of those pyritic deposits have been exposed to the oxidative conditions for so long. As a result of weathering processes of past and recent heaps of the Kure volcanic massive sulfide deposits in addition to the main ore mineral (chalcopyrite), significant amount of metals, especially Cu, are being released into the environment creating undesirable environmental conditions.

In order to elucidate Cu release mechanisms from Kure pyritic ore deposits and mining wastes, field and laboratory approaches were used. Surface water and sediment samples from the streams around the mining and waste sites were collected. Groundwater samples from the active underground mining site were also collected. Physical parameters (pH, Eh, T°C, and EC) of water samples were determined in situ and in the laboratory using probes (WTW pH 3110, WTW Multi 9310 and CRISON CM 35). Metal and ion concentrations of the water samples were analysed using ICP-MS and DR 2800 spectrophotometer, respectively. High Cu, Co, Zn and Fe concentrations were determined in the water samples with pH values ranging from 2.9- 4. Cu concentrions ranges from 345 ppm to 36 ppm in the water samples. Consistent with the water samples, high Cu, Fe, Zn and Co were also determined in the sediment samples. Laboratory chalcopyrite oxidation experiments under the conditions representing the field site were set up as biological and abiotic in order to elucidate Cu release from ore and wastes. Greater Cu release were measured from the biological experiments carried out with S and Fe oxidizers compared to those from the chemical experiments. Fe-oxide precipitation experiments carried out in the laboratory showed high Cu absorbtion into Fe-oxides produced by biological reactions carried out with Fe oxidizers. Overall, these preliminary experimental results showed that Cu release and migration from the source can be controlled by various microorganims which regulate S and Fe cycles in the field.

Key words: Metal sulfide oxidation, Kure pyritic copper mines, AMD, Bioleaching, Secondary Fe-oxide precipitation