

## **Oxidation of pentlandite and pyrrhotite surfaces at pH 9.3: Part 2. Effect of xanthates and dissolved oxygen**

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### **ABSTRACT**

Using X-ray photoelectron spectroscopy, the oxidation/alteration of massive coexisting pentlandite (Pn) and pyrrhotite (Po) from Voisey's Bay has been studied in aqueous solution at pH 9.3, with the addition of the xanthate collector potassium amyl xanthate (KAX) at varying solution O<sub>2</sub> concentrations. As in the accompanying XPS study, the oxidation/alteration of the two mineral surfaces is monitored by the Fe 2*p*, Ni 2*p*, S 2*p*, and O 1*s* XPS spectra. The major surface product on all surfaces is FeOOH. However, the amount of FeOOH depends greatly on the presence of KAX, the presence of ground Pn/Po of high surface area, and the O<sub>2</sub> solution concentration. At air-saturated O<sub>2</sub> solution concentrations of 8–9 ppm, the amount of FeOOH on both surfaces decreases in the presence of KAX compared to the situation without KAX. In the presence of the Pn/Po powder, the oxidation of Pn decreases still more, suggesting that the powder scavenges O<sub>2</sub>, and that the oxidation of Pn is more sensitive to O<sub>2</sub> concentration than the oxidation of Po. When the O<sub>2</sub> concentration is decreased drastically to <0.01 ppm (by Ar purging) in the presence of KAX, both minerals are relatively free of FeOOH: indeed, both minerals show less FeOOH than the unreacted sample, which implies that the mineral surfaces are being "cleaned" under these conditions. The degree of oxidation of both surfaces increases with increase in the O<sub>2</sub> solution concentration; but at about 0.03 ppm O<sub>2</sub> the pyrrhotite surface is heavily oxidized, while the pentlandite surface remains largely unoxidized, and less oxidized than the initial unreacted sample. This result strongly indicates that the flotation separation of Pn and Po could be enhanced at low O<sub>2</sub> concentrations.