

## OPEN LIMESTONE CHANNELS FOR THE TREATMENT OF ACID MINE DRAINAGE<sup>1</sup>

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**Abstract:** One of the major concerns in mining is the production of acid mine drainage (AMD). This drainage can be treated by a variety of techniques either chemical or biological. Most of the chemical methods can be expensive, due to labor costs and the price of the chemical. The exception is limestone and a problem with limestone is that it has a tendency to coat or armor with iron oxides that slow the rate of carbonate dissolution. Armoring occurs when iron is oxidized and precipitates in the presence limestone. Limestone has also been used to treat AMD in anoxic limestone drains (ALDs). Problems occur when ferric iron, aluminum or dissolved oxygen are present, and the metal hydroxides form and precipitate ( $\text{Fe}(\text{OH})_3$  &  $\text{Al}(\text{OH})_3$ ) in the drain as the pH is increased. this causes the ALD to plug and forces the AMD to rise to the surface and by-pass the treatment system.

Our laboratory is studying the effects of armoring in the lab and field. The lab study consists of cubitainers filled with limestone and AMD with high concentrations of ferric iron and aluminum. The results show the formation of a ferric hydroxide and aluminum hydroxide flocculent that remained mobile until the limestone was allowed to dry. As the flocculent dried, the limestone became armored. The armored limestone was placed in another cubitainer with fresh AMD (4 sources) and the rate of calcium carbonate dissolution was measured. Armored limestone from field drains (2 sources) was also used in the study. The results observed include: 1) the coating (armoring) on the limestone dissolved in deionized water and acidic water and 2) the rate for armored limestone dissolution is 1/4 to 1/5 the rate of unarmored limestone. The field studies (12 studied) also support our idea that Open Limestone channels (OLCs) can be used as a primary AMD treatment system or as a pretreatment system where space is a limiting factor. Our research is continuing and we will be evaluating the large scale (100-1000gpm) applications of passive systems to treat AMD.

**Key Words:** Open limestone channels, armored limestone, passive treatment.

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