Effect of Iron Coatings on Limestone Surface Area and Dissolution Rates

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Effectiveness of passive limestone treatment systems to neutralize acid mine drainage (AMD) is dependent on the dissolution rate of the limestone. Limestone dissolution in AMD is retarded by the coating of metal oxides and hydroxides that form on the limestone surface. Our objective was to determine the effect of the amount and nature of these coatings on limestone dissolution rates. A pH-stat method was used to determine dissolution rates of coated and uncoated particles, and data were corrected for dissolution of the coating. Dissolution rates were calibrated to surface area using spherical limestone particles. Mass of iron coating material was determined by dissolution of the coated pieces using the dithionite-citrate-bicarbonate method. Preliminary evidence suggests that only a relatively thin coating of less than 1 μm is needed to reduce dissolution rates for iron coated limestone by 20% (relative to uncoated limestone).