

BLASTING RESEARCH TO ENHANCE PERMEABILITY FOR IN SITU MINING

by Stephen A. Rholl, Research physicist
Mark S. Stagg, Civil engineer
and Rolfe E. Otterness, Mechanical engineer
Twin Cities Research Center, Bureau of Mines, U.S.
Department of the Interior, Minneapolis, MN.

ABSTRACT

The Bureau of Mines is engaged in research to develop and test high explosive fracturing and rubbleization techniques that will enhance ore body permeability and thus increase recovery during in situ mining. The natural permeability of many ore bodies is too low to allow successful in-place leaching. These deposits could be profitably mined if flow rates of leach solutions could be increased. Blasting represents a potentially low-cost and effective permeability enhancement technique.

This paper describes the initial model test program conducted by the Bureau to evaluate the effectiveness of using high explosives to enhance ore body permeability. The research focused on determining the effect of stress on the fracture pattern generated by blasting in blocks of granite.

Fifteen single-hole shots using 4.8 to 8.0 in of 25-, 50-, or 100-grain detonating cord were fired in granite blocks up to 16-in cubes in size. To simulate in situ stresses, three different polyaxial load cells were used to apply biaxial stresses of 250 to 2550 psi. All of the blocks were sawed in half after blasting to assess the fracture patterns. High explosives generated a zone of numerous (e.g., 20) tight radial fractures that extended at least 30 explosive diameters. In situ stresses influenced the fracture density and the total overall length of the cracks.