

Mark Board

Principal Mining Engineer

<i>Expertise</i>	Rock Mechanics, Instrumentation, and Mining Engineering
<i>Education</i>	Ph.D. (Geological Engineering), 1994 M.S. (Geoengineering), 1977 B.S. (Geoengineering, with High Honors), 1975 University of Minnesota
<i>Honors</i>	1995 Rocha Medal, International Society for Rock Mechanics Bush Leadership Fellow, 1993 Student Research Award in Rock Mechanics, 1976
<i>Professional Experience</i>	
2007 - Present	<i>HCItasca Denver Inc., Colorado Principal Engineer</i>
2005 - 2007	<i>Itasca Consulting Group, Inc., Minneapolis, Minnesota Senior Engineer, Principal</i>
2001 - 2005	<i>Bechtel SAIC Company, LLC, Las Vegas, Nevada Subsurface Project Engineer/Manager of Seismic Studies</i>
1982 - 2001	<i>Itasca Consulting Group, Inc., Minneapolis, Minnesota Mining/Geological Engineer</i>
1981 – 1982	<i>Science Applications, Inc., Salt Lake City, Utah, Staff Engineer</i>
1978 - 1981	<i>TerraTek, Inc., Salt Lake City, Utah, Senior Engineer</i>
1977 - 1978	<i>Rockwell Hanford Operations, Richland, Washington, Mining Engineer</i>
1976	<i>University of Minnesota, Department of Civil and Mineral Engineering, Research Associate</i>
1974 - 1976	<i>Hecla Mining Company, Wallace, Idaho/Case Grande, Arizona Mining Engineer</i>

Project Experience

Rock Mechanics Applied to Underground Mine Design: Consulting, field and numerical modeling projects for diverse problems in underground mining, including rockburst prediction and prevention, pillar assessment and design, backfill behavior and specification, assessment of caving potential and fragmentation or orebodies, determination of ground-support methods, and investigation and design of roof stability problems (including water inrush). Design, methods selection and stope sequencing for a variety of mining methods, including large- and small-scale blasthole stoping, cut-and-fill, block and panel caving, longwall and room-and-pillar mining in the United States, Canada, South America, Australia, South Africa and Scandinavia. Extensive application of two- and three-dimensional continuum and discontinuum numerical methods to various mine design problems, including dynamic analysis of excavation and pillar stability and support, analysis of fault-slip rockbursting mechanisms, analysis of use of backfills in thin-reef and large-excavation applications.

Rock Mechanics Applied to Surface Mining: Consulting and numerical modeling assessments for design of open-pit mines. Activities included geotechnical field mapping and assessment, development of field rock properties for design, application and calibration of finite-difference and discontinuum numerical models in two and three dimensions to problems in slope-stability assessments and slope specifications, back-analysis of slope failures, and specification of remedial measures. Dynamic analysis of slopes under effects of blasting and earthquakes.

Field Research in Mining: Numerous rock mechanics studies, including field demonstration of undercut-and-fill mining with pillar destressing for rockburst control at the Star and Lucky Friday Mines; installation of microseismic monitoring systems, analysis of data and use in planning stope sequencing and destress blasting in the Coeur d'Alene mining district; investigation and field testing of high-pressure fluid injection on faults for initiation of seismicity; instrumentation and evaluation of shaft support and lining systems in the Silver Shaft, instrumentation of progressive caving and associated effects to surrounding shafts at a caving mine.

Numerical Model Development: Worked in development of boundary-element, explicit finite-difference and discontinuum programs including the FLAC, UDEC and 3DEC codes. Research in prediction of seismic potential of a rock mass using numerical simulation of stress redistribution due to mining and its impact on probabilistically defined natural rock fracturing. Developed finite-difference programs for prediction of air temperature and moisture pick-up for forced ventilation of longwall mining faces in deep gold mining that was subsequently used as a module in standard ventilation design package for South African mining industry.

Rock Engineering: Rock mechanics engineer in deep cut-and-fill and caving mines.

Nuclear Waste Disposal: While employed by BSC, acted as manager of the subsurface repository design study and manager of seismic studies for the Yucca Mountain Project. Work scope included design of all subsurface facilities, including the repository layout, preliminary construction planning, HVAC and mechanical systems. The seismic-studies work scope included development of seismic site-response models for the Yucca Mountain site and analysis of the effects of seismic ground motions on surface and underground facilities.

Numerical Analysis for Nuclear Waste Disposal: Performed mechanical and heat-transfer analyses of waste-disposal options and in-situ testing at the Basalt and Yucca Mountain programs for the Nuclear Regulatory Commission.

Field and Laboratory Research for Underground Nuclear Waste Disposal: Extensive field research for rock mass characterization associated with nuclear-waste disposal in hard rocks. Field testing included mechanical and ultrasonic cross-hole measurements, heat flux and fracture permeability at high temperatures. Performed thermal modifications of stress and displacement instrumentation and analysis of field results for Stripa, Sweden, in-situ experiments, installation and analysis of deformation of excavations for Climax Stock spent-fuel storage experiments, design and specification of in-situ heating experiments for the Basalt Waste Isolation Program. Laboratory testing of thermal, mechanical and hydrologic matrices and joint behavior of welded tuff, performed laboratory research into the effects of temperature and confining pressure on thermal expansion coefficient of granite for the Stripa project.