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COLORADO
DEPARTMENT OF NATURAL RESOURCES

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Colorado Geological Survey study tying geology to poor water quality wins national award

Is high, pristine mountain water always clean and pure? Can streams unaffected by human activities and livestock influences be unfit for human consumption, or fish? A study by the Colorado Geological Survey (CGS) has some surprising answers. The study examines areas in Colorado that have naturally poor, surface-water quality due to the area's geology.

The pioneering report, titled "Natural Acid Rock Drainage Associated with Hydrothermally Altered Terrane in Colorado," was recently recognized by the Geological Society of America (John C. Frye Memorial Award) as the best environmental publication of 2011. The report identifies a number of streams in Colorado where surface water is acidic and has high concentrations of metals upstream of historic mining.

Hot water circulating in the earth's crust can "hydrothermally alter" rock composition by dissolving some minerals and depositing others. In affected areas, the hydrothermal-alteration process deposited metal-sulfide minerals, commonly pyrite (fool's gold), in the rocks.

When these rocks interact with oxygen, the iron sulfide "rusts" to form iron oxide minerals, creating striking yellow, orange, and red colors – similar to the oxidation of metal in an old rusty car. "Acid rock drainage" occurs when the sulfur combines with water to form weak sulfuric acid. The acid then dissolves minerals in rock, often adding significant amounts of dissolved metals to streams. Natural acid rock drainage has been active in Colorado for thousands, possibly millions of years.

Many of the areas exhibiting intense hydrothermal alteration also contain historic mine sites. Frequently, acid rock drainage from natural sources and mine sites combine to cause severe downstream water quality problems. In these situations it is important to distinguish the natural, or background, water quality so that realistic clean-up goals for water quality can be set.

"Due to Colorado's many naturally mineralized areas, it is challenging to separate mining impacts on water quality from natural sources. This well-written study has been invaluable in determining man-made mining impacts on water quality and the selection of reclamation projects at historic mines," said Bruce Stover, the director of the Colorado Office of Active and Inactive Mines.

“This useful publication provides an understanding of how natural acid rock drainage affects water quality in and downstream of Colorado’s mineralized regions and is an invaluable resource to the Division,” said Andrew Ross, Senior Hydrogeologist with the Colorado Water Quality Control Division.

Funding for this study came from the Colorado Geological Survey portion of the Department of Natural Resources Severance Tax Operational Account. Colorado severance taxes are derived from the production of gas, oil, coal, and metallic minerals.

To order the “Natural Acid Rock Drainage: Associated with Hydrothermally Altered Terrane in Colorado”, please call 303-866-2611 Option 0, or visit our online book store at http://geosurveystore.state.co.us and search for NARD. Price is $30.00 plus shipping.

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