CONTINUOUS MONITORING OF A UNIQUE HYDROLOGIC SYSTEM SYLVAN PASS, YELLOWSTONE NATIONAL PARK

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ABSTRACT

Sylvan Pass (~8500 feet elevation) is situated along the East Entrance Road approximately 7 miles inside Yellowstone National Park at the topographic divide separating the Yellowstone Lake basin to the northwest from the Middle Creek drainage to the southeast. The pass is a narrow, U-shaped, glacially-carved valley (Sylvan Gulch) in 50 million year old Absaroka volcanic rocks. Cliffs form the highest portions of the sides of the pass and angular rock fall debris has coalesced to form spatially extensive talus aprons filling Sylvan Gulch. Several hundred feet of talus has accumulated in the valley since the last glacial retreat began approximately 15,000 years before present. Several conditions combine to make Sylvan Gulch hydrologically quite unique including 1) its occurrence high in a watershed straddling a divide underlain by thick talus with a discontinuous permafrost 2) quarrying of the talus from the top of the pass and its use as a major material source in gravel mining and processing operations over the last several years to support the Yellowstone roads construction program 3) despite the area's moderately high precipitation, a general lack of surface water drainage through the gulch and 4) ground water discharges to a major spring/pond that intermittently display anomalously high turbidities (200 or more NTU).

Beginning in 2006, continuous monitoring of water quality (temperature, specific conductance, and turbidity) and stream gage levels has been conducted at 5 sites in the Sylvan Pass area to better understand the hydrologic system. This monitoring was precipitated when in August 2004, a plume of milky white turbidity of unknown origin extended out of Yellowstone National Park several miles to the Shoshone River and beyond by way of Middle Creek. The surface water plume was traced upstream by park staff to Mammoth Crystal Springs (MCS), located in Sylvan Gulch on the southeast side of Sylvan Pass. MCS is a small, shallow pond (< 1 acre) fed by ground water discharging at/near the contact between talus and the volcanic bedrock surface.

Dye trace tests in the talus and sediment coring and analysis of the spring pond sediment proved critical in understanding ground and surface water interactions, the ground water flow path, site depositional history and in attributing the probable cause to an anthropogenic source. High runoff events continue to remobilize anthropogenic fines lodged in the talus and impair the "crystal spring".

KEYWORDS
Continuous monitoring, turbidity, talus, permafrost, ground and surface water interactions, gravel mining and crushing, anthropogenic fines