Geochemistry & Ecology of Red Mat Systems (GERMS)
Summer Research Program

Red Layer Microbial Observatory (RLMO)
National Science Foundation
Western Oregon University
Yellowstone National Park

Team Role/Activity - Water Collection and Chemistry

Remember - Site Manager Will Be Photographing Steps, Checking Data

Water Collection and Parameters

Student team will assist instructor in removing 1 L from target site*****
Measure temperature where collected – remember to wipe probe with alcohol before use
Measure pH where collected - dip into water (possibly using pole), read immediately

****When finished, carefully pack the water collection device back in the sterile bag as you will reuse it to fill the bottle back up after completing the chemistry testing below.***

Chemistry Supplies and Set-Up

Prepare chemistry testing kits (see next table); carry 3-4 of each test/site so we have spares
AccuVac (AV) systems should be carried and sub-divided into extra styrofoam AV containers
Chemical Mix (CM) systems should be properly packed as some compounds are toxic or corrosive
Carry/use plastic container for Hazardous Waste - NITRATE and SULFATE must be saved as such
Non-nitrate liquid can be dumped on site (in bushes away from feature)
Non-nitrate solid is stored in non-hazardous waste designated bottle – dispose at hotel nightly

****When finished, refill 1 L bottle and label; this will be taken back to the hotel and acidified/preserved for future experiments.***

Field Chemical Tests

AccuVac - Your Best Friend

Test Protocol With Water Collected On-Site	Special Notes
Bromine - SAME AS CHLORINE, BUT PROGRAM 6 Fill sample cell with 10 ml sample (BLANK) and ZERO Fill DPD Total Chlorine AccuVac with sample (SAMPLE) - invert Press TIMER ENTER (3 minutes) - READ Sample; Pink = (+)	Analyze after collection; chlorine/derivatives and manganese interfere; detection limit: 0.03 mg/L.
Total Chlorine - PROGRAM 11 Fill sample cell with 10 ml sample (BLANK) and ZERO Fill DPD Total Chlorine AccuVac with sample (SAMPLE) - invert Press TIMER ENTER (3 minutes) - READ Sample; Pink = (+)	Analyze after collection; bromine/derivatives and manganese interfere - all levels; detection limit: 0.02 mg/L.
Chromium - PROGRAM 14 Fill Chromaver3 with sample (SAMPLE) - invert Press TIMER ENTER (5 minutes) - wait Fill sample cell with 10 ml sample (BLANK) and ZERO READ SAMPLE; Purple = (+)	Analyze after collection; Mercury and iron (over 1 mg/L) interferes; detection limit: 0.01 mg/L.
Copper - PROGRAM 20 Fill sample cell with 10 ml AD-sample (BLANK) and ZERO Fill CuVer2 AccuVac with sample (SAMPLE) - invert Press TIMER ENTER (2 minutes) - READ Sample Purple = (+)	Ideally, analyze after acidification; ferric iron may interfere; detection limit: 0.02 mg/L.
Molybdenum - PROGRAM 44	Analyze IMMEDIATELY after

Fill sample cell with 10 ml sample (BLANK) Add 4 drops 0.4 CDTA to 40 ml pre-AccuVac beaker sample Fill MolyVer 6 AccuVac with sample - invert Press TIMER ENTER (5 minutes) ZERO BLANK and READ SAMPLE; Yellow = (+)	collection; Some metals at high levels (50+ mg/L) can interfere; detection limit: 0.2 mg/L.
Nitrate - PROGRAM 50 Fill NitraVer AccuVac with sample (SAMPLE) - invert Press TIMER ENTER (1 minute) - MIX SAMPLE ACCUVAC At first timer beep, press ENTER (5 minutes) and wait, no mixing Fill sample cell with 10 ml sample (BLANK) and ZERO READ SAMPLE; Amber = (+)	Analyze IMMEDIATELY after collection; All ferric iron, nitrite, and chloride interfere; detection limit: 0.5 mg/L. ***Product contains cadmium, SAVE as hazardous waste.***
Nitrite - PROGRAM 62****** Fill NitriVer AccuVac with sample (SAMPLE) - invert Press TIMER ENTER (15 minutes) Fill sample cell with 10 ml sample (BLANK) and ZERO READ SAMPLE; Pink = (+) ***ONLY perform on upper Hillside, both Fairy (mat and rod)**	Analyze IMMEDIATELY after collection; watch for precipitates as this may interfere; detection limit: 0.005 mg/L.
Sulfate - PROGRAM 92 Fill sample cell with 10 ml (BLANK) Fill Sulfate AccuVac with sample (SAMPLE) - shake 30 seconds Press TIMER ENTER (5 minutes) ZERO BLANK and READ SAMPLE; Turbidity = (+)	Analyze IMMEDIATELY after collection; no major interferences; detection limit: 3 mg/L.
Total Iron - PROGRAM 33 Fill sample cell with 10 ml AD-sample (BLANK) Fill TPTZ AccuVac with sample (SAMPLE) - invert Press TIMER ENTER (3 minutes) ZERO BLANK and READ SAMPLE; Blue = (+)	Ideally, analyze after acidification; copper, molybdenum, nitrite interfere; detection limit: 0.04 mg/L.

Non-AccuVac - Your Good Acquaintance

Test Protocol With Water Collected On-Site	Special Notes
Sulfide - PROGRAM 93 Fill sample cell with 25 ml (SAMPLE) Fill second cell with 25 ml deionized water (BLANK) Add 1 ml Sulfide 1 Reagent to each - swirl Add 1 ml Sulfide 2 Reagent to each - swirl Press TIMER ENTER (5 minutes) and ZERO BLANK READ SAMPLE; Pink = (+)	Analyze IMMEDIATELY after collection; turbid samples interfere; detection limit: 0.01 mg/L. ***Product contains chromium, SAVE as hazardous waste.***
Manganese - PROGRAM 41 Fill sample cell with 10 ml sample (BLANK) ZERO BLANK and remove BLANK cell Add 1 Buffer Powder Pillow Citrate Type, invert to dissolve Then add 1 Sodium Periodate Powder Pillow and… Invert 10 sec and Press TIMER ENTER (2 minutes) READ SAMPLE; Violet = (+)	Ideally, analyze after acidification; no major interference; detection limit: 0.12 mg/L.

Supply Ordering and Price Information

Item	Catalog Number	Amount/Price
Bromine Test	Hach/25030-25	25/$15
Chlorine	Hach/25030-25	25/$15
Chromium	Hach/25050-25	25/$19
Molybdenum	Hach/25220-98	25/$22
Nitrate	Hach/251110-25	25/$16
Nitrite	Hach/25120-25	25/$16
Sulfate	Hach/25090-25	25/$16
Sulfide	Hach22445-00	100/$40
Dedicated 50ml beakers	Fisher/02540G	12/$20

Water Chemistry Equipment

DR890 colorimeter
Sample cells
Dedicated 50ml beakers