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Column experiments on U(VI) transport in smear zone composite:

Transient chemistry & transient flow results

Roy Haggerty & Jun Yin

with acknowledgments to Doug Kent, Deborah Stoliker, Chongxuan Liu, Mark Rockhold, Janek Greskowiak, John Zachara, Jack Istok

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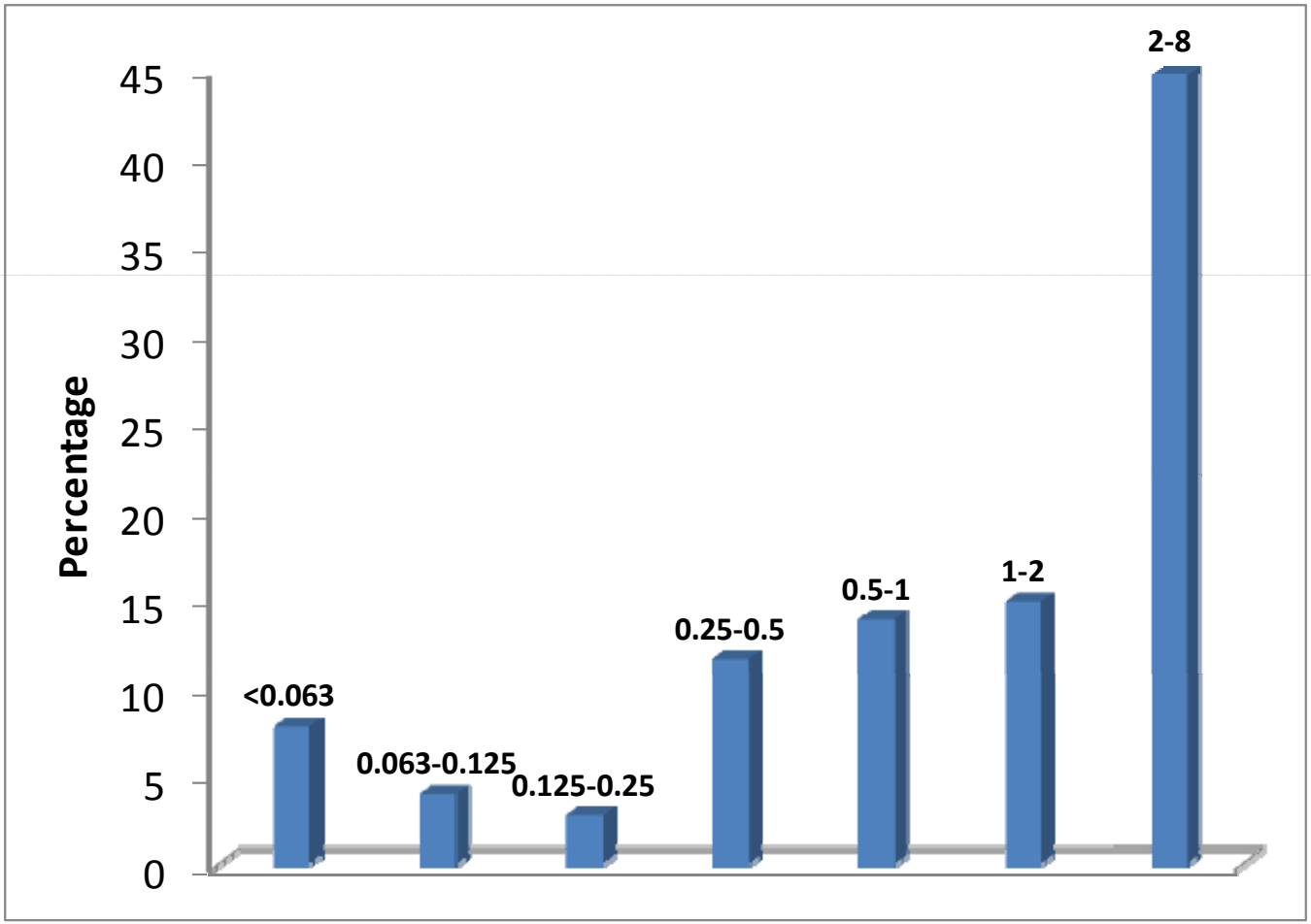
Pacific Northwest NATIONAL LABORATORY

OSU Oregon State UNIVERSITY

Outline

- Smear zone composite sediment
- Saturated column: Transient water chemistry results
- Unsaturated column: Transient water table results
- Next steps

Smear zone composite particle size distribution



Smear zone composite mineralogy and chemical characterization

- All samples are quite similar containing primarily quartz (>25%), plagioclase (5-25%), and pyroxene(<5%).

- Total U: $1.2 \pm 0.1 \times 10^{-8}$ mol/g
- Adsorbed U: 4.39×10^{-9} mol/g
- Specific surface area: 14.1 ± 1.6 m^2/g
- Fitted surface complexation reaction:

$$>SOH + UO_2^{2+} + 2H_2CO_3 = >SOUO_2(CO_3HCO_3)^{2-} + 4H^+$$

$$\log K = -11.73$$

Transient chemistry smear zone experiments

Size: 50 cm X 5 cm

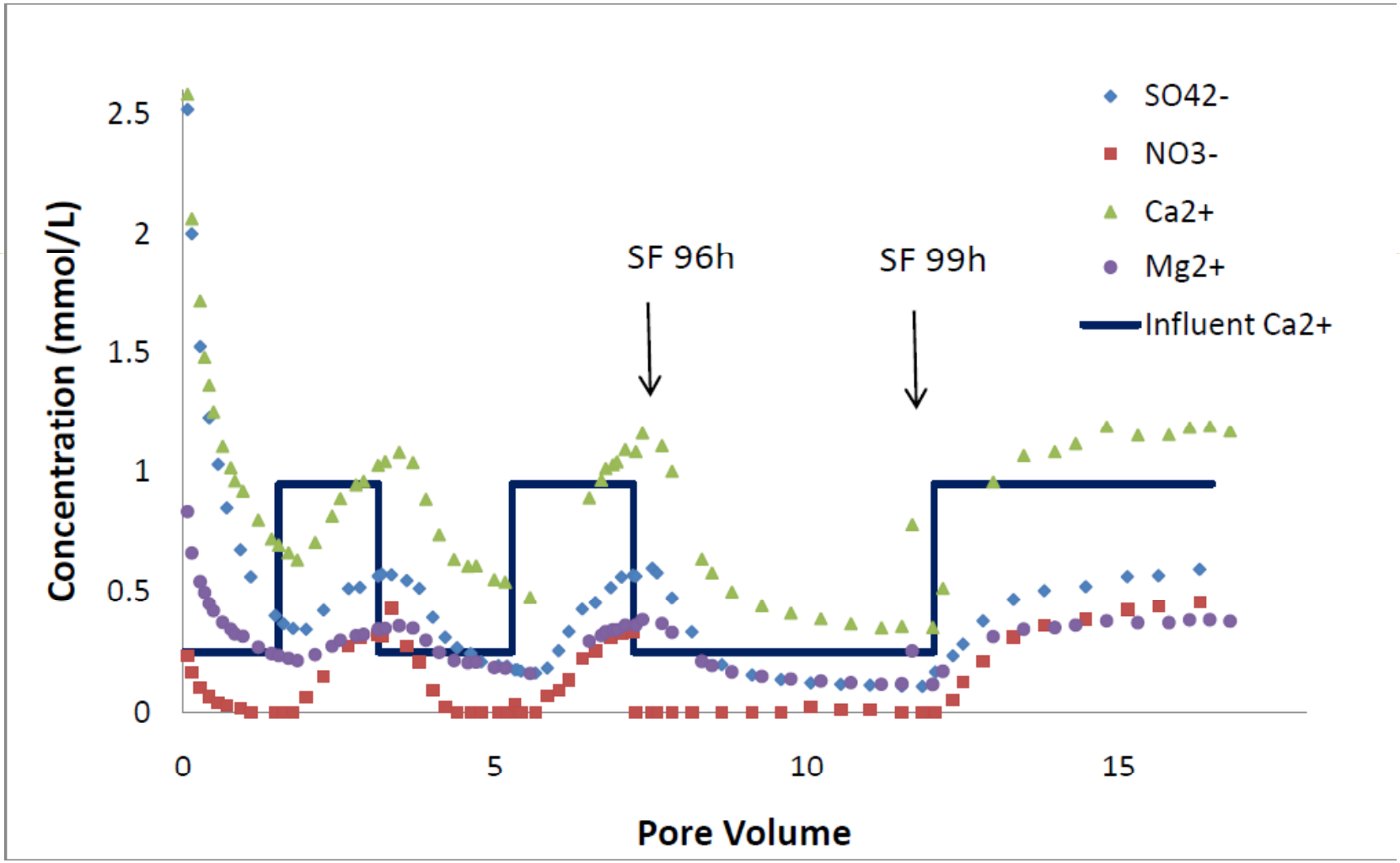
Porosity: 0.377

Pumping rate: 1mL/min

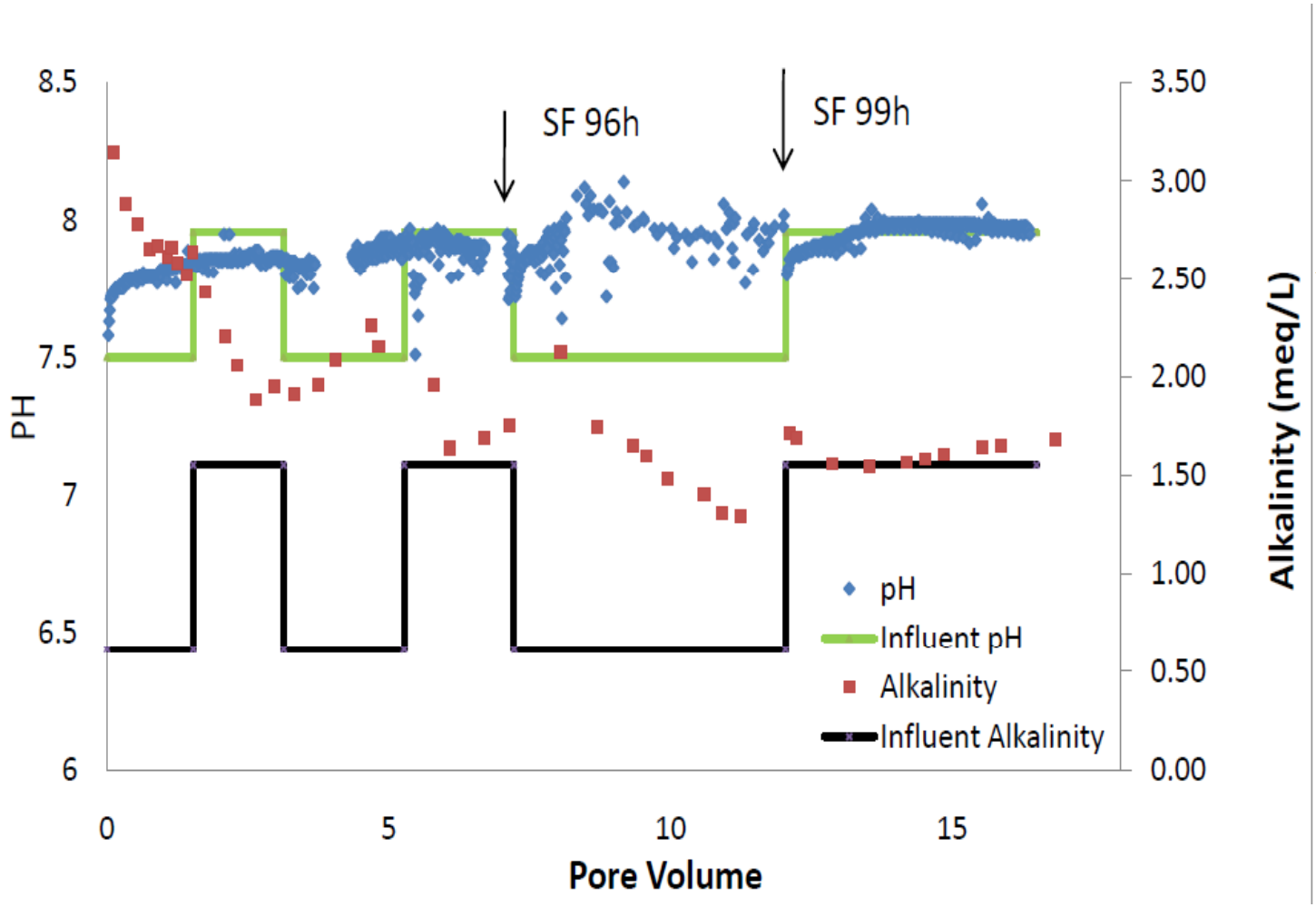
- Experiment 1
  Flush the sediment using synthetic ground water (SGW)

- Experiment 2
  Flush the sediment alternately using SGW and synthetic Columbia River water (SCRW)

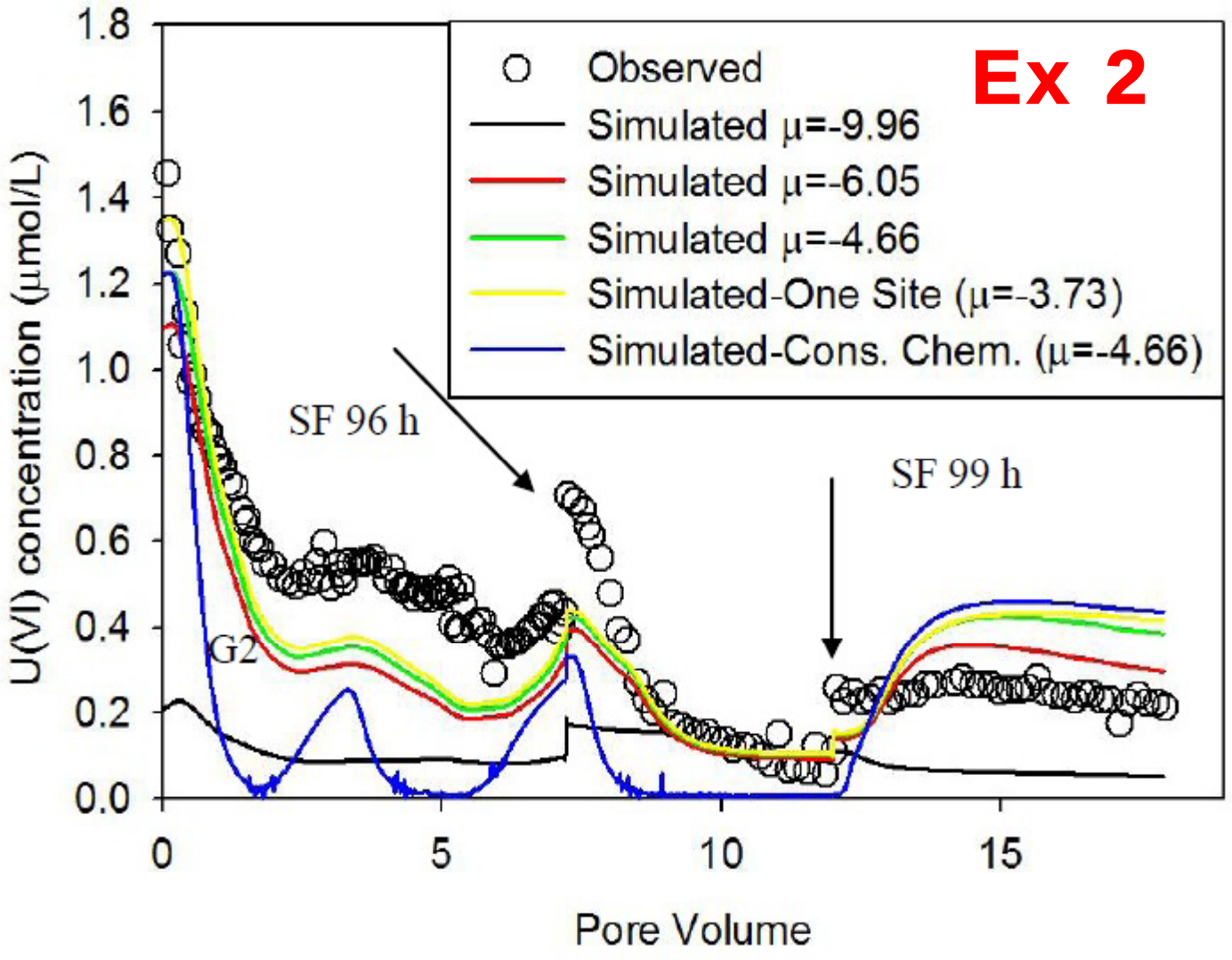
Results for Ex2: Major ions

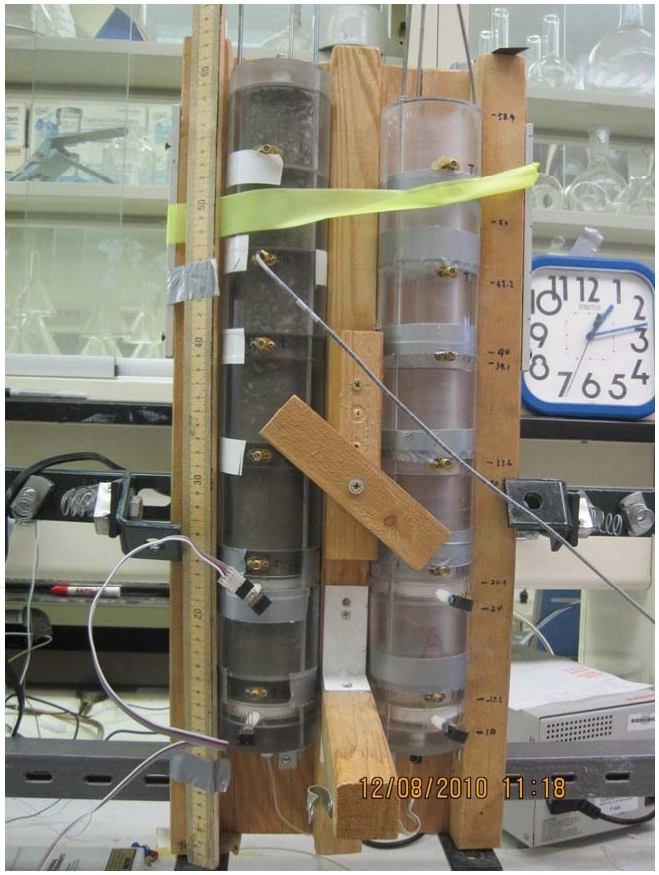


Results for Ex2: pH and Alkalinity



Modeling Results: U(VI)





Transient flow smear zone experiments

Size: 46.8 cm X 4.28 cm

Grain size: < 8 mm

Porosity: 30%

Flushing rate: 1mL/min

Drainage: gravity

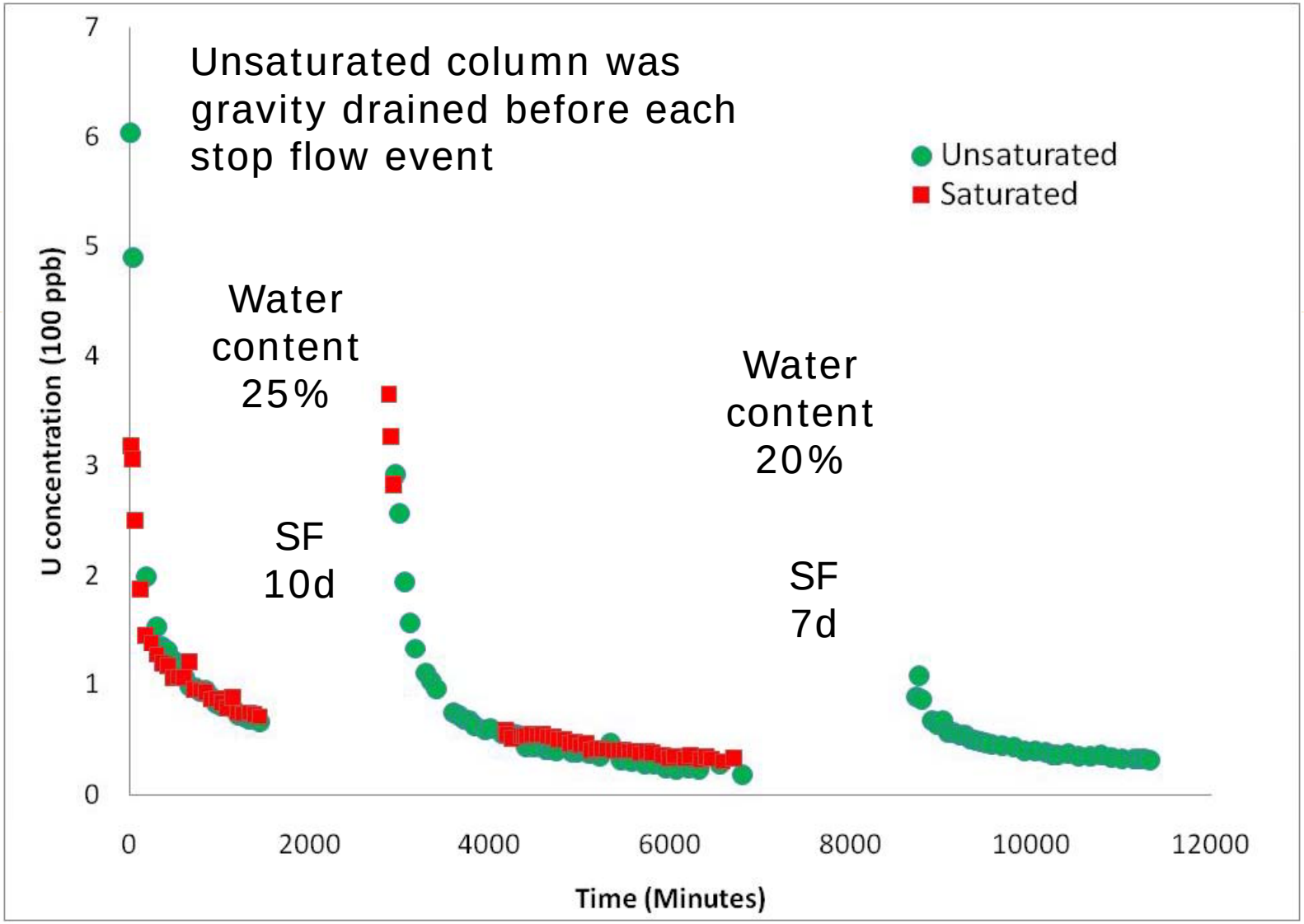
Water content: measured by TDR & tensiometer

Chemistry: major cations, anions, alkalinity, Br tracer, U, DO, pH, EC

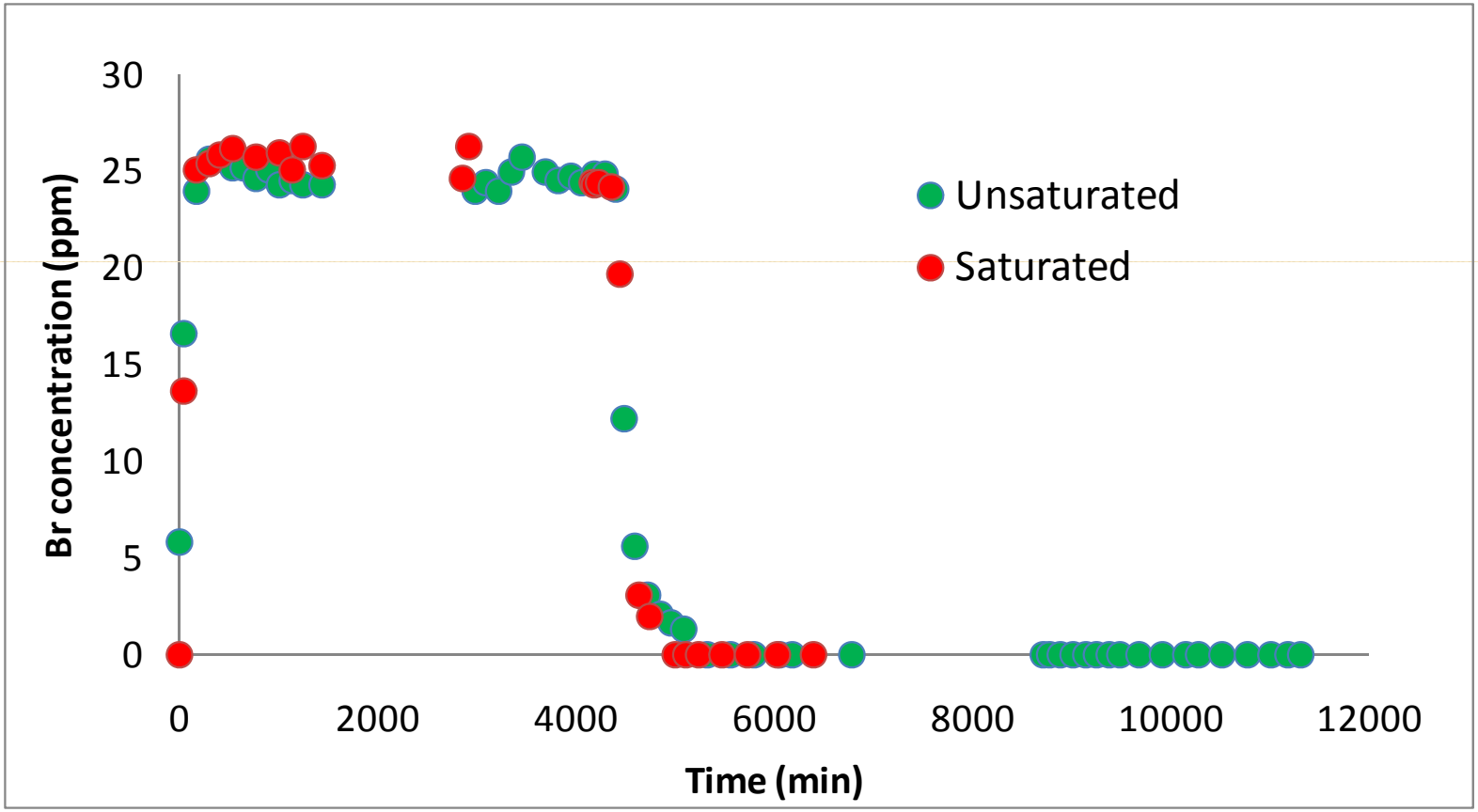
- Experiment 1
  Flush with SGW
  with two saturated stop flow events

- Experiment 2
  Flush with SGW
  with two unsaturated stop flow events

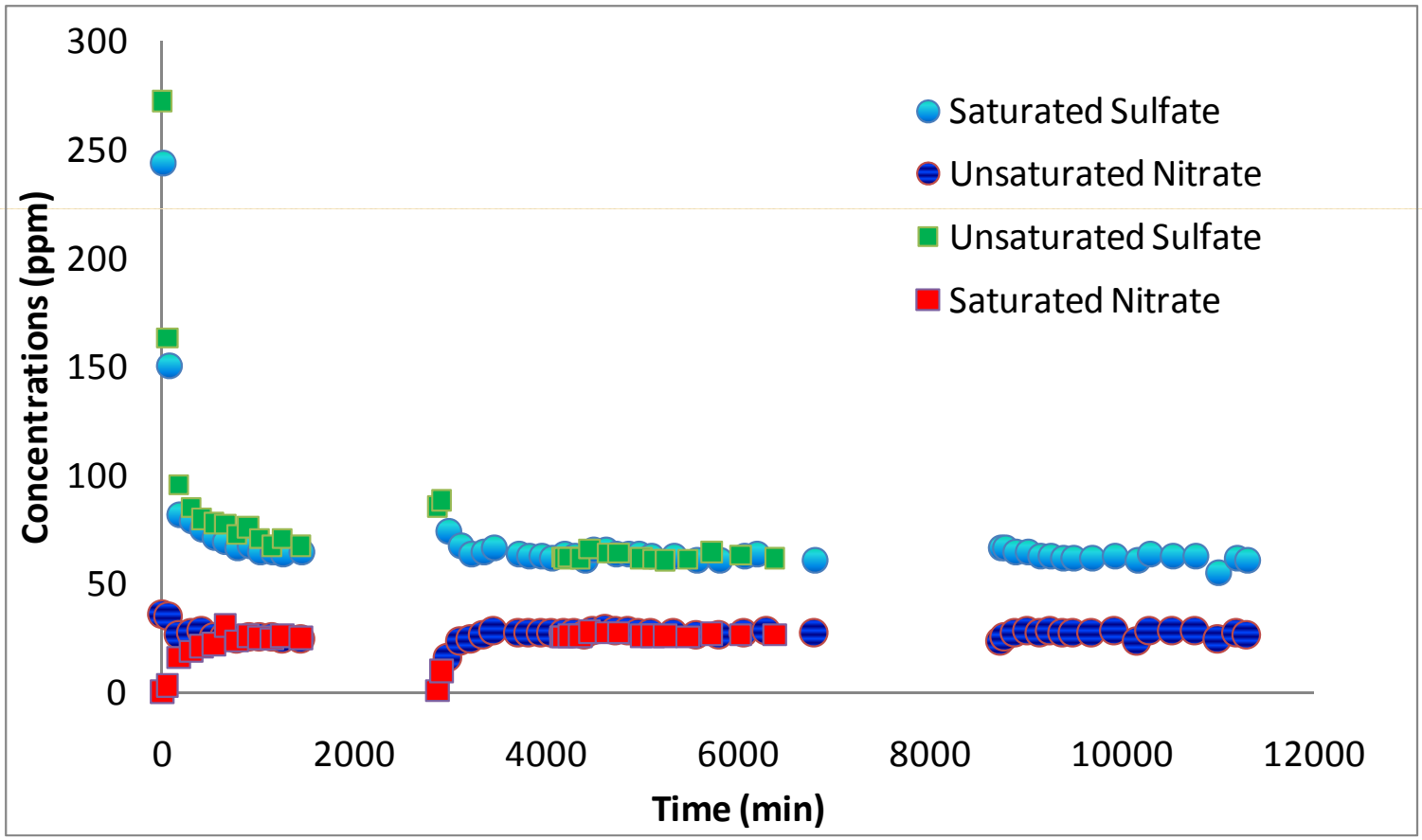
Experiment Results: U(VI)



Experiment Results: Br



Major ions


300
250
200
150
100
50
0
Concentrations (ppm)
0
2000
4000
6000
8000
10000
12000
Time (min)
Saturated Sulfate
Unsaturated Nitrate
Unsaturated Sulfate
Saturated Nitrate

Experiment plans in 2011

- Complete the unsaturated column experiments and modeling (publication 1)
- Two more saturated experiments using < 8 mm (<2 mm?) sediments. One with synthetic Hanford groundwater and one with synthetic Columbia river water. The sensitivity analysis of the developed model will be conducted based on the the measured data (publication 2).