Geochemistry and Water Quality of the Britannia Mine Workings

by Kelly Sexsmith and Stephen Day

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Background

- Geology/Mineralogy
- Low pH's and High Copper Concentrations Early in Mine Life
- Copper Recovery Mine Water Starting in 1928.
- Historic Discharges to Britannia Creek and Howe Sound

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Britannia Remediation Project

- Water Treatment Plant
- Water Quality
  - Flow-through conditions
  - Seasonal flooding and draindown
- Study Objective
  - Predict chemical effects of storage behind the plug

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Approach

- Review of Historical Water Quality Data
  - Historical trends
  - Relationship between flow and chemistry
  - 1980's Plug Test Data
  - Equilibrium Modelling
- Plug Test

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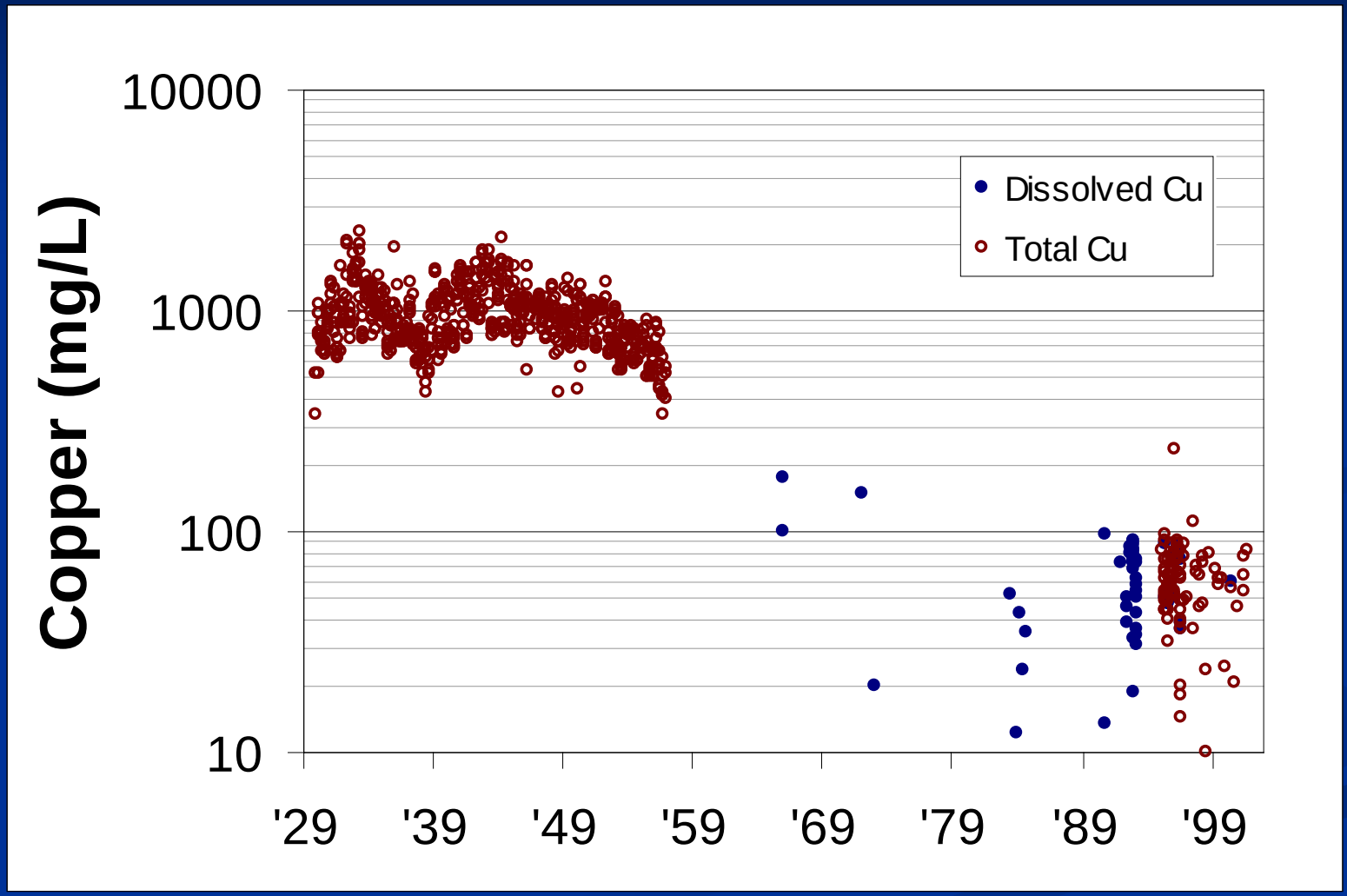
Historical Data – 2200 Level



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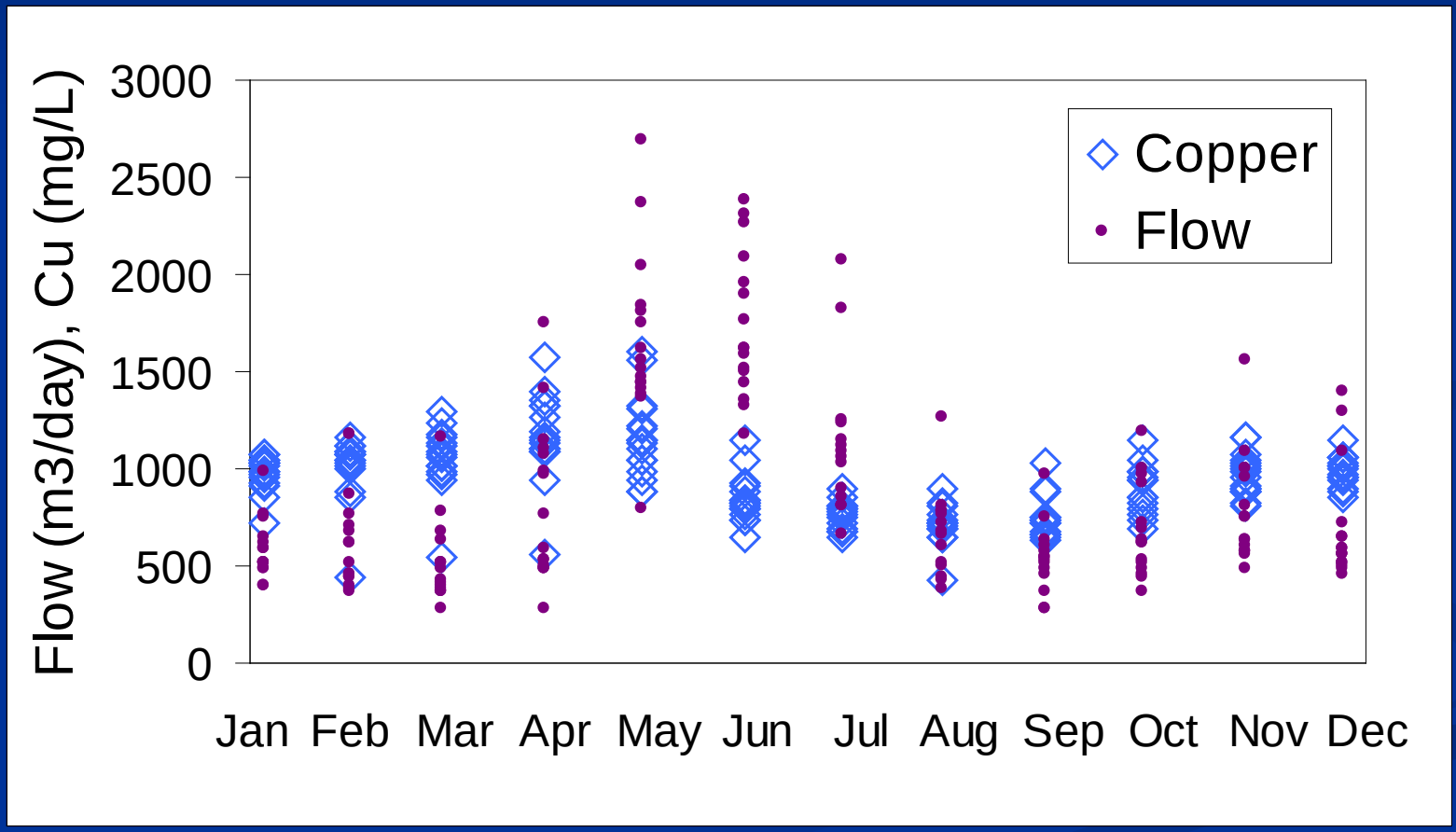
1990 to 2001 Data – 2200 Level

	Average	Std. Dev.
pH	3.1	0.3
SO4	1088	354
Al	42	11
Cd	0.19	0.05
Cu	59	20
Fe	31	12
Zn	29	7.3

Seasonal Flows and Copper Concentrations (1945 to 1952)



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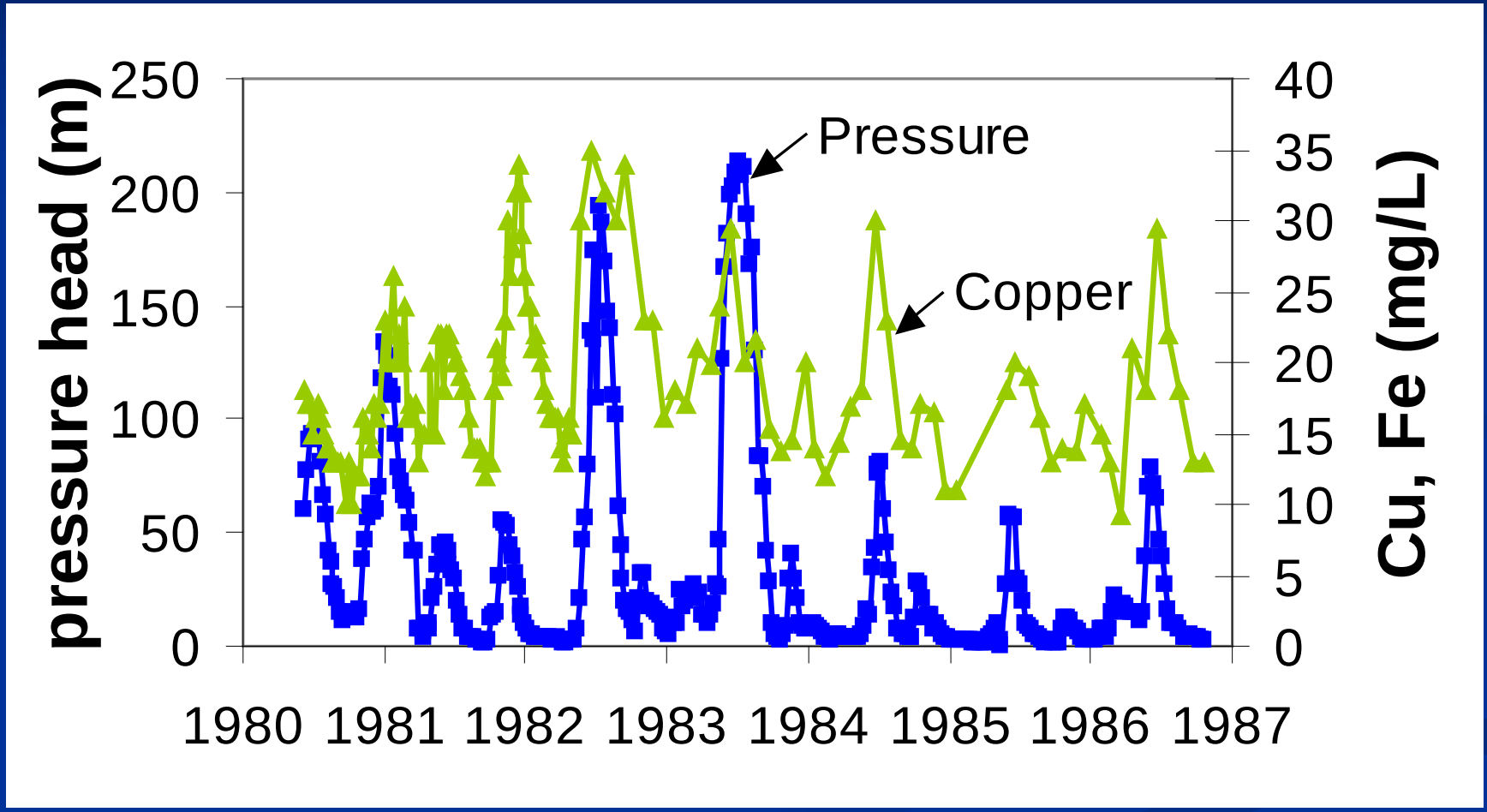
4100 Plug – Early 80's data



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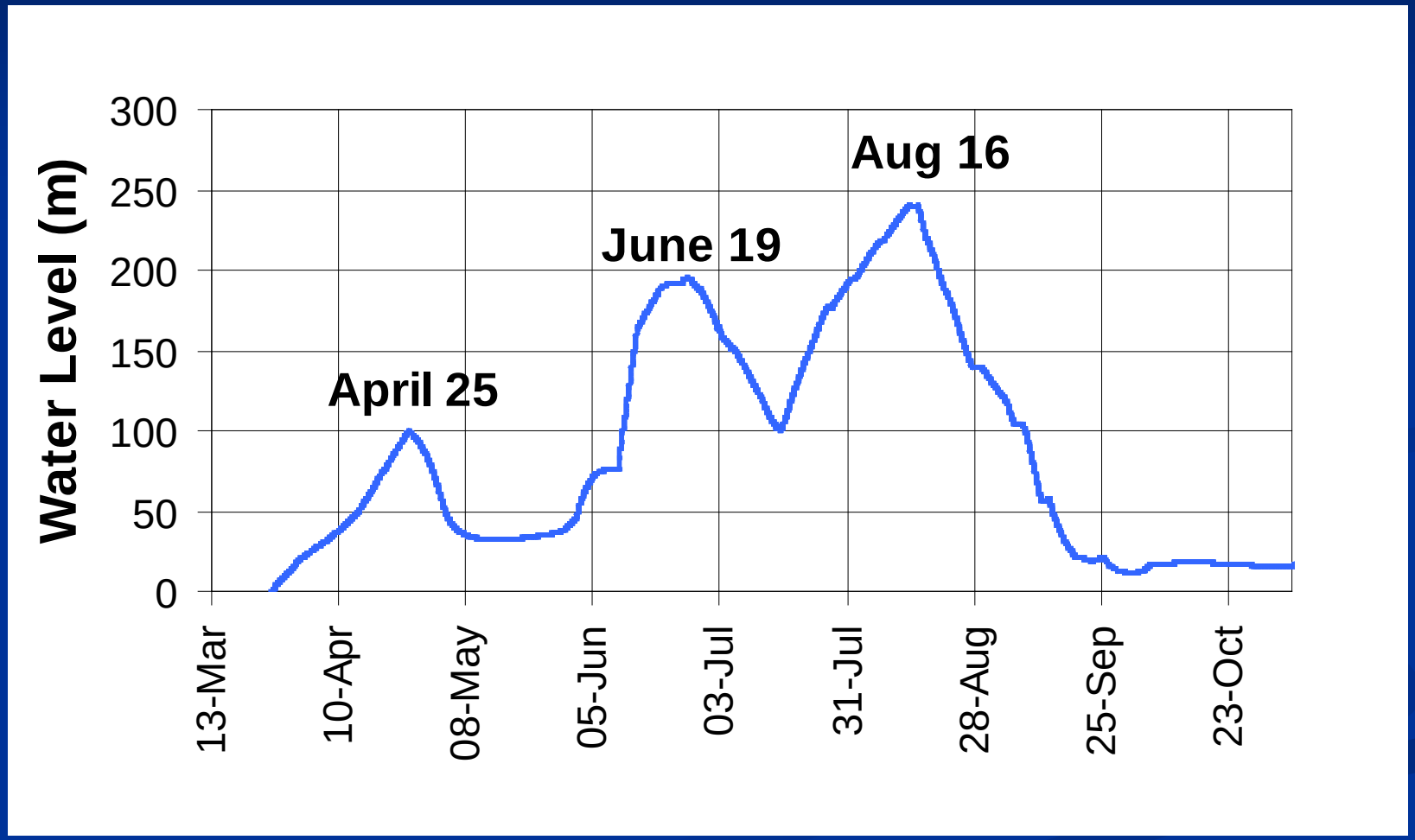
1990 to 2001 Data - 4100

	Average	Std. Dev.
pH	3.8	0.6
SO4	1528	199
Al	26	5.9
Cd	0.089	0.022
Cu	18	3.9
Fe	4.5	2.1
Zn	21	3

Plug Tests



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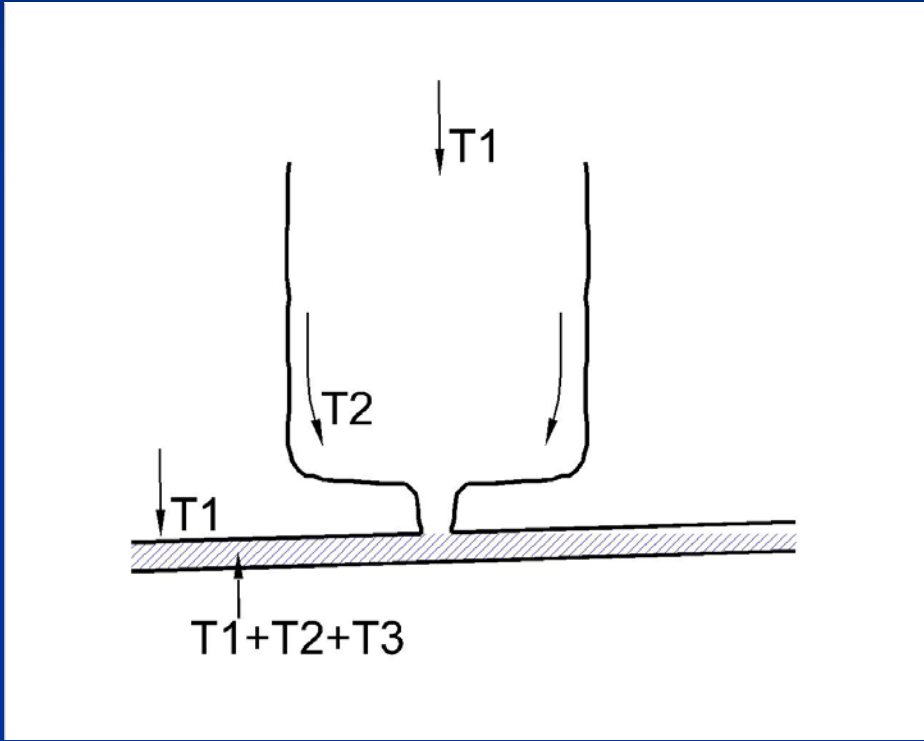
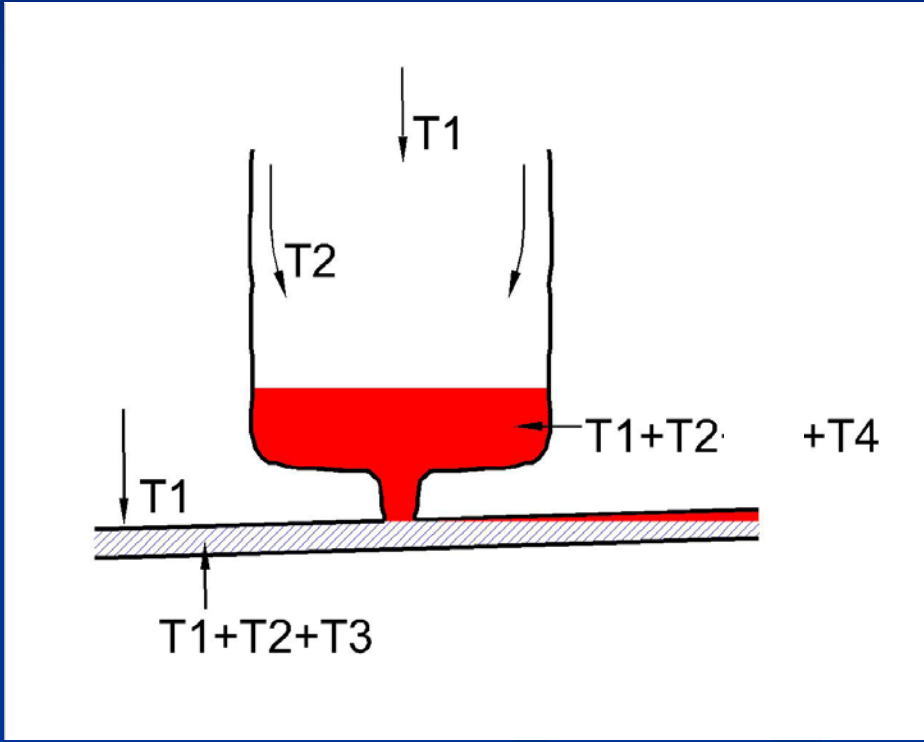
Conceptual Model (Filling)





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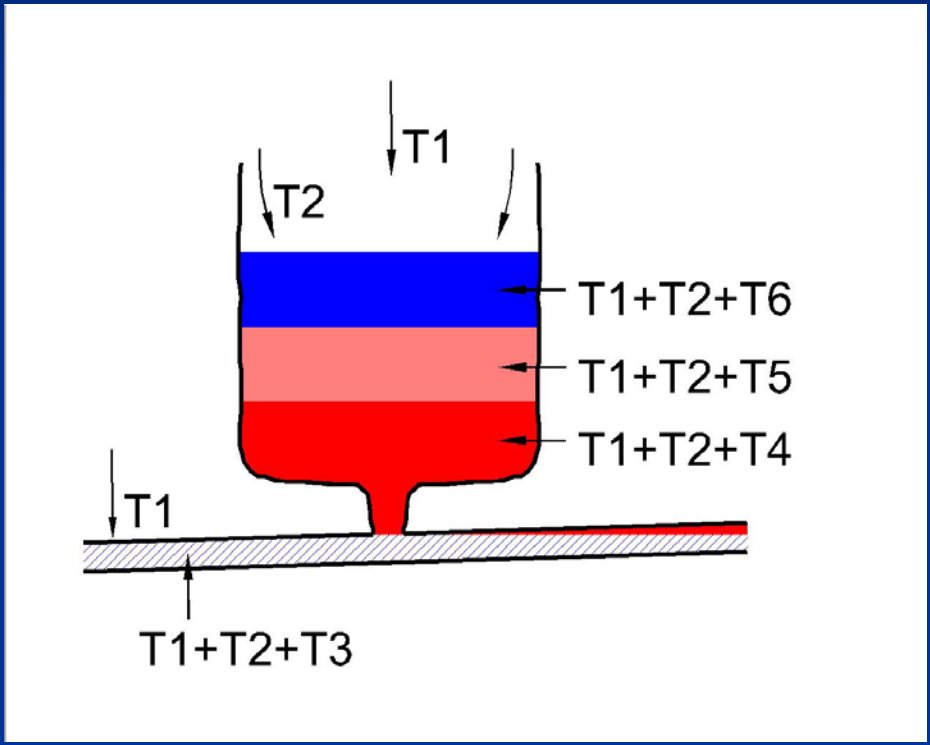
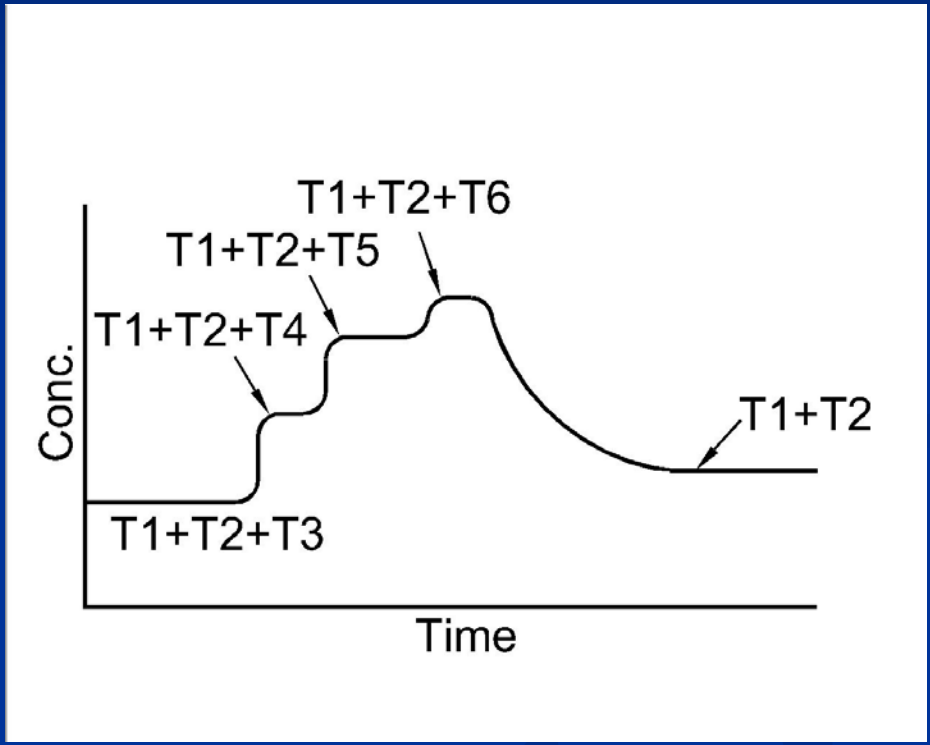
Conceptual Model (Draindown)





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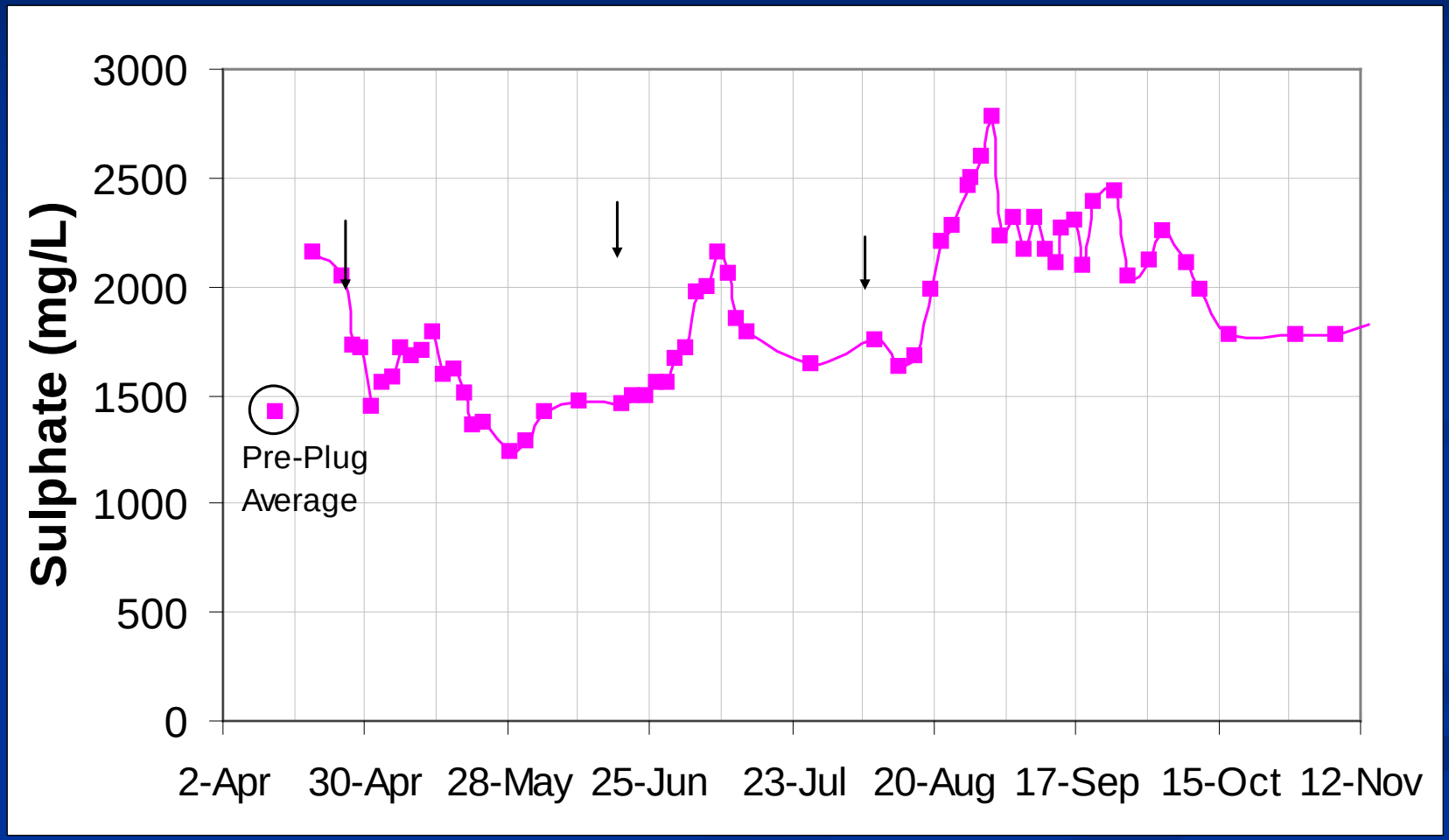
Initial Estimates of Sulphate Concentrations

- Two Approaches
  - Establish Equilbrium Controls
  - Extrapolate from Cumulative Increase in Load Measured During the Initial Test
- Results
  - Equilibrium: 2600 mg/L
  - Extrapolation: 1800-2200 mg/L

Sulphate



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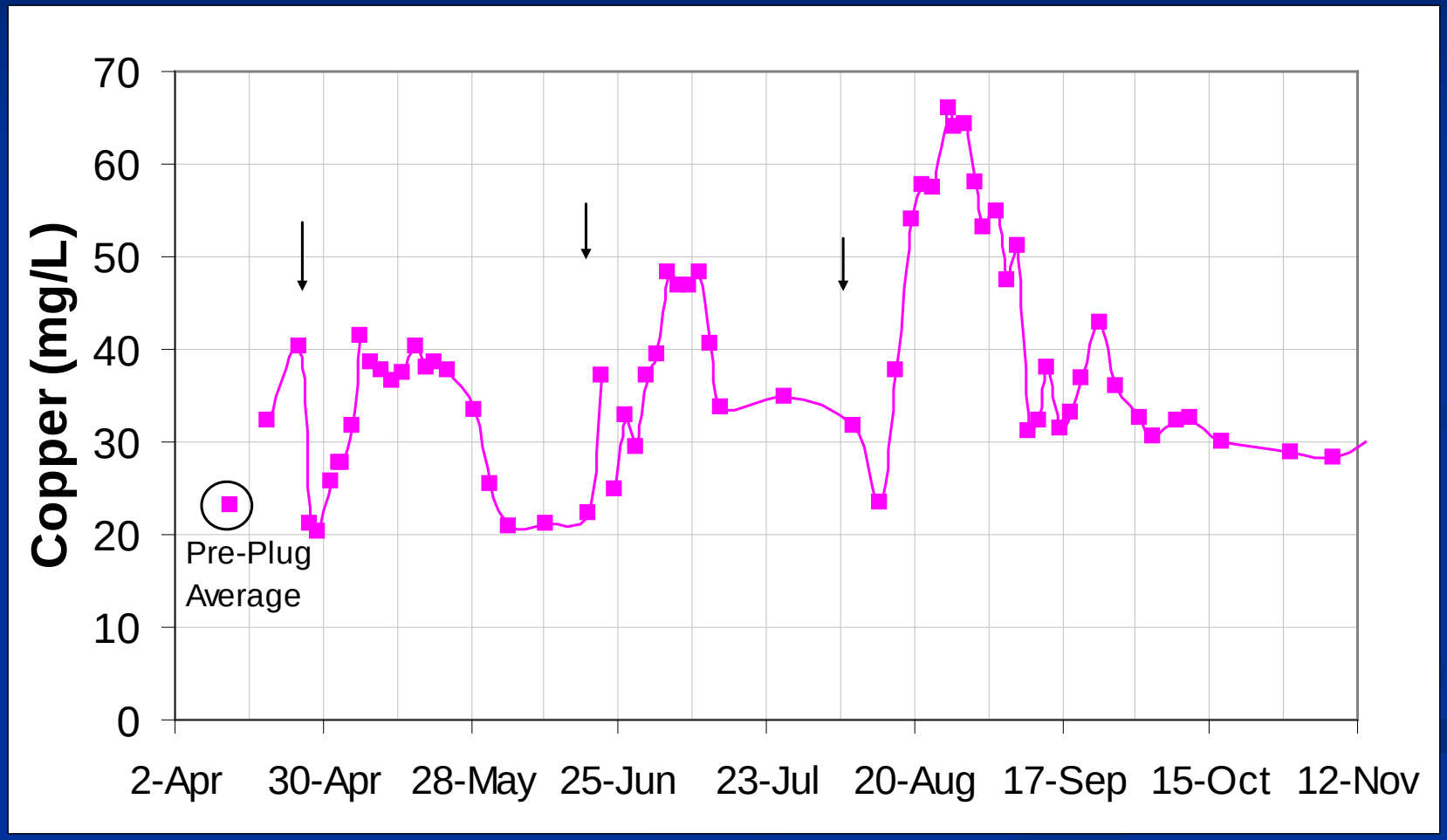
Copper



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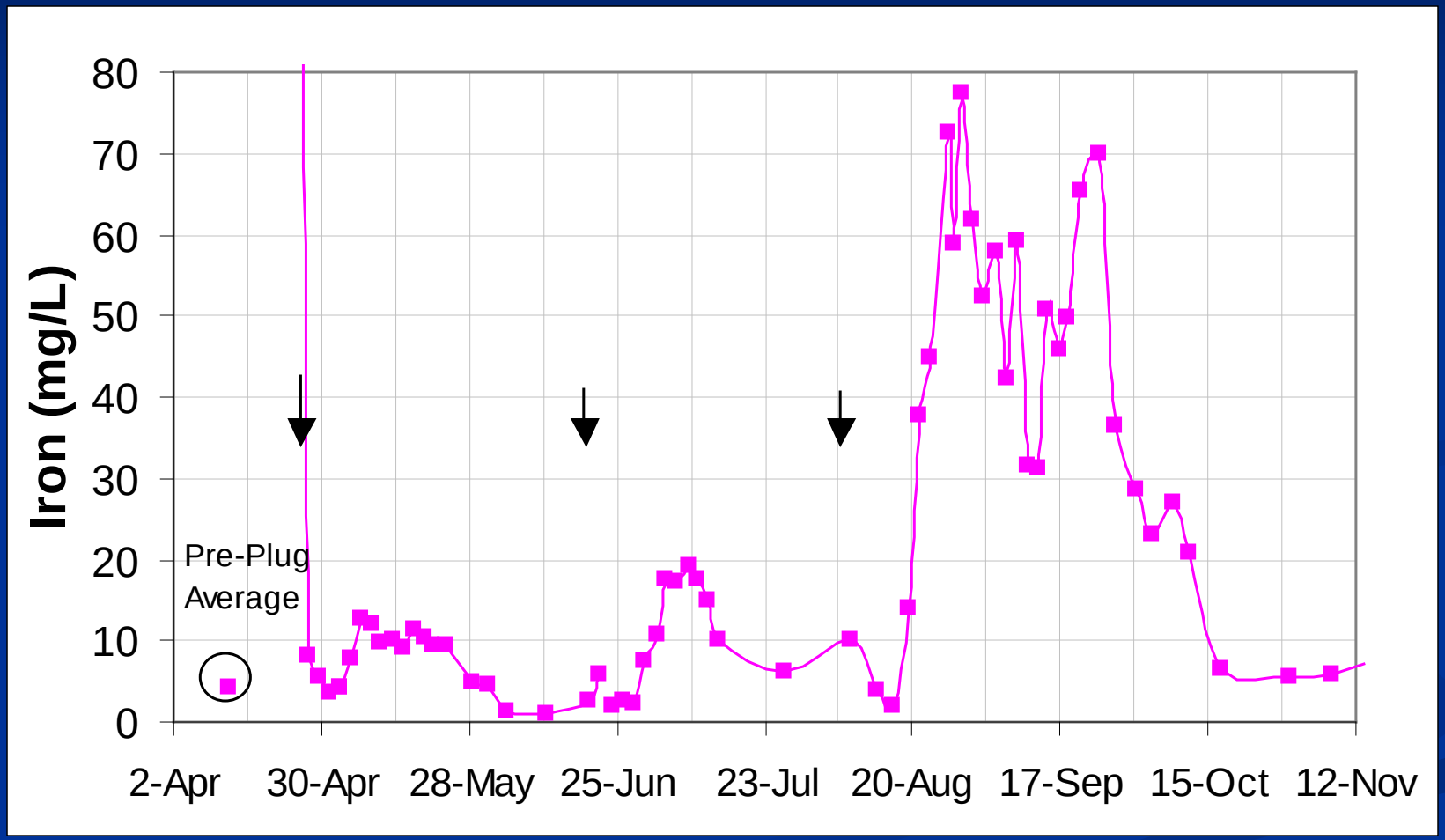
Iron



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Contaminant Release During Plug Test

	Tonnes (April to Nov.)		
	SO4	Cu	Fe
Measured	4926	100	47
Calculated (Pre-plug Avg.)	3995	65	12
Calculated (Historical Avg.)	4003	77	30

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Conclusions

- Copper concentrations increased from 23 mg/L to as high as 65 mg/L, and sulphate concentrations went from 1400 mg/L to 2700 mg/L.
- Plug test was the preferred approach for estimating concentrations in the reflooded mine.
- The initial test allowed us to estimate the magnitude of change that could be expected under fully flooded conditions.

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