

# Research Possibilities at the Underground Research Laboratory Homestake Mine

John E. Gale

*Memorial University of NFLD*

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## Basic Premises

- All rock masses are fractured
- Fractures exist in all scales
- Rock masses consist of fractures and matrix



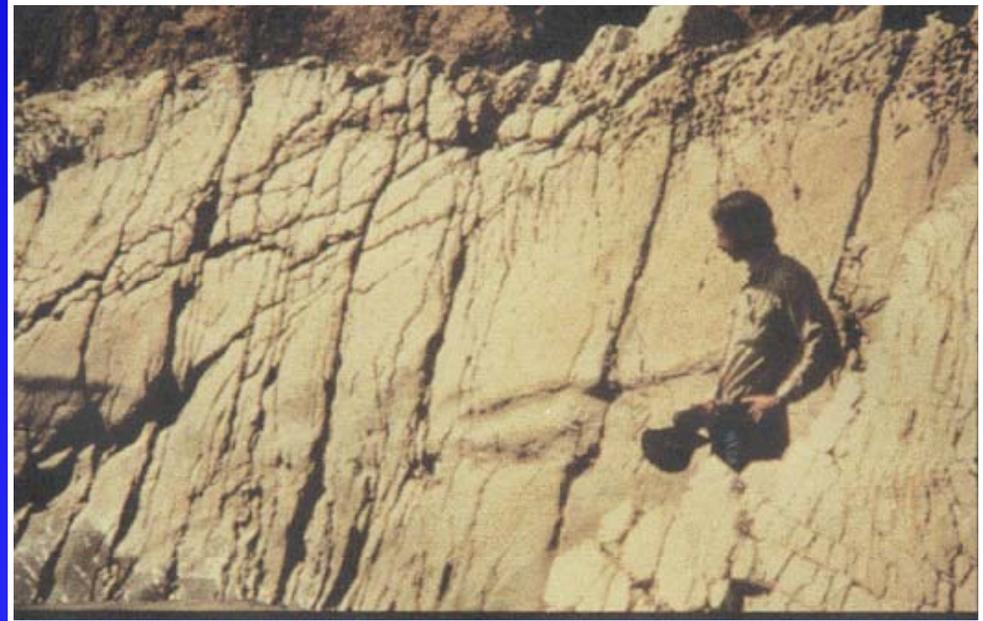
## Basic Premises

- All rock masses are fractured
- Fractures exist in all scales
- Rock masses consist of fractures and matrix
- For rocks with low matrix permeability, fractures are the primary pathways



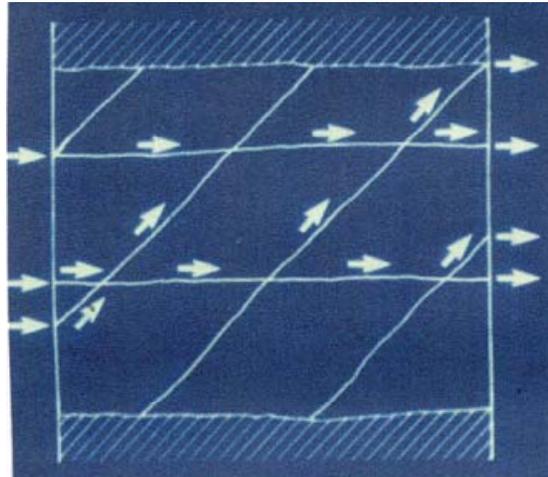
# Fracture Geometry

- Oriented sets
- Spacing
- Apertures
- Length and Continuity

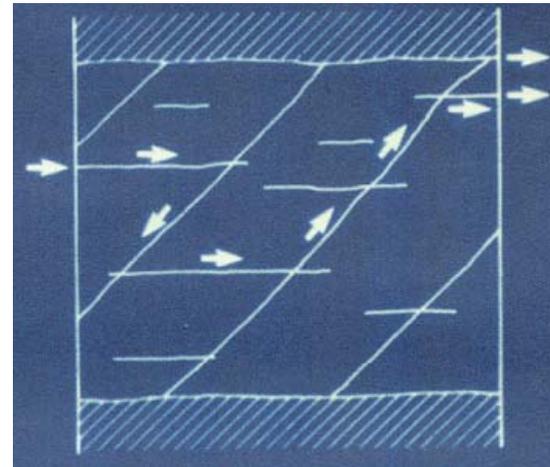


# Fracture Continuity

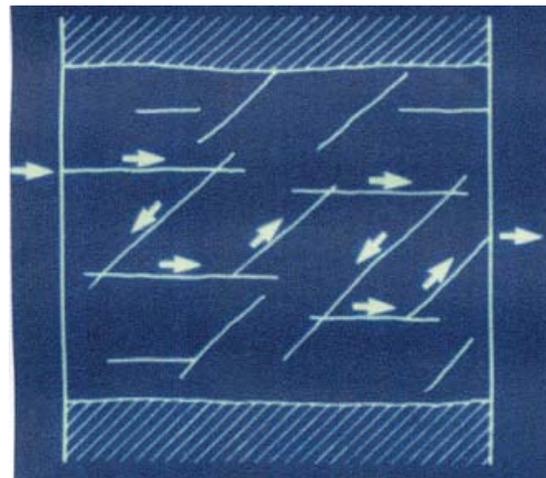
Both sets  
continuous



Set 1 only  
discontinuous

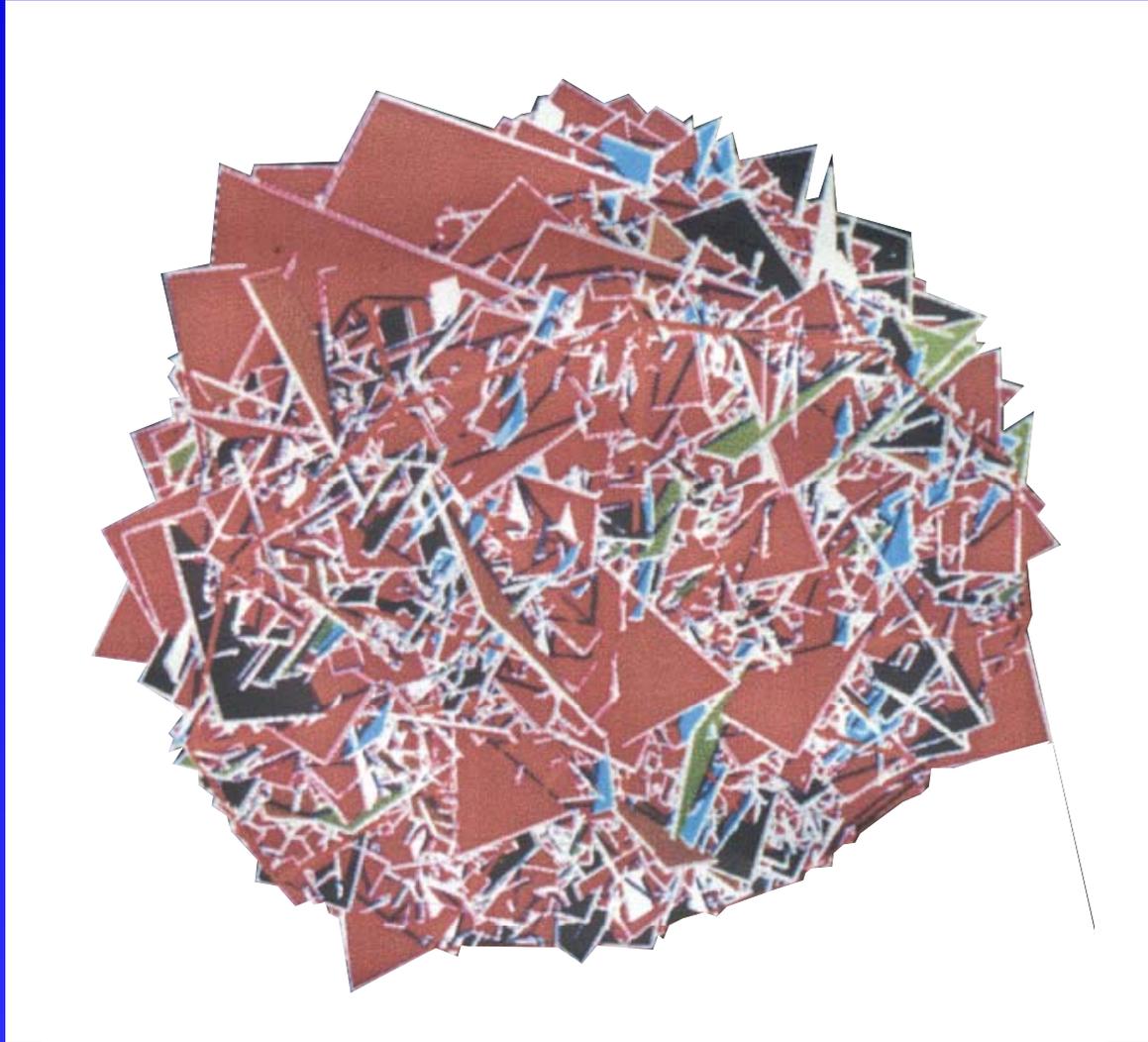


Both sets  
discontinuous

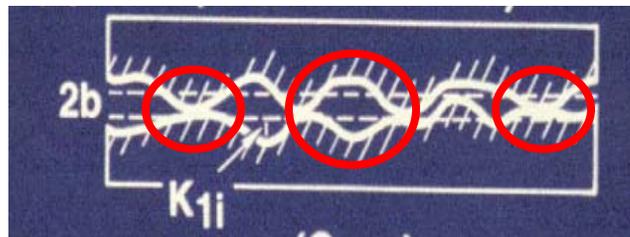
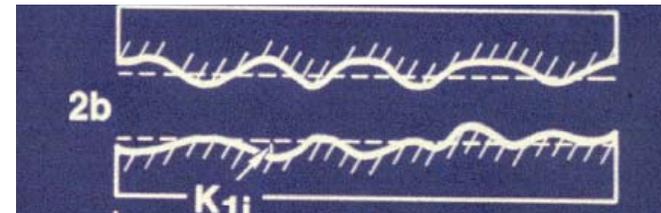
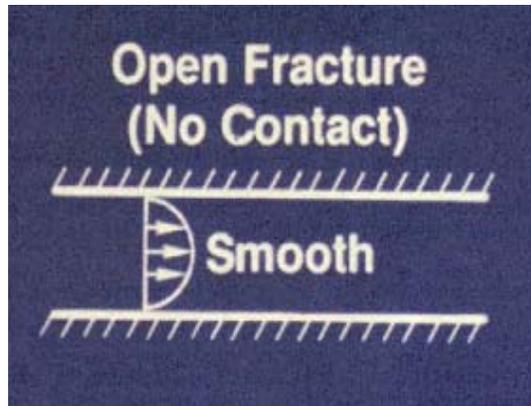


(Rouleau, 1984)

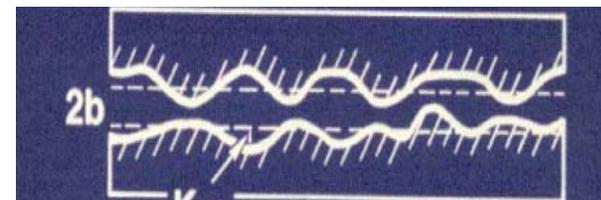
# Fracture Interconnection



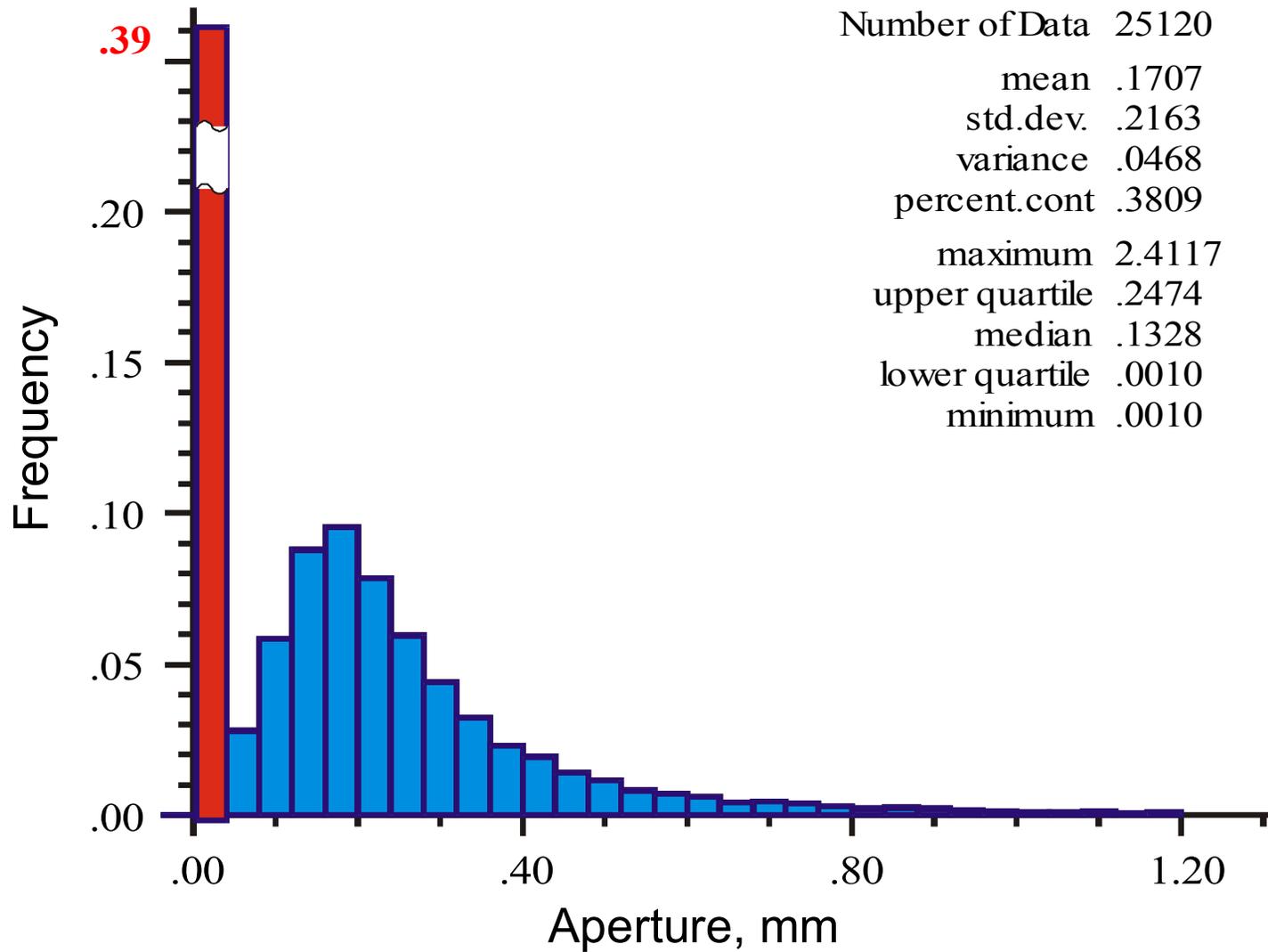
# Flow Through Single Discrete Fracture



**STRESS**

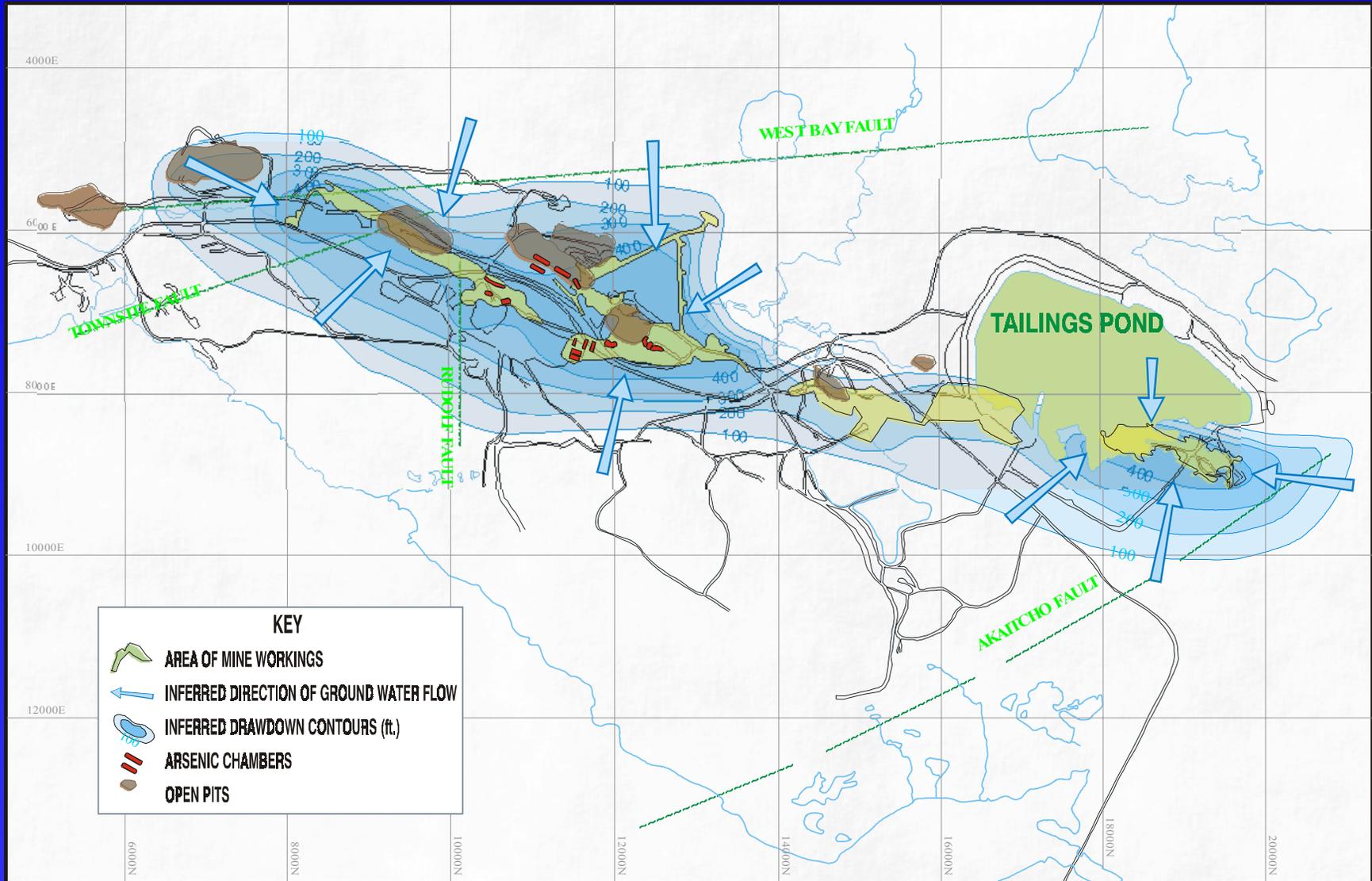


# Contact and Open Pore Space

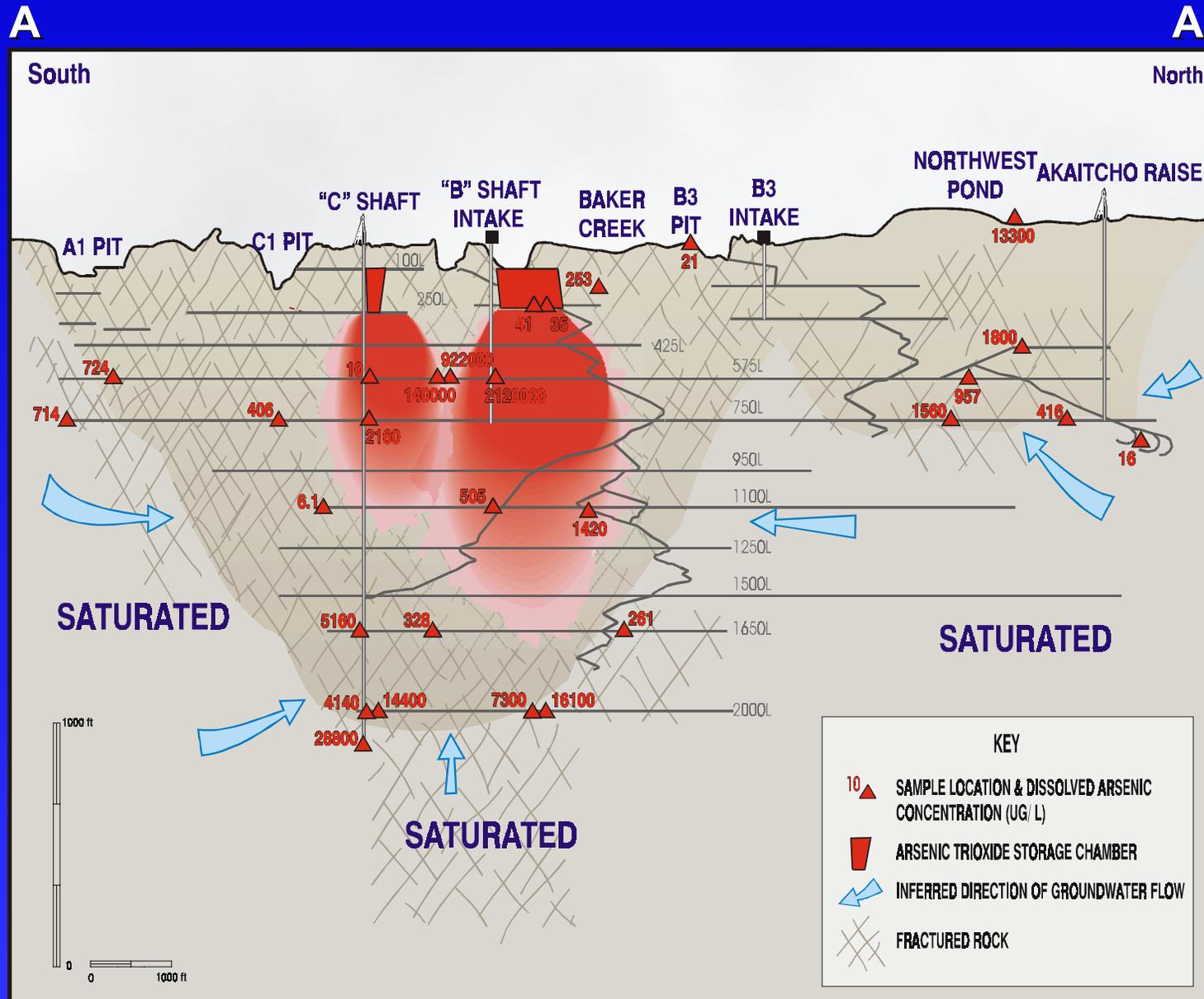




# Plan View and Drawdown



# Vertical Section & Arsenic Plume



# Research Areas and Focus

## -Scaling up Processes

- Fracture Geometry, Spatial distribution, Connectivity
- Hydraulic Conductivity, Directional K
- Compatibility between flow and transport
- Coupled processes

\*\*\* Earth Science Research Incubator \*\*\*

# Research Areas and Focus

- Coupled Processes

- Coupled T, M, H, C

- Basic Fracture Mechanics; Responses are non-linear with stress – Need field sites in different rock types at different depths, Need to include time dependent responses.

- Need parallel laboratory and field studies to determine scaling relationships.

## Research Areas and Focus

- Drift and rock mass interaction and the role of heterogeneities and discrete features as a function of depth
- Extent of dewatering, relationship to structure, rewetting phenomena and impact on surface ecosystems
- Sustainability of water resources as determined from geochemical and isotopic evidence.

# Research Areas and Focus

- Define the Overall Science Agenda or Program
- Identify stakeholders
- Develop Organizational Structure
- Show Integration of Human and Material Resources
- Ball park Costs
- *Identify zones*
- *Identify zones of inflow and related structures*