The Virtues of Laboratory-Scale vs Field-Scale Experiments

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by

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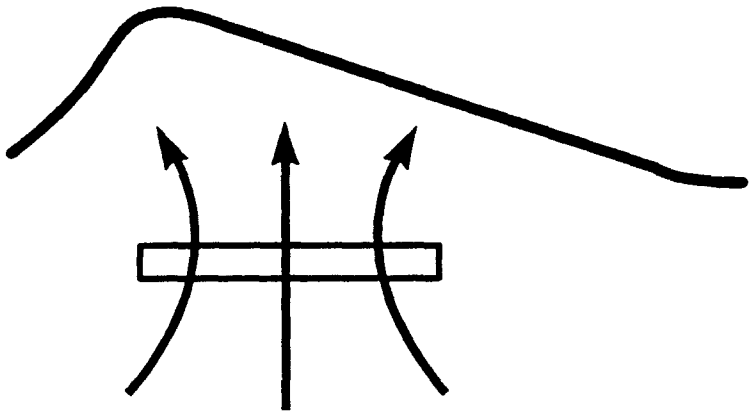
HLW Repository Thermal Regime Conceptual Model

- Heating Period - Moisture Transported as Advection Driven Water Vapor
- Transitional Period - Moisture Transported as Both Water Vapor and Liquid
- Cooling Period - Moisture Transported as Capillarity Driven Liquid

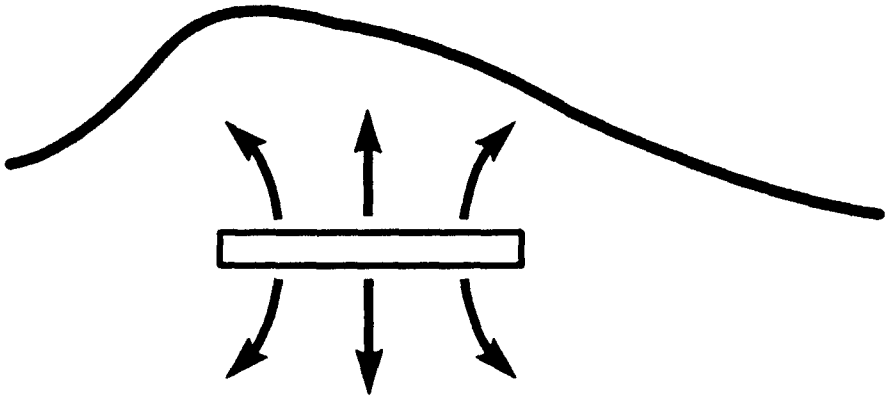
WATER VAPOR FLOW REGIMES

Buoyancy Driven

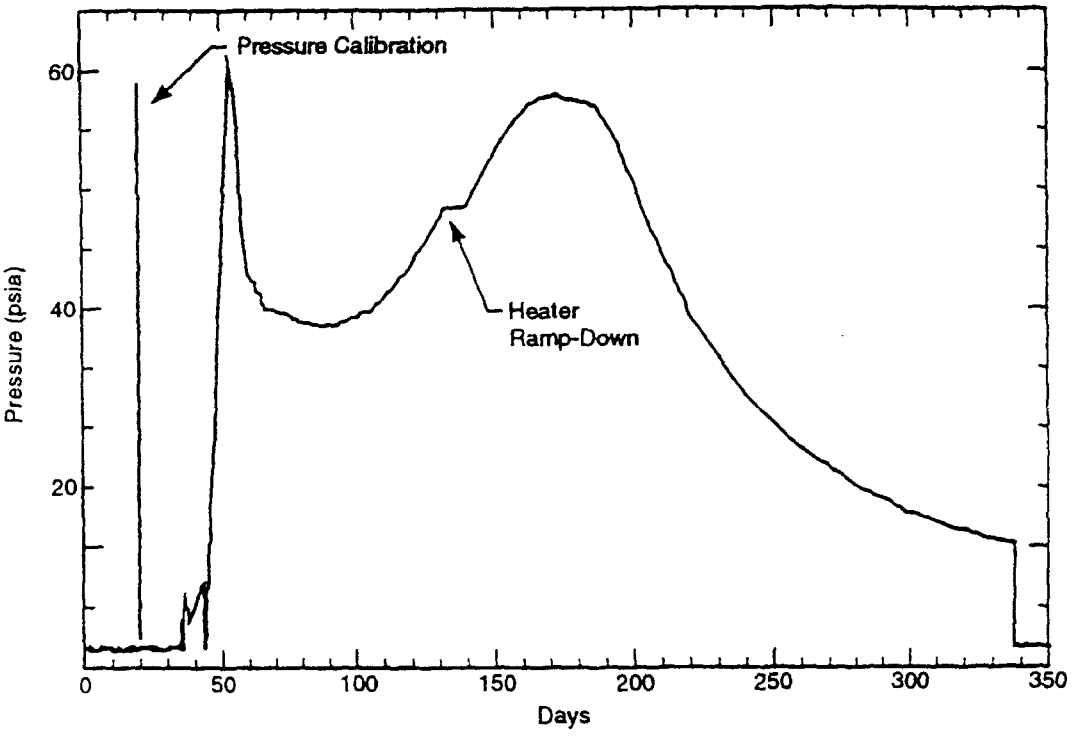


Low Heat Load
High Bulk Permeability

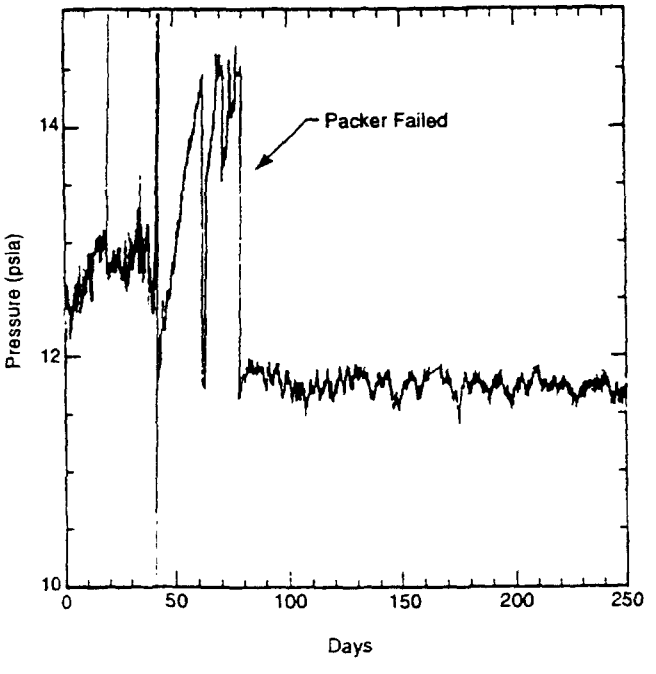
Advection Driven



High Heat Load
Low Bulk Permeability



(a)



(b)

Figure 4-48. Gas pressure measurement from Lawrence Livermore National Laboratory G-tunnel heater experiment for (a) P1, (b) P2 (after Ramirez, 1991)

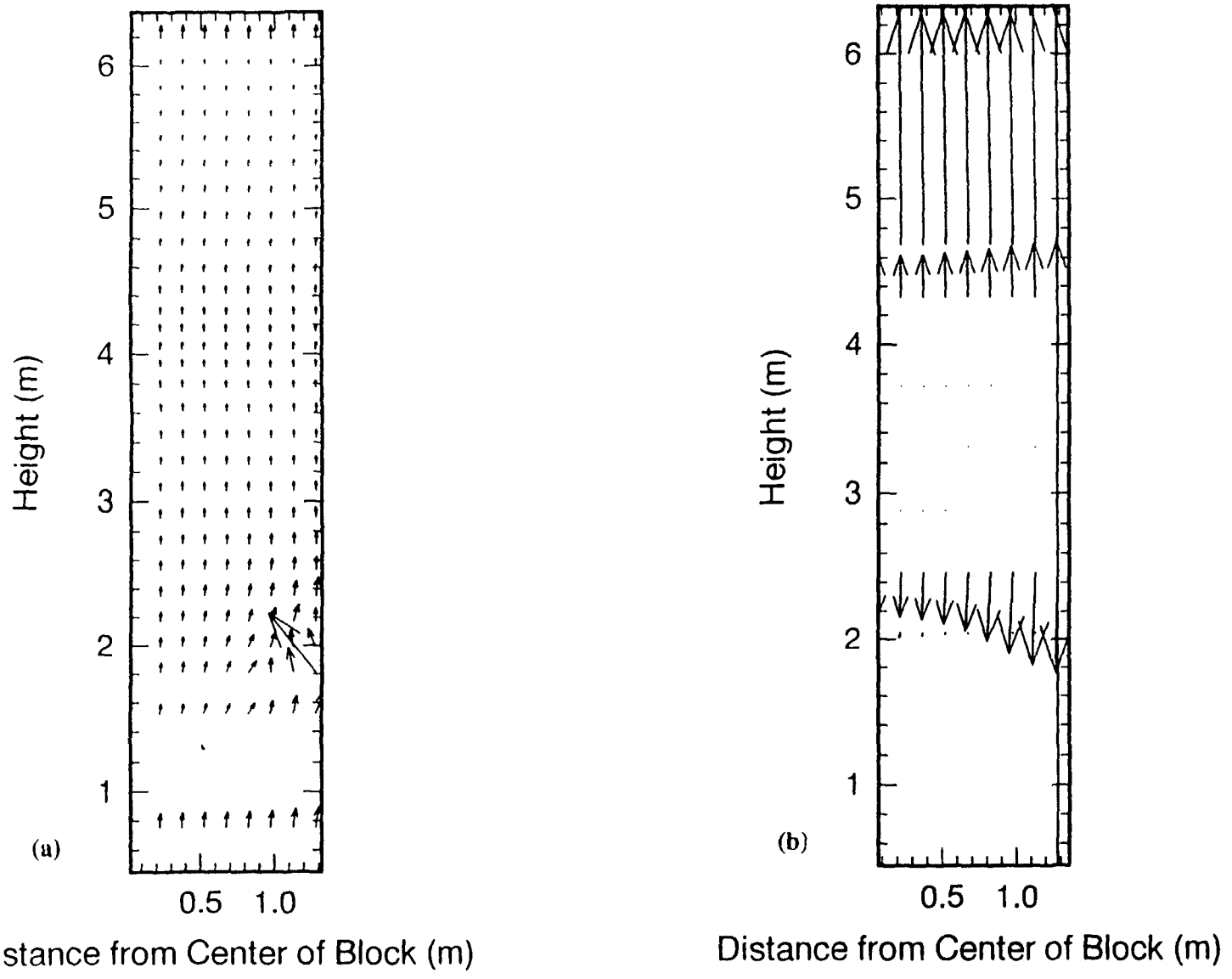


Figure 5-6. Numerically simulated gas flow velocity vectors of the Fran Ridge Large Block Test at 92.5 days at: (a) 50-percent heating rate (750 W), and (b) 100-percent heating rate (1,500 W)

Summary Observations

- Conceptual models supported by laboratory-scale experimentation may not be valid for larger scales
- Physical mechanisms present at full scale may not be reproducible at laboratory scale
  - multiple matrix/fracture interactions
  - large-scale heterogeneities
  - perched water conditions
- Property values may be spatially dependent
- Laboratory-scale experiment boundary conditions may be prohibitive