

The Effect of Accessory Minerals on Bentonite Erosion Rates – How much does homogeneity matter?

Prof Rebecca Lunn, Prof Alessandro Tarantino,
Dr Grainne El Mountassir, Christopher Reid

Department of Civil and Environmental Engineering
University of Strathclyde, UK

Issues

- Limiting bentonite erosion critical to long-term safety
 - Bentonite will be used as buffer material, but also as backfill in shafts, tunnels and boreholes.
 - Mechanical and hydraulic performance relies on low rates of mass loss
- Current estimates based on experiments using compacted pure montmorillonite
 - Significantly overestimate erosion of MX80
 - No data for other sources of bentonite
 - No data available for erosion of backfill

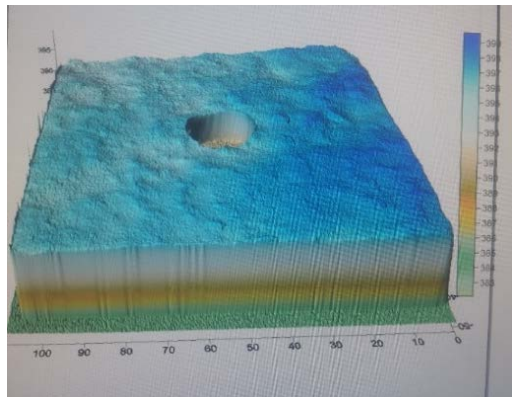
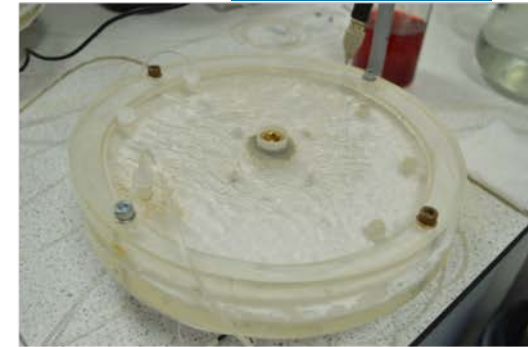
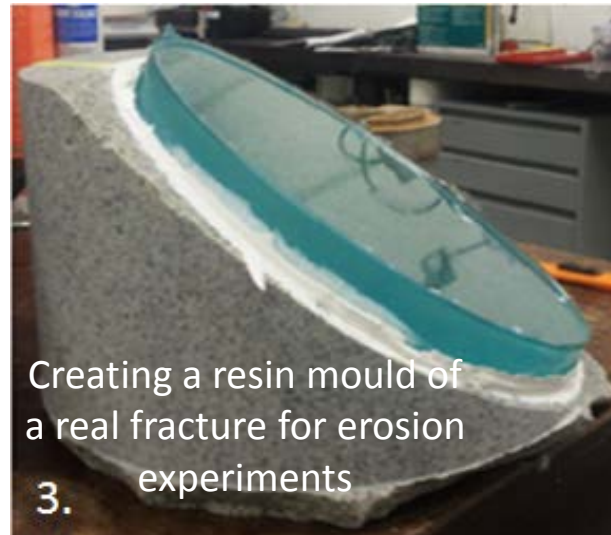
Experimental Methodology

Bentonite compaction:

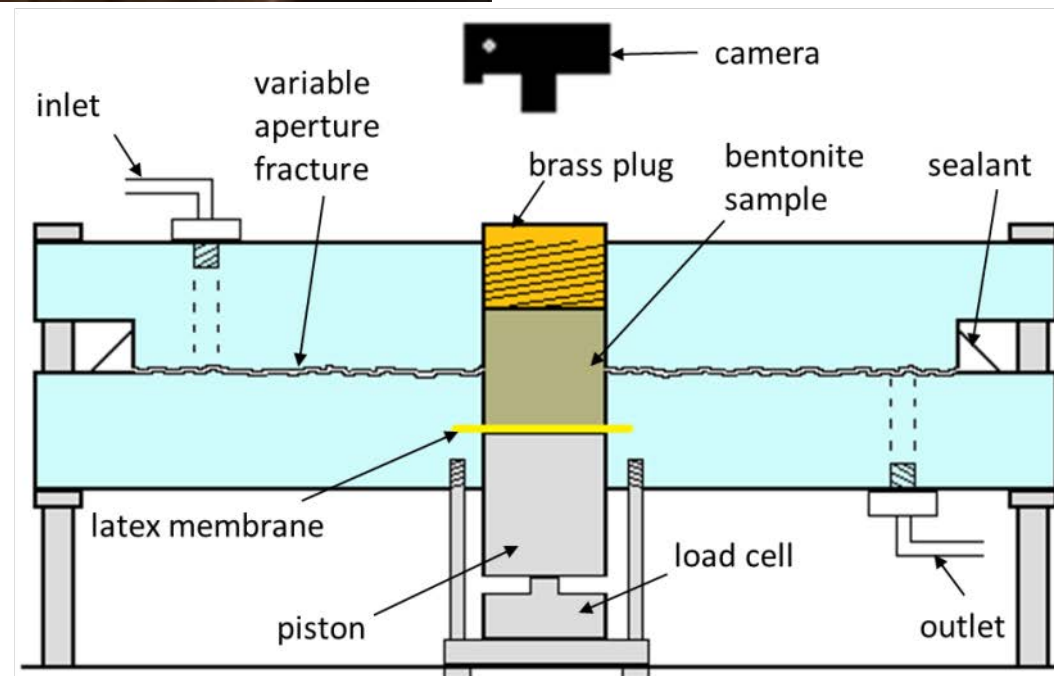
- Dry density: 1650 kg/m^3
- Water content: 18%

Flow through conditions:

- Constant flow rate:
1ml/min
- Deionised water



Laser scan of a fracture face
(central hole for bentonite plug)



Uniform aperture, pure montmorillonite

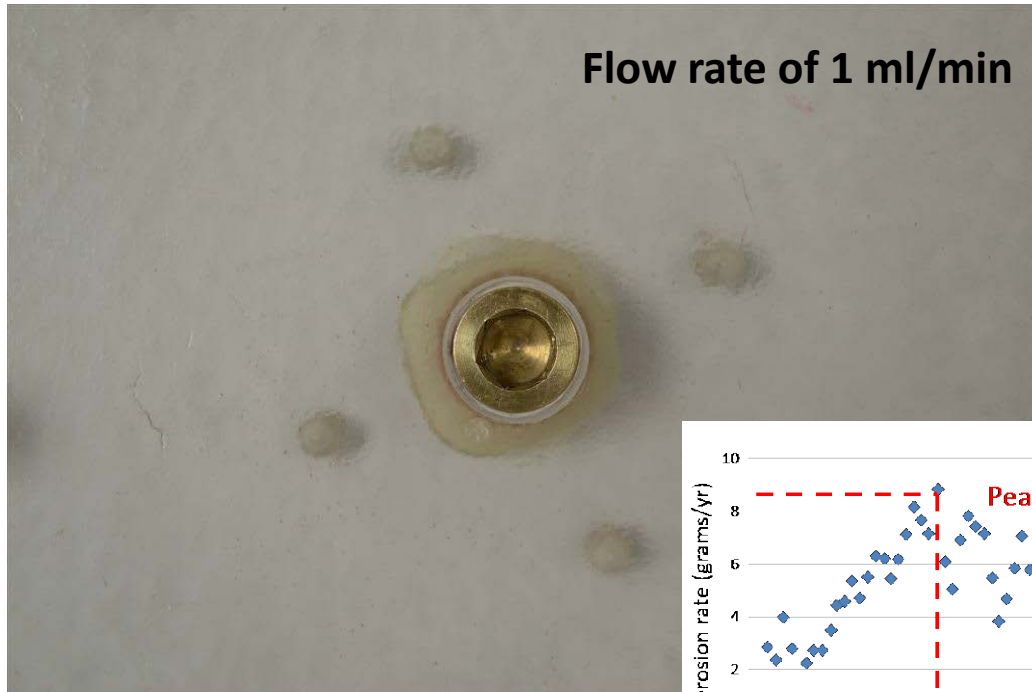
Video

Flow rate of
0.38ml/min
Constant mass
loss of ~6
g/year

**For 1ml/min,
loss rate
>300g/year**

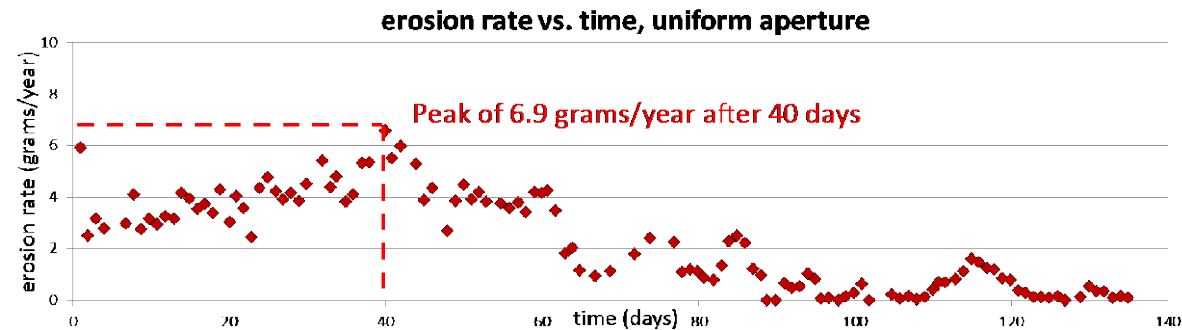
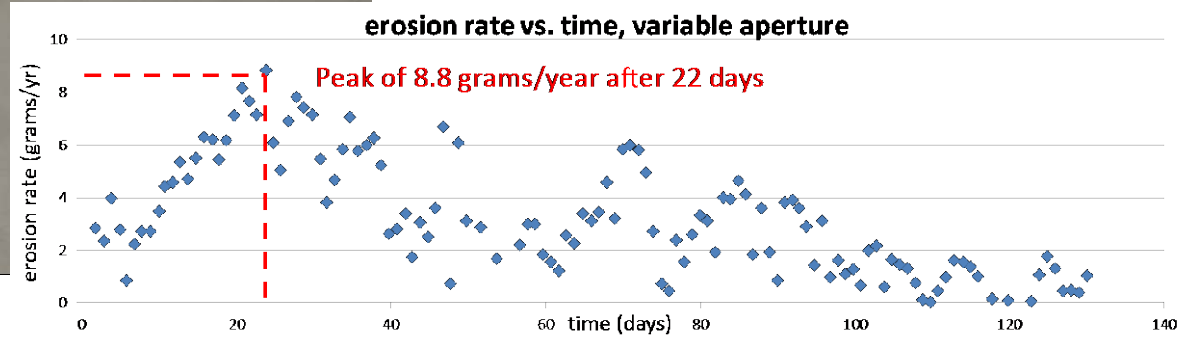
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Bentonite Erosion



New erosion mechanism
- Measure swelling pressure
2mm ring thickness
corresponds to decrease in
erosion rate

Erosion rate two
orders of magnitude
smaller than for pure
montmorillonite



Future Research Needs



- To develop a *realistic* model of bentonite erosion that includes the role of accessory minerals
- To validate the model with laboratory experiments using variable accessory mineral compositions
- To determine the percentage and composition of accessory minerals required to inhibit erosion
 - Produce design criteria for manufacture of buffer and backfill materials in terms of accessory minerals, including **homogeneity and composition**.

Approximate resources required as part of a wider programme: €500k



University of
Strathclyde
Glasgow