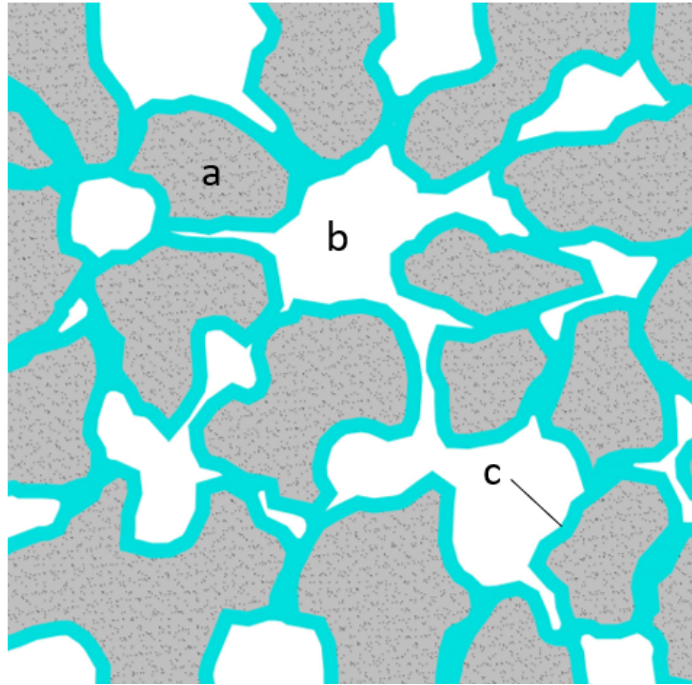


Breathability and Sacrificiality

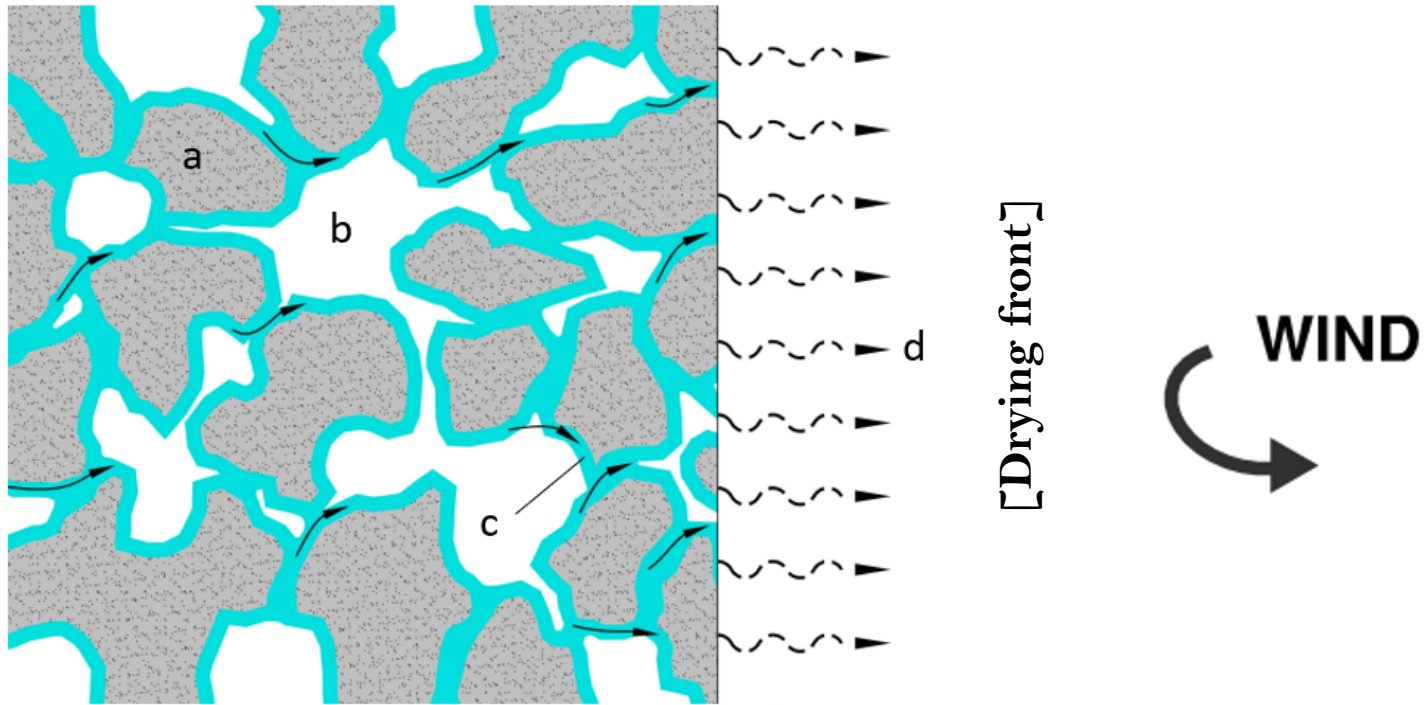


Water distribution without movement

Some physical principles

- Water molecules adhere to “wetable” solids
- Water molecules self-coherent
- Creates a ‘film’ which wets the pore walls

Breathability and Sacrificiality

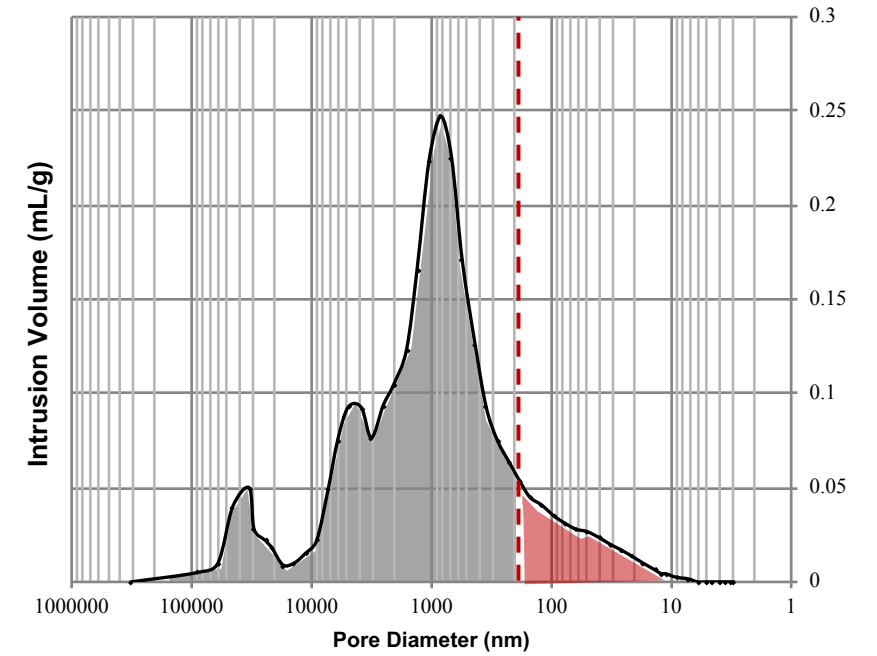
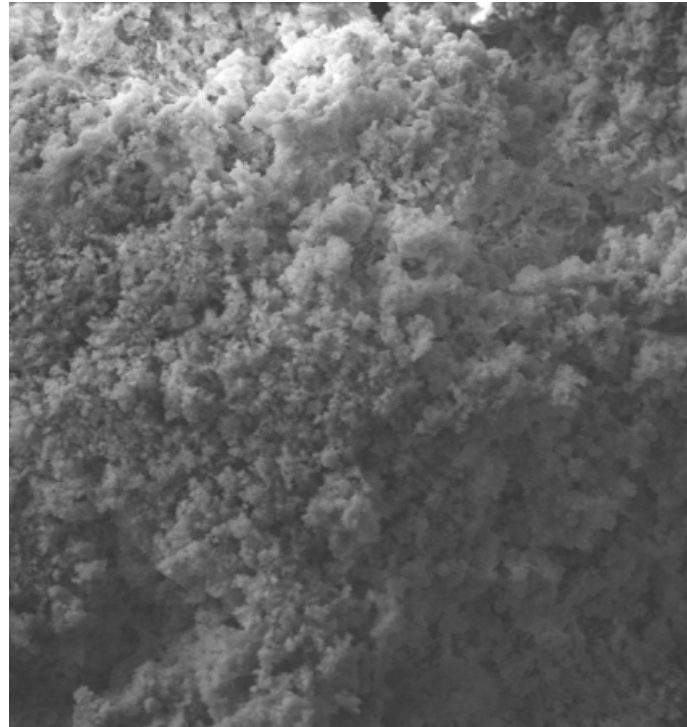
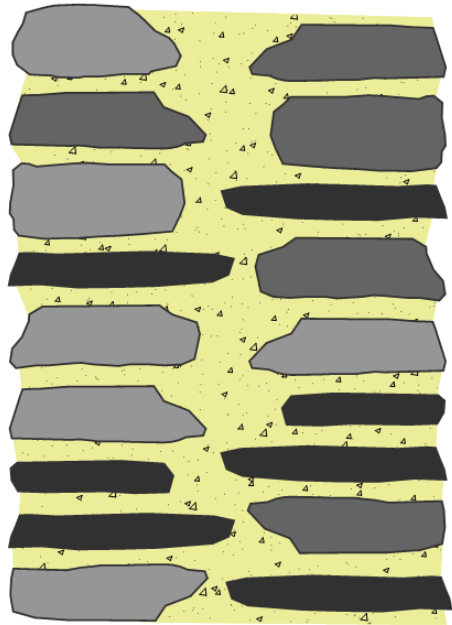


Water distribution with movement

Breathability and Sacrificiality

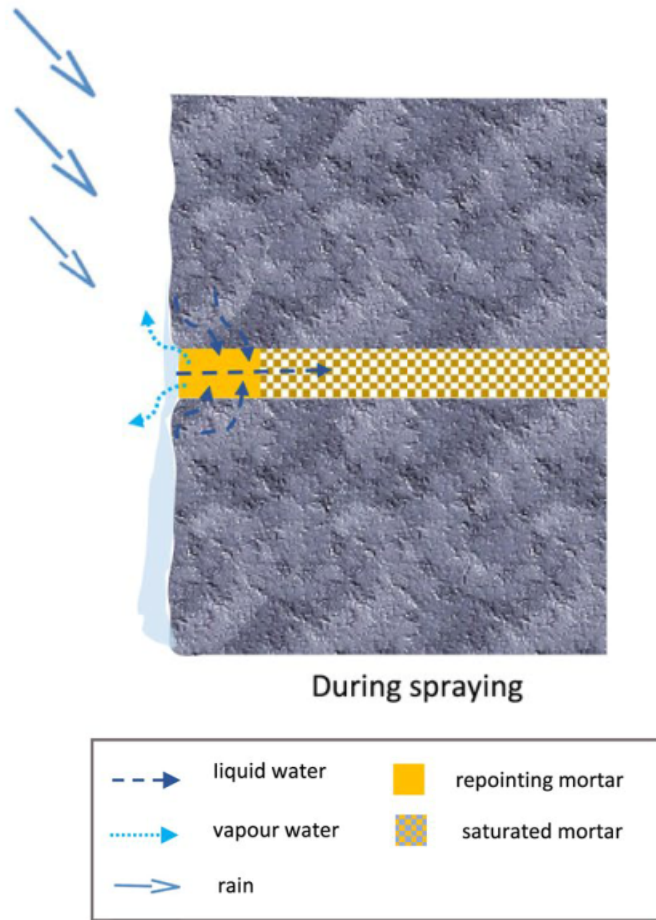


Breathability and Sacrificiality



Breathability and Sacrificiality

- Mortar is a microporous sponge built into the wall

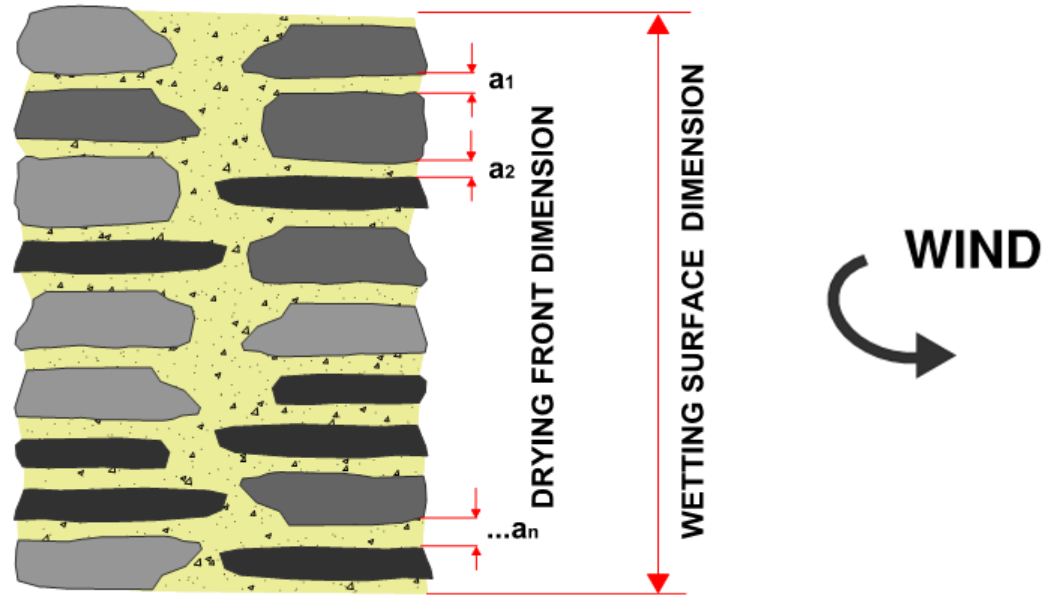


- In heavy rainfall, outer portion of mortar saturates, holds water, and reduces further water ingress by increasing surface runoff (Fusade et al. 2019)
- “Overcoat effect”
- Quickly reverts to non-saturated conditions exploiting capillary drying regime
- Capillary drying vital for deep drying – the mortar should stay wetter for longer to maintain that liquid film pathway

Fusade et al. (2019)

Breathability and Sacrificiality

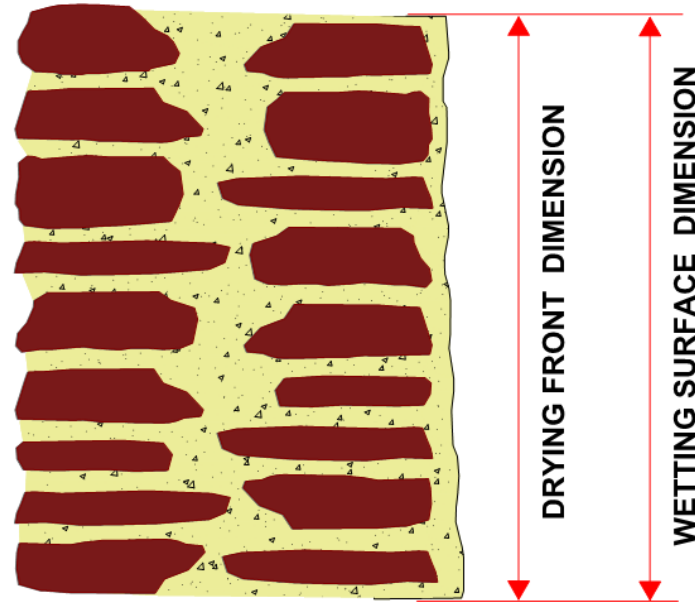
- Mortar is a microporous sponge built into the wall



In context A the mortar joints do all the work

Breathability and Sacrificiality

- Context B: Sandstone wall with lime harling



Size of drying front magnified – levelled playing field

Breathability and Sacrificiality

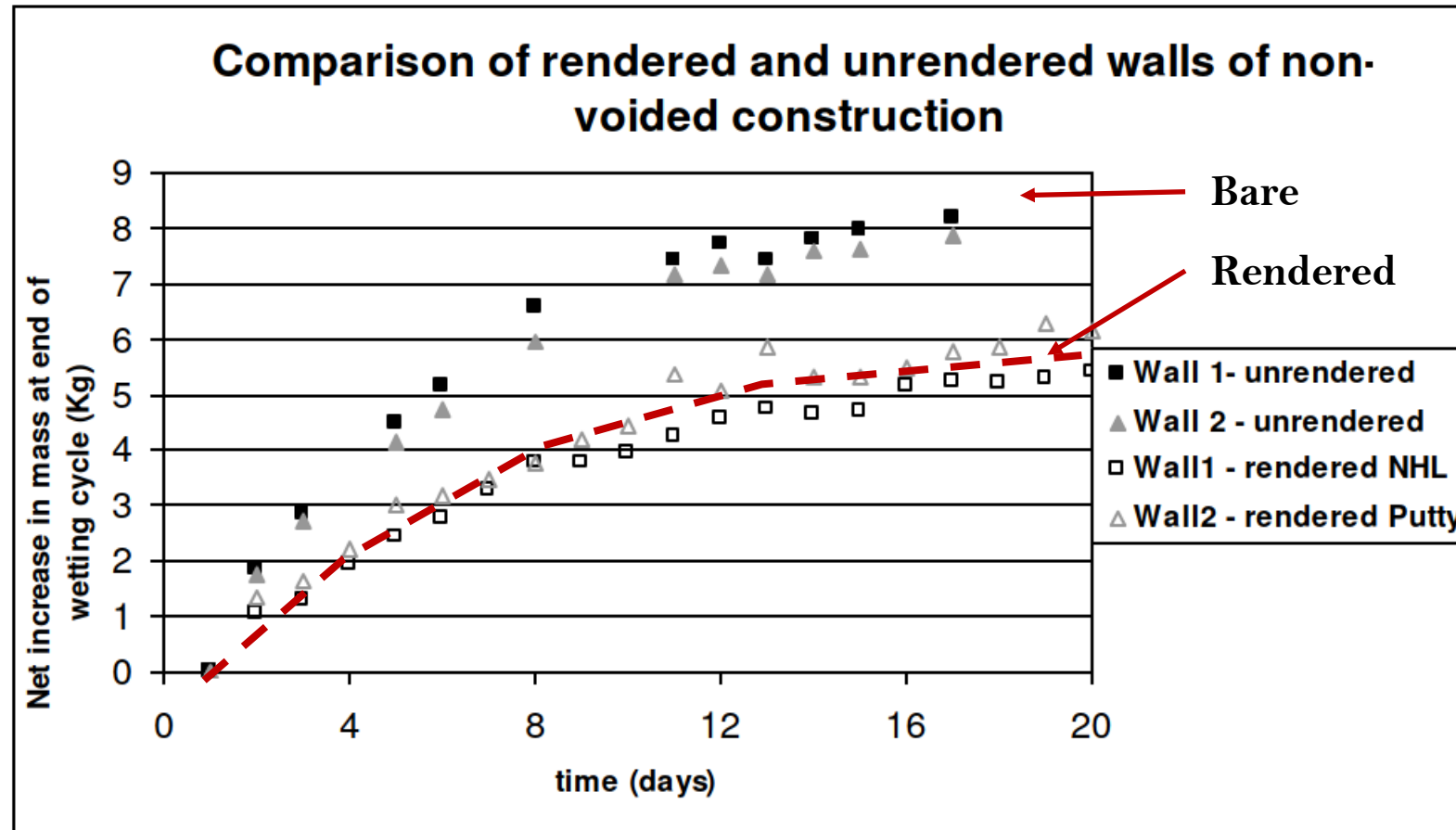


Figure 16 Graph to show performance of the same walls pre and post application of render

Breathability and Sacrificiality

- **Overcoat behaviour:** outer surface becomes water-logged, film forms, extra rainfall either splashes off or runs down film (you can hear it gurgle...)



Breathability and Sacrificiality



Film

**Windward
side soaked**

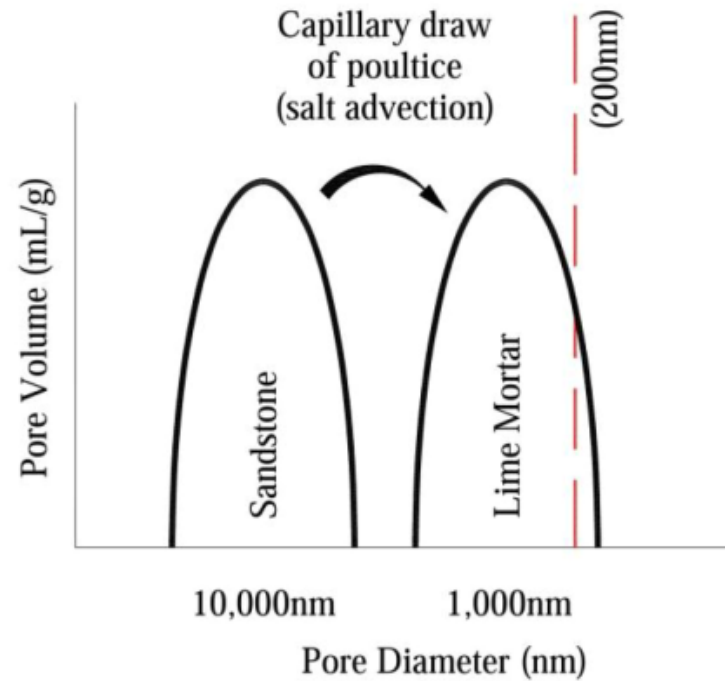
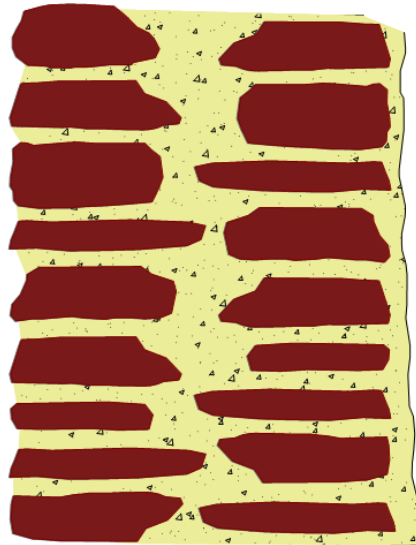
**Sheltered
side bone dry**

Puddle



Breathability and Sacrificiality

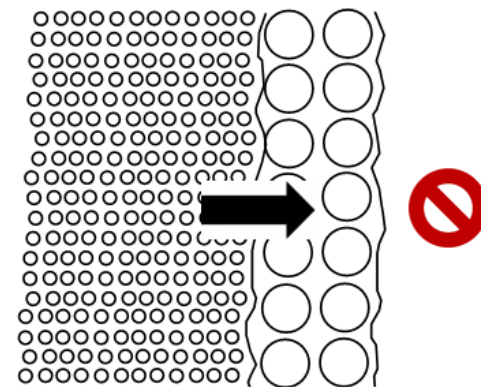
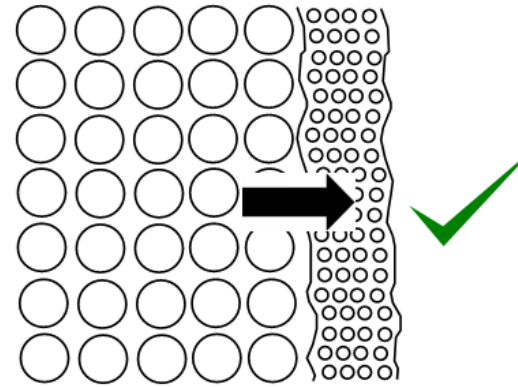
- Context B: Sandstone wall with lime harling



Fine pored material on coarse pored substrate creates a poultrice

Breathability and Sacrificiality

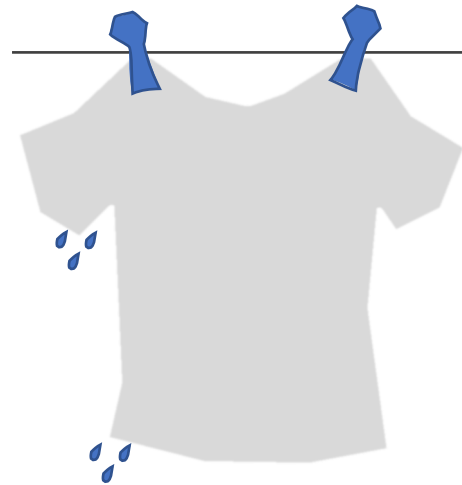
- A fine-pored material wicks water from coarse-pored (advection);
The reverse is not true – back-diffusion unfavourable



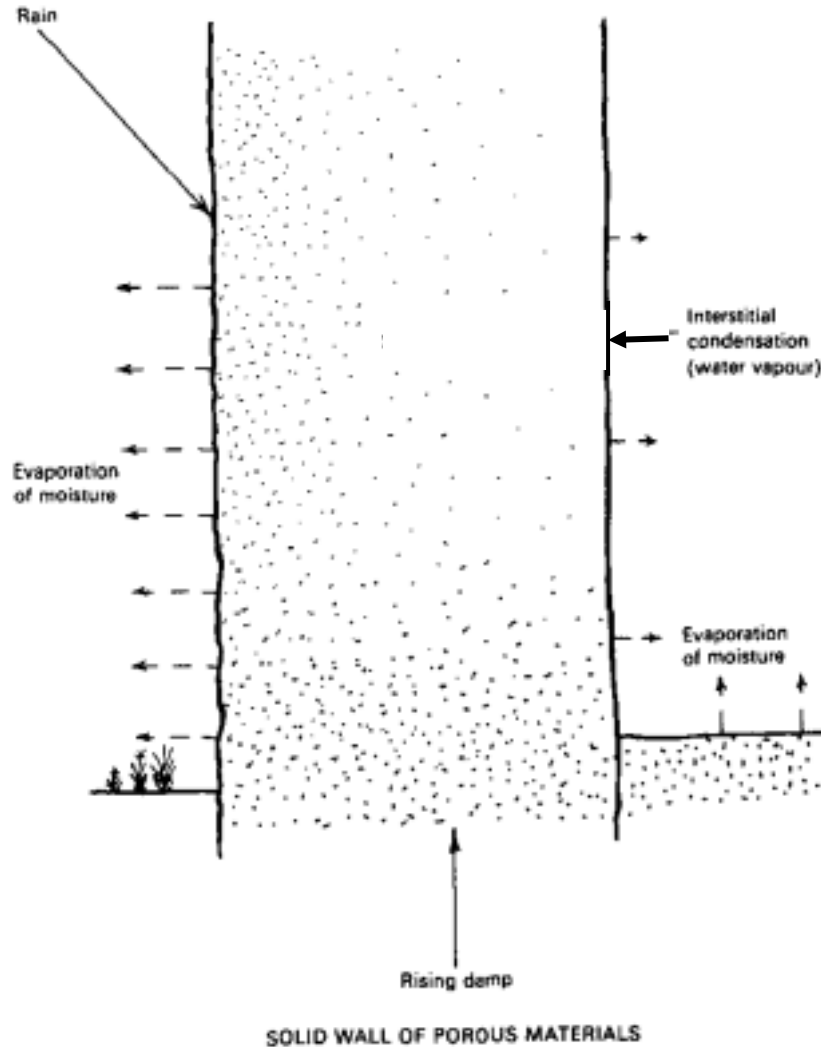
Breathability and Sacrificiality

VAPOUR PERMEABILITY IS A NONSENSE

- Traditional buildings 'breathe' by convective drying
- NOT by vapour permeability of the walling material
- Wrap your wet washing in a Gore-Tex tent and see what happens
- Wet clothes



Breathability and Sacrificiality



Warning
The term "breathing" is now being applied to many products which are only slightly vapour permeable. In general, no synthetic modern materials should be applied to the masonry or plaster surfaces of historic buildings. If in any doubt contact SPAB.

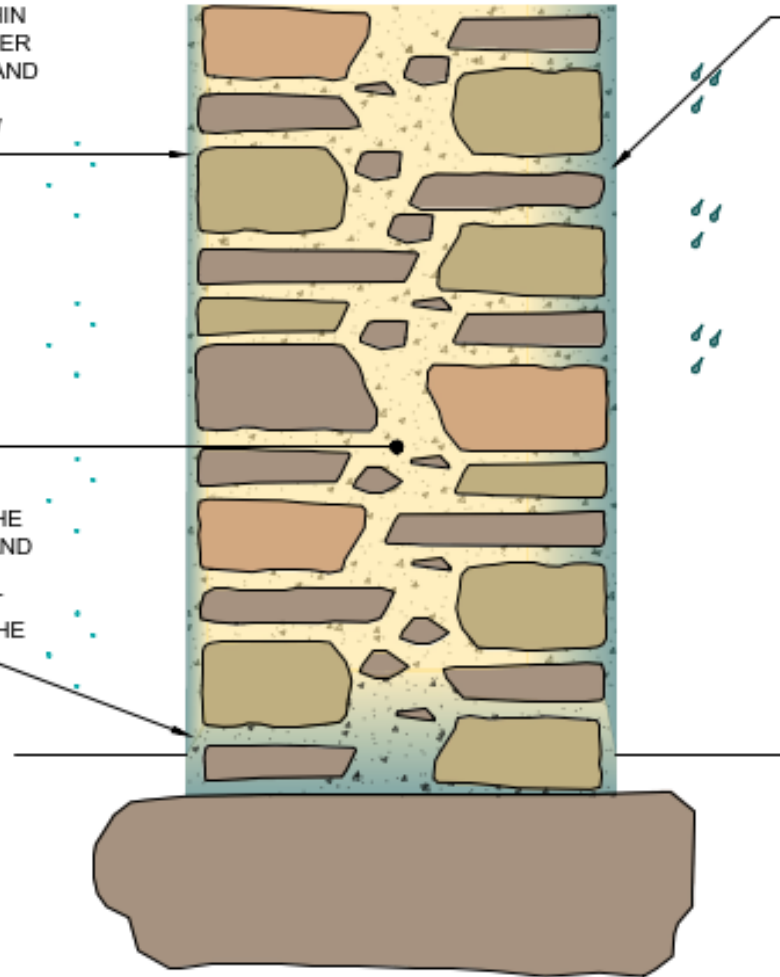
Breathability and Sacrificiality

Liquid phase moisture handling in real masonry.

WATER VAPOUR CONDENSES WITHIN THE FIRST FEW PORES OF THE INNER FACE OF THE SURFACE COATING, AND IS DIFFUSED THROUGH NON-SATURATED CAPILLARY FLOW AMONGST THE MORTAR

THE BEDDING MORTAR AND RUBBLE CORE ARE ABSORPTIVE MICROPOROUS 'SPONGES' WHICH MOP UP THE MOISTURE, EVEN IT OUT AND STORE IT LIKE A STORMWATER ATTENUATION TANK, UNTIL DRYING CONDITIONS INDUCE CAPILLARY FLOW TO DRAW OUT THE BOUND WATER

A SIMILAR PROCESS APPLIES AT THE BASE, THE ABSORPTIVE MORTAR AND SURFACE COATINGS DRAW THE WATER OUT AND LIMIT THE HEIGHT OF RISING DAMP BY EQUALISING THE WETTING WITH DRYING



WIND-DRIVEN RAIN IS ABSORBED BY THE SURFACE OF THE WALL, AND THE ABSORPTIVE MORTAR DIFFUSES THE WATER THROUGH CAPILLARY FLOW, AND STORES IT UNTIL CONDITIONS CONDUCIVE TO DRYING OCCUR. CAPILLARY CONTINUITY IS REQUIRED THROUGHOUT THE WALL PROFILE FOR THIS TO WORK.

DRYING IS OVERWHELMINGLY GOVERNED BY WIND FLOW ACROSS THE SURFACE OF THE WALL. IT IS A LIQUID-PHASE PROCESS (CONVECTIVE DRYING COMPENSATED BY CAPILLARY FLOW THROUGH THE MATERIAL).

Breathability and Sacrificiality

- Daft question #2...



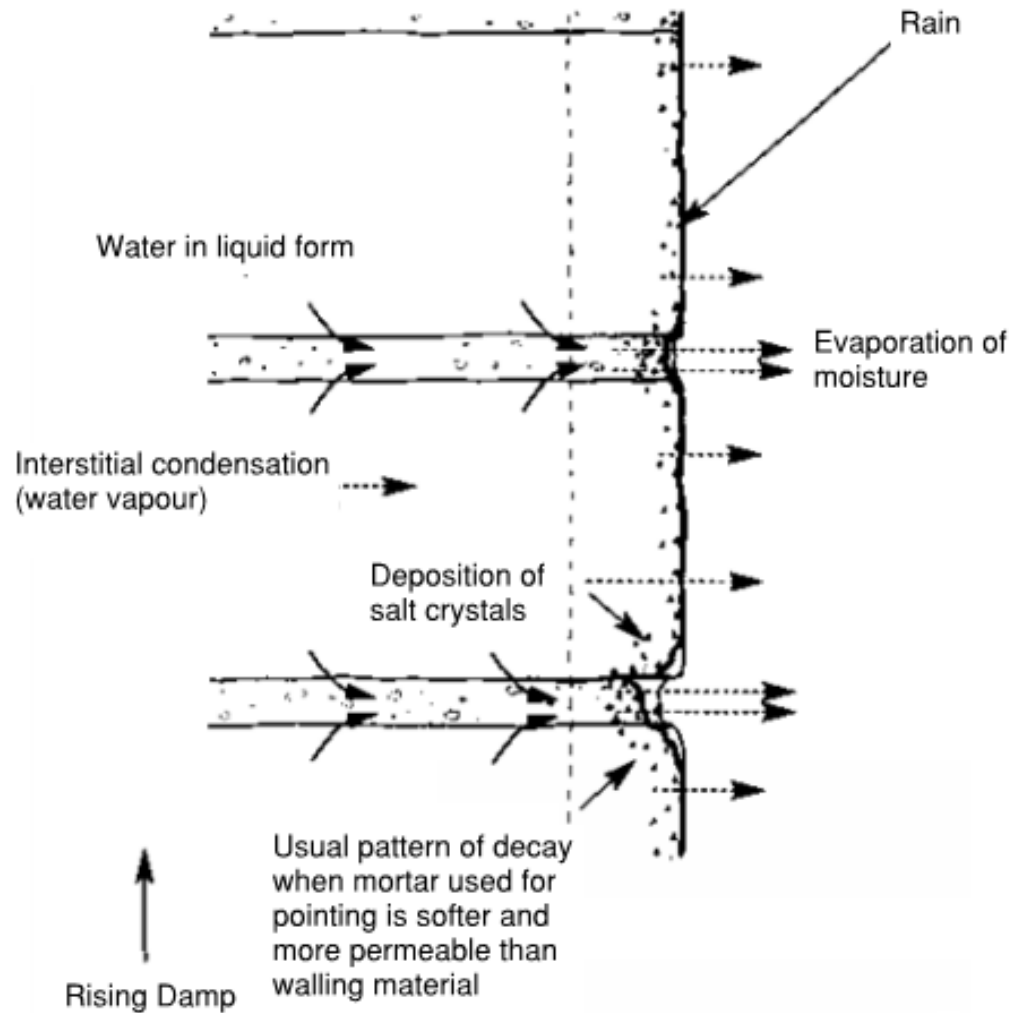
...No. They 'sweat'. It's a liquid phase movement process.

Breathability and Sacrificiality

Vapour permeability is an absolute load of rubbish

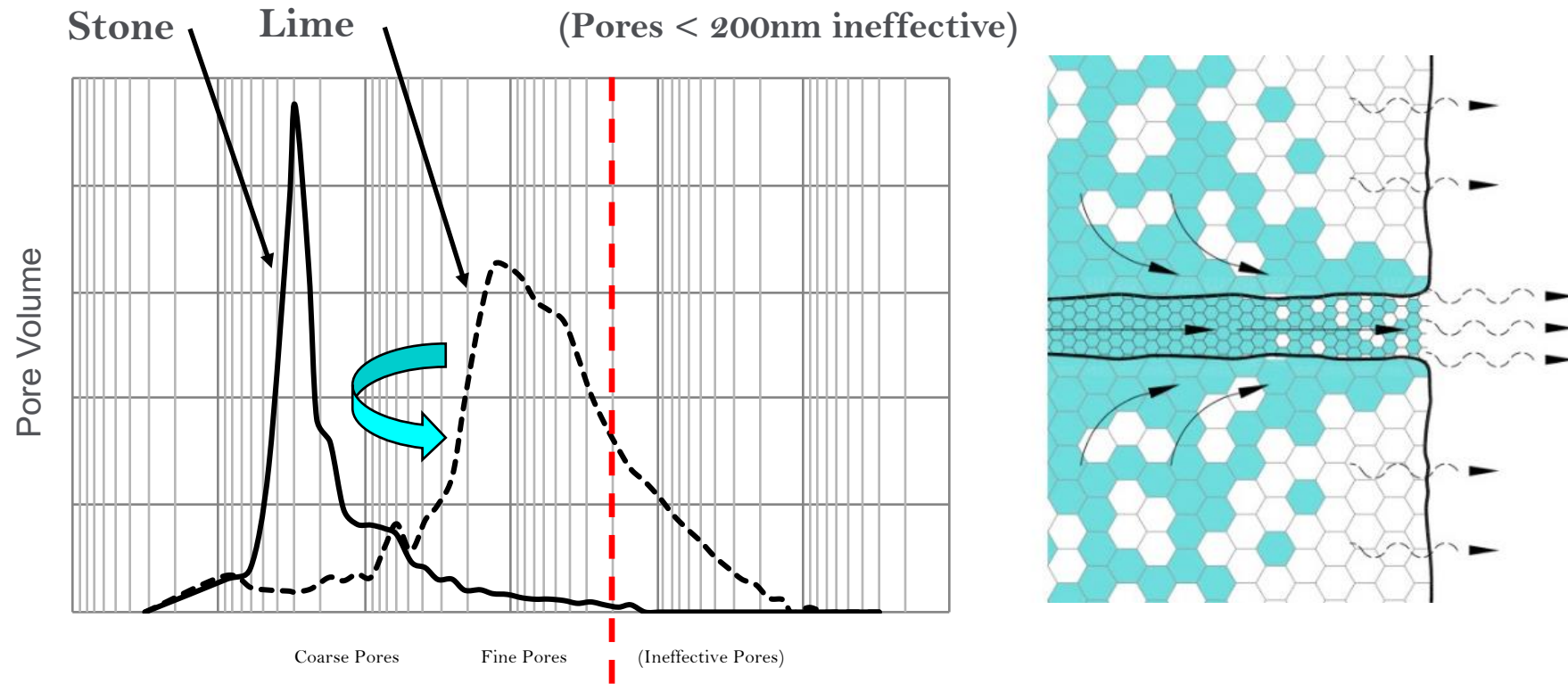
See <https://clach-conservation.co.uk/lime-training-%2F-r%26d> for a debunking of breathability myths and an examination of convective drying

Breathability and Sacrificiability



What's going on here?

Breathability and Sacrificiality



Soluble salts advected, evaporation front forced away from the surface of the stone.

Breathability and Sacrificiality

- Relative microstructure of fine-pored mortar vs. coarse-pored masonry units (poultice mechanics)

