I <Heart>Brownstones: Not Just a Pretty Façade
Friday, March 3, 2017

LANDMARKWEST!
THE COMMITTEE TO PRESERVE THE UPPER WEST SIDE

Generously hosted by ARUP
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Brownstone
Formation Cycle

Granite

Marble, Slate, Gneiss

Sandstone, Limestone

Magma

Metamorphic Rocks

Igneous Rocks
Brown Stone Quarry, Portland, Conn.
Why it’s “brown”
Scabbled
Margined
Rock faced
Combed
Chiseled
Hammered
Punched
Inadequate choice of stone
Harmful extraction
Careless shipment
Inappropriate storage (cure)
Bad workmanship
Poor placement

Acid rain
Dry deposition
Salt crystalization
Freezing water
Hygric swelling
Biological attack
Thermal effects
Mechanical damage

Inappropriate treatments
ACID RAIN

\[ \text{CaCO}_3 \rightarrow \text{H}^+ / \text{water} \rightarrow \text{CO}_2 \rightarrow \text{Ca}^{2+} / \text{anion} / \text{water} \]
DRY DEPOSITION

$H_2O$

$CaCO_3$

$SO_2$

$Ca^{2+}/SO_3^{2-} \text{ or } SO_4^{2-}$
- Bacteria
- Algae
- Fungi
- Lichens
- Mosses
- Higher Plants
- Animals
SWELLING WITH WATER

[Diagram showing swelling process with water]

CALCITE, QUARTZ OR FELDSPAR
CLAY

[Image of a building entrance with steps and a door]
FREEZING WATER

Liquid → Solid

10% volume increase

$\Delta T = \frac{2z}{r}$
• Test for salts
• Determine composition of material (chem/micro)
• Test soil for water level, drainage capacity
• Assess moisture level, porosity of material
• Monitor cracks, efflorescence
• Determine construction details
• Perform material analysis
  (ex: infrared thermograph)
Thank you!