MATERIAL & TECHNOLOGY OF PARGETING AND RENDERED WALLSURFACES

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HISTORIC OVERVIEW

Neolithicum

Surfaces and mortars
• mud-mortar
• stone
HISTORIC OVERVIEW

Ancient Egypt, Greece, and Rome

Surfaces
- brick
- stone
- plaster
- painted surfaces

Mortars
- lime mortar
- lime mortar + volcanic ash (pozzolan, Santorin)
- lime mortar + brick dust (Aegean area)

Middle Age

Surfaces
- brick
- stone
- plaster
- painted surfaces

Mortars
- lime mortar
- cocciopesto in cellars (Venice)
- cocciopesto plasters in swimming pools (Turkish bath)
**Renaissance**

- **Surfaces**
  - brick / stone
  - stone quoins, window frames
  - rendered surfaces

- **Mortars**
  - lime mortar
  - cocciopesto

**Baroque**

- **Surfaces**
  - brick / stone
  - stone quoins and window frames + rendered surfaces
  - (pargeting – "plaster architecture")

- **Mortars**
  - lime mortar
  - gypsum mortar
  - 17th century: trass (Nette, Bohr) – Dutch Dam constructions
**Surfaces**
- brick / stone
- stone quoins, window frames
+ rendered surfaces

**Mortars**
- lime mortar
- all historic hydraulic mortar
+ natural hydraulic lime (NHL)
+ spread of cements

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**HISTORIC OVERVIEW**

**Classicism 19th century**

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**HISTORY OF THE MODERN CEMENTS**

1755-59 John Smeaton uses hydraulic lime mortars at the construction works of the Lighthouse at Eddistone

1796 James Parker – patent of Roman cement

1820 Directions for Engineers (Hungary) – prescriptions for the application of hydraulic limes (pozzolan, trass)

1824 Joseph Asidin – patent of Portland cement

1844 Isaac Charles Johnson – clinker burnt over shrinkage temperature

1840-42 Construction of the Chain Bridge in Budapest – on-site production of Roman cement (natural cement)

1860 Lábatlan, Piszke – The first cement factories in Hungary

1860-89 Establishment of several cement factories all over the country (Beocsin, Nyergesújfalu, Mogyoróska, Újaki(Obuda), Gurahonc, Lédec) + continuous cement import (mainly from Austria)

1897 Prescriptions of the Hungarian Association for Architects and Engineers (the first standard for cement)
**COMPONENTS**
- water
- aggregates
  - sand
  - rock flour
- binder
  - lime
  - gypsum
  - hydraulic materials
  - cement
- additives
  - pigments
  - etc.

**AGGREGATES & AGENTS OF HISTORIC MORTARS**
- sand
  - fluvial sand
  - shifting sand
  - sea sand
- crushed stone
- fine stone dust
- marble dust
- charcoal
- straw
- animal hair
- secondary binder
- brick dust
- volcanic ash
- secondary binder
plastering mortars
- mud mortar
- lime mortars
- gypsum mortars
- hydraulic mortars
  - natural hydraulic lime mortars
  - mortars with hydraulic additives
  - mortars with pozzolan
  - Roman cement mortar
  - Portland cement mortar

- lime mortar
- hydraulic lime mortar
- gypsum plaster (plaster of Paris)
- cement mortar
- cocciopesto (lime mortar with brick dust)
- other mortars

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CEMENT TYPES

The production of the cement fabric in Lábatlan (Hungary) between 1878 and 1900

<table>
<thead>
<tr>
<th>Year</th>
<th>Roman cement (t)</th>
<th>Portland cement (t)</th>
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<tr>
<td>1878</td>
<td>1200</td>
<td>10</td>
</tr>
<tr>
<td>1880</td>
<td>1200</td>
<td>10</td>
</tr>
<tr>
<td>1885</td>
<td>2180</td>
<td>510</td>
</tr>
<tr>
<td>1890</td>
<td>7100</td>
<td>1090</td>
</tr>
<tr>
<td>1895</td>
<td>7100</td>
<td>1090</td>
</tr>
<tr>
<td>1900</td>
<td>8610</td>
<td>10980</td>
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CEMENT TYPES

Roman cement
Portland cement
DECORATIVE PLASTER COATINGS

- stukko-lustro
- tadelakt
- artificial marble types
- calce rasata

SURFACE DECORATION OF THE PLASTER COATINGS

- patterned plaster surfaces
- fresco
- pargeting
- sgraffito
- plaster inlay
- plaster relief
- etchwork in plaster

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STUKKO-LUSTRO

work sequence:

1. course-grained lime plaster layer
2. smoothing
3. fine-grained lime plaster layer
4. smoothing
5. course-grained plaster with marble flour
6. smoothing
7. base of the painting
8. smoothing
9. painting
CALCE RASATA
work sequence:
1. wetting the wall
2. 2 coats of plaster
3. smoothing
4. rubbing (with a sponge)
5. drying (binding)
6. wetting the wall
7. 4-5 coat of smoothed, colored limewash
8. polish
9. making waterproof

TADELAKT
work sequence:
1. base coat of normal plaster
2. coat of Tadelakt mortar
3. rubbing (with a board)
4. smoothing
5. rubbing (with pebble)
6. polishing
ARTIFICIAL MARBLE

work sequence:
1. base coat of plaster
2. smoothing coat
3. preparing color rolls of the gypsum pulp
4. marble-like smear of the gypsum rolls on the surface
5. drying
6. 3x polishing + scraping
7. linseed oil + polishing

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work sequence:
1. 2 or 3 coat of base plaster
2. 2 or 3 coat of lime plaster of marble flour
3. rubbing (with a board/trowel)
4. several coat of whitewash mixed with color marble flour
5. polishing

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PATTERNED PLASTER SURFACES

pattern types:
• rubbed
• broomed
• scratched
• raked
• pointed
• etc.

tools:
• plaster broom
• rake
• wire brush
• metal comb
• etc.

FRESCO

work sequence:
1. cleaning the wall
2. wetting the wall
3. two base coats of plaster
4. coarse-grained base coat of the painting
5. fine base coat of the painting
6. whitewash
7. painting

tools:
• paintbrushes
• templates
• etc.
PARGETING technology:
- gypsum- or cement plaster
- rough structure or precast elements

the base:
- cast cement
- cast metal (zinc or tin)
- terracotta
- gypsum

tools:
- plastering tools
- moulding template
- scraper
- other templates

RESTORING OF MOULDINGS
- cleaning the surface, revealing the original forms
- selecting material
- to mould the negative form (e.g. with gypsum)
- preparing the moulding template, fastening the laths
- moulding:
  - base coat
  - first coat
  - rough coat
  - sharp coat
  - finishing coat
SGRAFITTO

technology:
1. base coat of plaster
2. colored layers of plaster
3. finish coat
4. manufacturing the pattern

tools:
• chisels
• rulers
• spoons
• blades

ETCHWORK IN PLASTER

technology:
1. plastering
2. making the etching
3. paint the lines

PLASTER INLAY

technology:
1. plastering
2. scraping according to the patterns
3. fill with color mortar
4. smoothing
5. polishing

PLASTER RELEIF
1. diagnostics, investigation of the structures – analysing the technical needs
   - moisture
   - salt load
   - mechanical properties

2. suggested method (in case of no confronting technical needs)
   - use of the original (historic material)
   - preserving the original fabric of the building
   - equal technology to the original one

The treads of restoring with altering material / improper technology:
- removing the original facture /material the building losing historical character/value
- material incompatibilities - improper (self-destroying) solutions
- aesthetic failures
- **thick mortar** coating covers the fine details of the surface (disfiguration)

- the **color** of the used new material can be different from the host one

- restoring the building with different material – the **vapor transport** capacity could be changed as well

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**Re-pointing, re-grouting**

- re-pointing, re-grouting with the original material

- in case of lime mortar - removing cement pointing if the wall was re-grouted with cement earlier – and it can be removed without damaging the bricks/stones

- in case of 19th century and early 20th century buildings, where originally Portland cement was used – it should not be changed unless it is technically inevitable
Restoring material for lime mortars

- every effort should be taken to match with the composition of the original material

- similar vapor-transport capacity needed as the original material has

- no higher strength recommended than the original material has

- complex investigation of the structural system (vapor stream, frost hazard etc.) have to be proceeded

- for fine work - 2-3 years lime putty should be used

Suggested compositions for Roman cement mortars (ROCEM)

<table>
<thead>
<tr>
<th>Application</th>
<th>Aggregate</th>
<th>Cement-aggregate ratio</th>
<th>w/c</th>
</tr>
</thead>
<tbody>
<tr>
<td>for cast elements</td>
<td>Ø &lt; 10mm (round)</td>
<td>1 : 2 (1 : 3)</td>
<td>0.65</td>
</tr>
<tr>
<td>for pargeting</td>
<td>Ø &lt; 4mm (main fraction: 0.25mm)</td>
<td>1 : 1.5</td>
<td>0.6</td>
</tr>
<tr>
<td>for pargeting (finish coat)</td>
<td>Ø &lt; 2.5 (1.25)mm</td>
<td>1 : 1</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Remarks:
- time of binding - 30 min
- citrus acid can be used as retarder
- 1 hour follow up time within two layers
- the thickness of a coat is 3-60 mm
- cleaning the surface – removal of paints (techniques depending on the material)
- treating the cracks
- completion with mortar defined by composition analyses of the original material
- surface coatings – with the same material if possible

- analyzing the ingredients (aggregates, lime, cement)

- the early Portland cements are similar mortars to Roman cement

- plastering work – depending on the ingredients’ ratio

- post treatment

- fiber or mesh reinforcement – depending on the wall (base) structure, etc.
Special mortars for evaporation

Use of mortars with high micorporosity and capillarity.

**Traditional method**
- lime mortar mixed with charcoal dust

**Modern materials**
- modern mortar with microporous additives
- pre-fabricated traditional mortar officially tested, with CE marking
**Special mortars for desalination**

in case of high salt load in the wall

1. Use of mortars with high microporosity and capillarity that "pulls out" the salts from the wall (building a sacrificial coat)

2. If this sacrificial coat is full of salt, it should be changed depending on the state of the wall:
   - with a new desalinating coat
   - with an evaporating coat

**Restoring paints on plastering**

1. If the original painting at least partially exists – it should be analyzed (color, pigments, ingredient materials, etc.)

2. If a new paint is to be chosen – it should let sufficient vapor-transport through according the wall’s capacity (e.g. lime-paints, silicate paints)
1. How do we know what kind of material do we have on the walls?

2. Certification (ETA, CE)

3. Garante and lasting

4. Budget

THANK YOU FOR YOUR ATTENTION!
REFERENCES

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