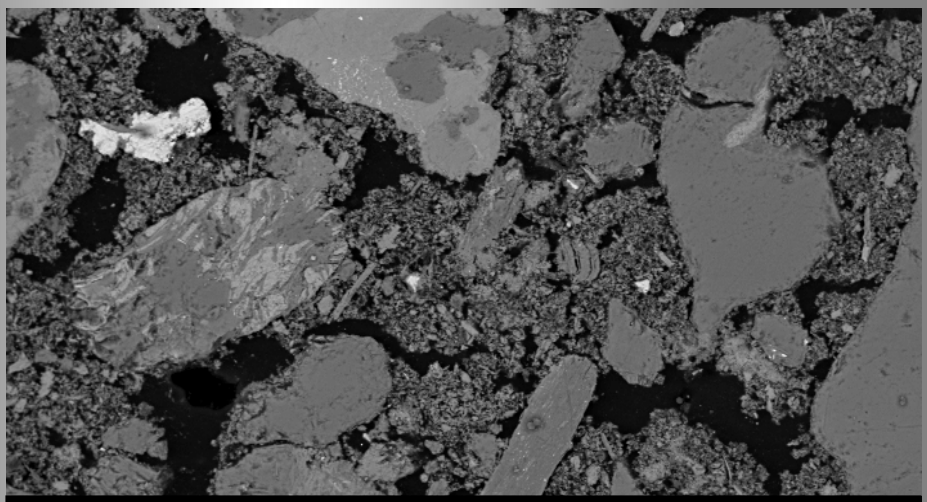


MATERIAL & TECHNOLOGY OF PARGETING AND RENDERED WALLSURFACES

October 2012

HISTORIC OVERVIEW

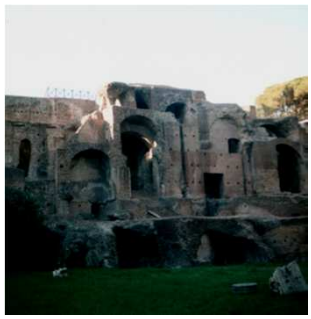
Neolithicum

Surfaces and mortars

- mud-mortar
- stone without mortar

Mortars
- lime mortar
- lime mortar + volcanic ash (pozzolanic ash)
- lime mortar + brick dust (Aegean area)
- gypsum mortar

Surfaces
- brick
- stone
- plaster
- painted surfaces

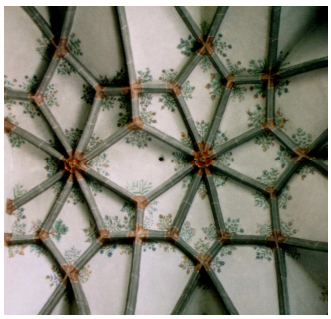


HISTORIC OVERVIEW

Ancient
Egypt
Greece
and Rome

Surfaces
- brick
- stone
- plaster
- painted surfaces

Mortars
- lime mortar
- cocciopesto in cellars (Venice)
- cocciopesto plasters in swimming pools (turkish bath)



HISTORIC OVERVIEW

Middle Age

Surfaces
•brick / stone
• stone mouldings
+ rendered surfaces

Mortars
•lime mortar
•cocciopesto

HISTORIC OVERVIEW

Renaissance

Surfaces
•brick / stone
• rendered mouldings (quoin and window frames) + rendered surfaces (=pargeting – „plaster architecture")

Mortars
•lime mortar
•gypsum mortar
•17th century - trass (Nette, Bohr) – Dutch Dam constructions

HISTORIC OVERVIEW

Baroque

HISTORIC OVERVIEW

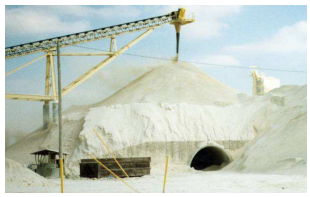
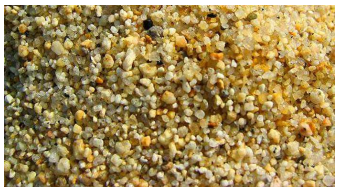
Classicism
19th century

Surfaces
• brick / stone
• stone quoins, window frames
+ rendered surfaces

Mortars
•lime mortar
•all historic hydraulic mortar
•natural hydraulic lime (NHL)
•spread of cements

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 Aspdin – patent of Portland cement
1840-42	Construction of the Chain Bridge in Budapest – on-site production of Roman cement (natural cement)
1844	Isaac Charles Johnson – clinker burnt over shrinkage temperature
1860	Lábatlan, Piszke – The first cement factories in Hungary
1860-89	Establishment of several cement factories all over the country (Beocsin, Nyergesújfalu, Mogyoróska, Újlak(Óbuda), 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

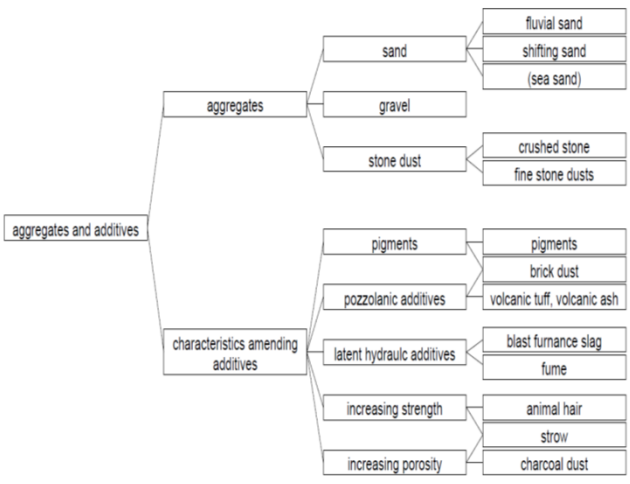
- sand
- rock flour

binder

- lime
- gypsum
- hydraulic materials
- cement

additives

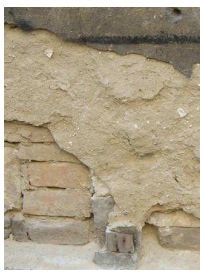
- pigments
- etc .



AGGREGATES & AGENTS OF HISTORIC MORTARS

MORTARS

- plastering mortars
  - mud mortar
  - lime and dolomithic lime mortars
  - gypsum mortars
  - hydraulic mortars
    - lime mortar + pozzolanic / latent hydraulic additives
      - lime mortar + brick dust
      - lime mortar + pozzolanic additives
      - lime mortar + latent hydraulic additives
    - natural hydraulic lime mortars
    - Roman cement mortar
    - Portland cement mortar


lime mortar


cocciopesto


Roman cement mortar


Roman cement mortar


Portland cement mortar


lime stone

MORTARS

lime mortar

hydrauilc lime mortar

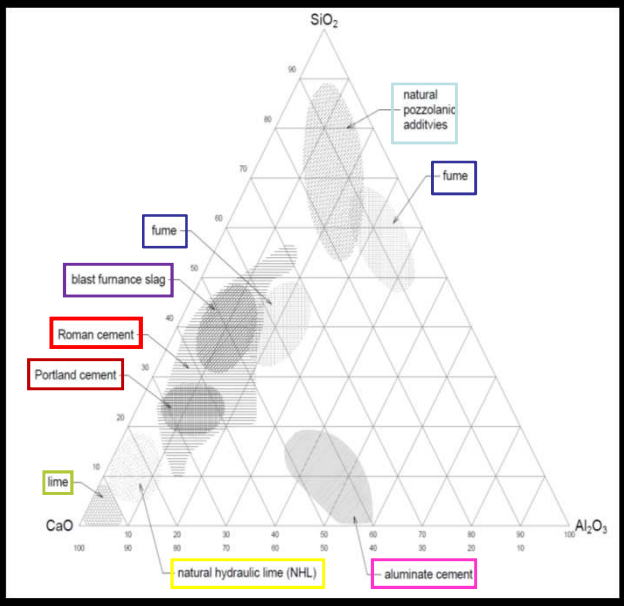
gypsum plaster (plaster of Paris)

RC mortar

PC mortar

cocciopesto (lime mortar with brick dust)

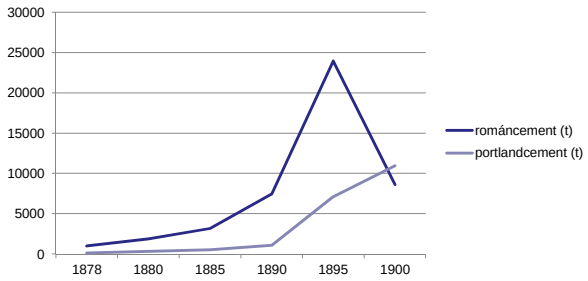
other mortars



CEMENT TYPES

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

Year	Roman cement (t)	Portland cement (t)
1878	1000	120
1880	1890	340
1885	3180	510
1890	7490	1090
1895	23950	7100
1900	8610	10980



CEMENT TYPES

Roman cement

Portland cement

DECORATIVE PLASTER COATINGS

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

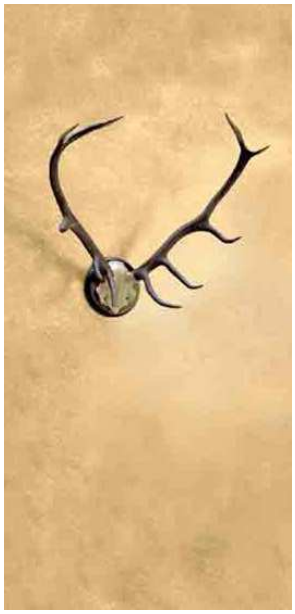
SURFACE DECORATION OF THE PLASTER COATINGS

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

STUKKO-LUSTRO

work sequence:

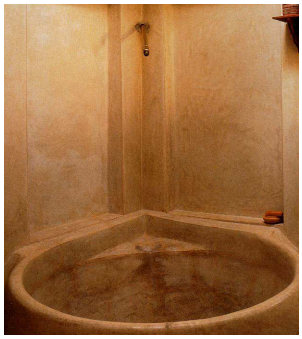
1. course-grained lime plaster layer
2. smoothing
3. fine-grained lime plaster layer
4. smoothing
5. course-grained plaster with marble flour
6. smoothing
7. base of the painting
8. smoothing
9. painting

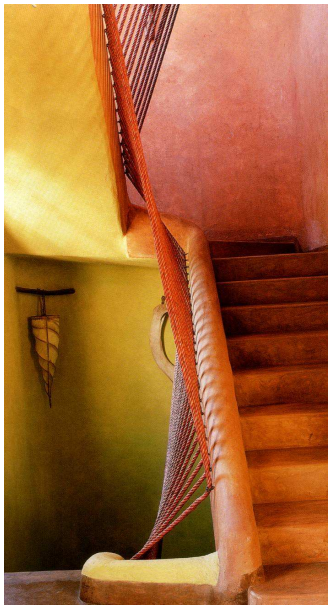


CALCE RASATA

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.lenseed oil + polishing

ARTIFICIAL MARBLE

work sequence:

- 2 or 3 coat of base plaster
- 2 or 3 coat of lime plaster of
- marble flour
- rubbing (with a board/trowel)
- several coat of whitewash mixed with color marble flour
- polishing

PATTERNED PLASTER SURFACES

pattern types:

- rubbed
- broomed
- scratched
- raked
- pointed
- combbed
- etc.

tools:

- plaster broom
- rake
- wire brush
- metal comb
- etc.

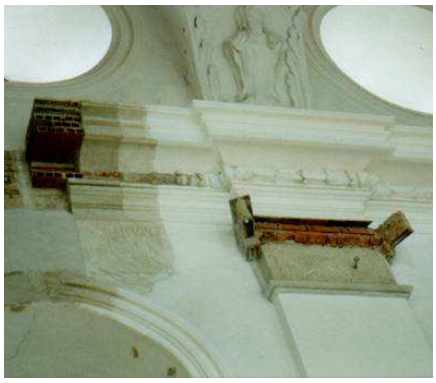
FRESCO

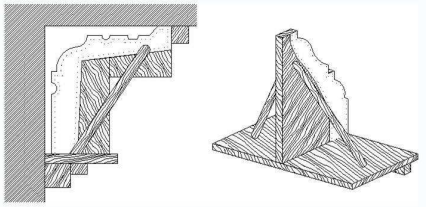
work sequence:

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

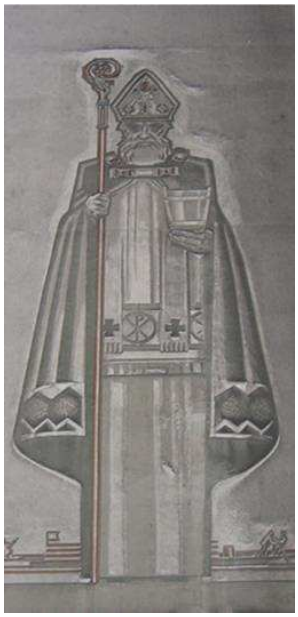
- cleaning the surface, revealing the original forms

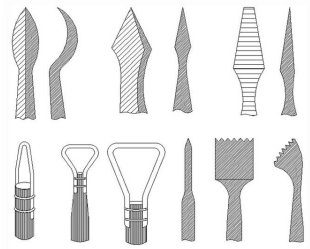
- selecting material

- 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





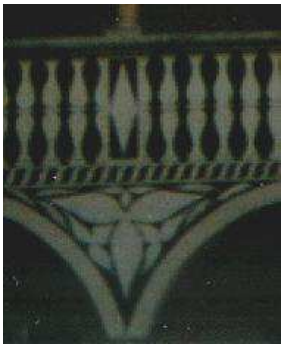
SGRAFITTO

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 REILEF

RESTORING HISTORIC PLASTERS

•analyse

•guidelines

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

TREADS/ HAZARDS OF IMPROPER RESTORING

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**

FREQUENTLY OCCURRING FAILURES OF RESTORING

- **thick mortar** coating covers the fine details of the surface (dis-figuration)

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

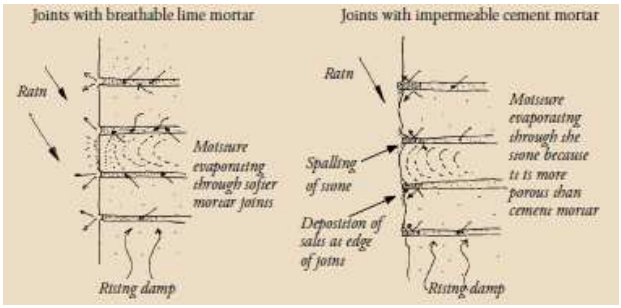
- restoring the building with different material – the **vapor transport** capacity is also will be likely to differ

RESTORING LIME AND HYDRAULIC LIME MORTARS

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 if 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 LIME AND HYDRAULIC LIME PLASTERS

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

RESTORING ROMAN CEMENT PLASTERS

Suggested compositions for Roman cement mortars (ROCEM)

Application	Aggregate	Cement-aggregate ratio	w/c
for cast elements	∅ < 10mm (round)	1 : 2 (1 :3)	0,65
for pargeting (base coat)	∅ < 4mm (main fraction: 0,25mm)	1 : 1,5	0,6
for pargeting (finish coat)	∅ < 2,5 (1,25)mm	1 : 1	0,6

Remarks:

- time of binding – 30 min
- citric acid can be used as retarder
- 1 hour follow up time within two layers
- the thickness of a coat is 3-60 mm

RESTORING ROMAN CEMENT PLASTERS

- **cleaning** the surface – removal of paints (techniques depend ing 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

RESTORING PORTLAND CEMENT PLASTERS

- analyzing the ingredients (aggregates, !lime, cement)

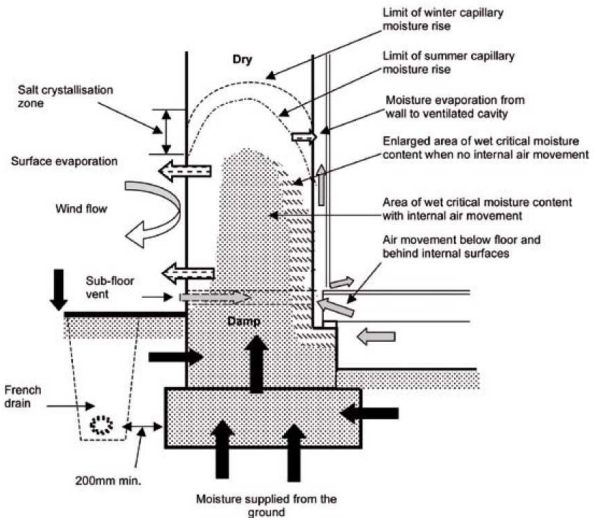
- the **early Portland cements** are some way similar to Roman cement

- plastering work – depending on the ingredients' ratio

- post treatment

- fiber or v. mesh reinforcement – depending on the wall (base) structure, etc.

RESTORING WALL SURFACES – VAPOR TRANSPORT



RESTORING PLASTER SYSTEMS FOR EVAPORATION

Special mortars for evaporation

Use of mortars with high micorporousity and capillarity.

Traditional method	**Modern materials**
- lime mortar mixed with charcoal dust	-modern mortar with microporous additives
	- pre-fabricated traditional mortar officially tested, with CE marking
	- renovation plaster
	- multi-layered plaster system (WTA)

RESTORING PLASTER SYSTEMS FOR DESALINATION

Special mortars for desalination

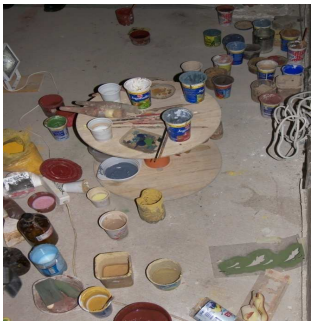
in case of high salt load in the wall

1. Use of mortars with high micorporousity 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 have at least the same vapor-transport capacity as the wall's capacity is (e.g. lime-paints, silicate paints)



CHALLENGES

1. How do we know what kind of material do we have on the walls?
2. Certification (ETA, CE)
3. Garantee and lasting
4. Budget

THANK YOU FOR YOUR ATTENTION !

REFERENCES

http://autonopedia.org/buildings_and_shelter/Rural_Building/Plaster_and_Render.html 2010-10-30

http://www.rocare.eu/page/start.html 2010-10-30

Roman Cement – Volume 5 of a series EU-project ROCEM

Bereczky E. – Reichard E.: *A magyar cementipar története.* Budapest, Szilikátipari Központ

és Tervező Intézet, Cement és mészművek, 1970, p. 151

Dennis Urquhart (ed.): *Conversion of Traditional Buildings Application of the Scottish Building Standards PART 1-2*. Historic Scotland - Technical Conservatuon Research and Education Group , Edinburgh, 2007

http://www.rtbullard.com/stucco/progress/progress81.htm 2010-11-02

Richard Fawcett: *The Conversion of Architectural Ancient Monuments in Scotland. Guidance on Principles.* Historic Scotland – Heritage Policy, Edinburgh, 2001

The use of lime & cement in traditional buildings - HS INFORM, Historic Scotland, Edinburgh, 2007

Vidovszky, István, Katalin Bukta, and Péter Simon. "Vakolt homlokzatok helyreállításának feltételei Magyarországi piaci viszonyok mellett." *Építés-Építészettudomány* 42.1 (2014): 43-56.

Weber, Helmut u.a.: *Fassadenschutz. Der Leitfaden für die Sanierung, Konservierung und Restaurierung von Gebäuden.* Kontakt & Studium – Band 40. Expert Verlag, Grafenau,1980.

Reichel, A. – Hochberg, A. – Köpke, C.: *Plaster, Render, Paint and Coatings.* Birkhauser, Basel–Boston–Berlin 2004.