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TECHNICIAN TRAINING FOR THE CONSERVATION OF MOSAICS

PART 1
THE CONSERVATION OF IN SITU MOSAICS

Conservation mortars for in situ mosaics:

their formulations

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Factors influencing the properties of a mortar

- Non-hydraulic or hydraulic properties
- Binder-aggregate ratio
- Particle-size distribution of aggregates
- Amount of water
- Color and texture if the mortar will be visible

Non-hydraulic or hydraulic properties

A lime-based mortar with non-hydraulic properties is made with a non-hydraulic binder and inert aggregates.
It needs to be in contact with air to set.

A lime-based mortar with hydraulic properties is obtained in several ways. It can be a mixture of non-hydraulic lime and aggregates giving hydraulic properties (fired clay and/or volcanic earth and rocks) or a mixture of hydraulic lime and inert aggregates, or one that gives hydraulic properties.
Most of the setting is done in contact with water.

Binder/Aggregate Ratio

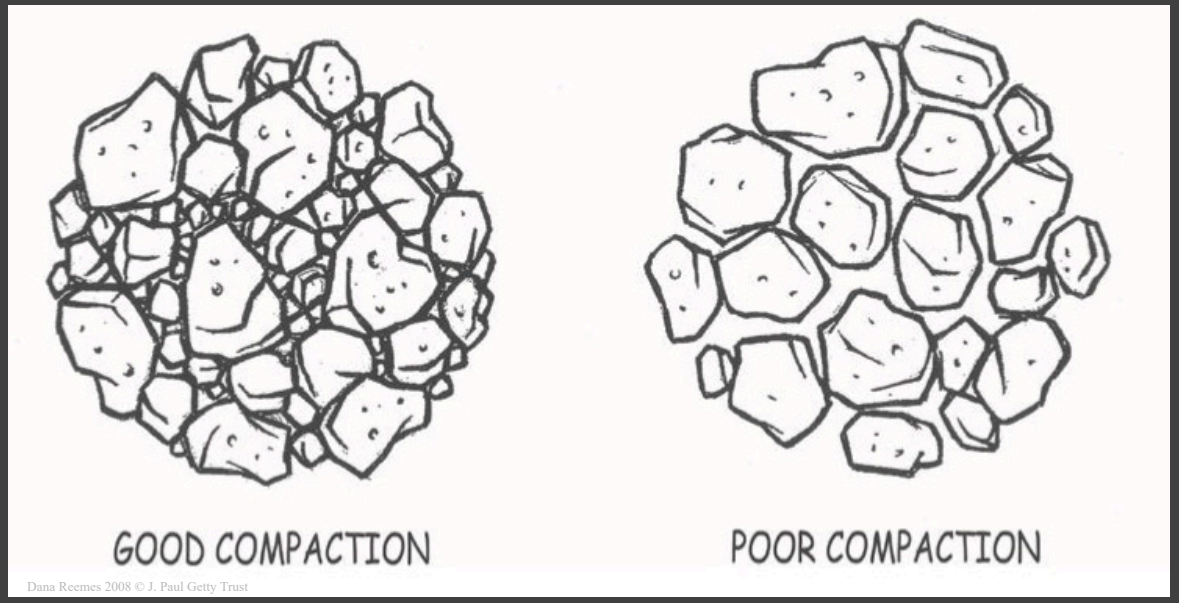
The binder/aggregate ratio is the ratio between the amount of binder and the amount of aggregates contained in the mortar. That ratio significantly influences the properties and the performance of a mortar.

A mortar that contains more lime is called ‘lime-rich mortar’. It is more malleable, easier to work, and more adherent, but it will have a stronger tendency to shrink and crack more easily during setting.

A mortar that contains less lime is called ‘lime-poor mortar’. It is more difficult to work and less adherent, but it will have a lesser tendency to shrink.

Particle-size distribution of aggregates

The particle-size distribution of aggregates influences the properties and performance of a mortar. To make a good mortar, aggregates should have a good particle size distribution between coarse and fine particles.



Amount of water

Mortar with too much water

Mortar with the right amount of water

Mortar with too little water

Color and texture if the mortar will be visible

The visual appearance of a mortar depends on the color of the binder and aggregates.

Beige background mortar and colored particles

White background mortar and black particles

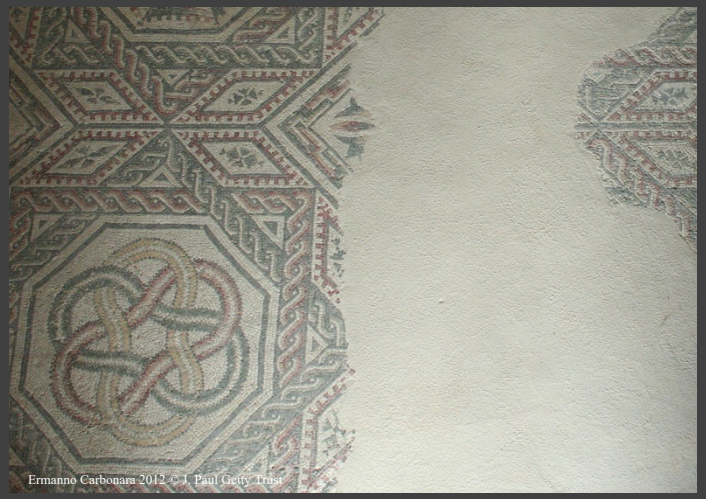
A mortar for mosaic stabilization should consider:

- Quality of materials
- Affinity with original materials
- Reversibility
- Visual impact

Quality of materials

To obtain a mortar that is stable and durable over time, binders and aggregates without soluble salts should be used.

Poor quality



Good quality

Poor quality

Affinity with the original materials

A mortar should have a good affinity with the ancient materials and, in particular, it should have a hardness and porosity similar to the materials of the mosaic.

Poor affinity

Good affinity

Poor affinity

Reversibility

A stabilization mortar should be reversible; that is, it should be removable without damaging the mosaic.

Not very reversible

Very reversible

Visual impact

The color and texture of a mortar should not stand out. The mosaic surface should always remain visually dominant.

Mortar with a pronounced visual impact

Low visual impact

Mortar with a pronounced visual impact

Formulation of different mortars for different stabilization interventions

Resetting detached tesserae

1 lime putty

½ white sand .....0 – 0.5 mm
½ beige gravel.....0 – 0.5 mm

BINDER : AGGREGATE RATIO = 1 : 1

Parameters for the formulation of a mortar

- Non-hydraulic or hydraulic properties
- Binder-aggregate ratio
- Particle-size distribution of aggregates
- Amount of water
- Color and texture if the mortar will be visible

Filling of voids between preparatory layers
liquid mortar – grout

1 lime putty
1 natural hydraulic lime NHL 3.5

1 brick powder.....0 – 0.25 mm
½ sand.....0 – 0.25 mm
½ stone powder.....0 – 0.25 mm

2 lime putty

1½ brick powder.....0 – 0.25 mm
½ stone powder.....0 – 0.25 mm

BINDER : AGGREGATE RATIO = 1 : 1

Parameters for the formulation of a mortar

- Non-hydraulic or hydraulic properties
- Binder-aggregate ratio
- Particle-size distribution of aggregates
- Amount of water
- Color and texture if the mortar will be visible

Filling of interstices

Light color

1 lime putty

1 white sand.....0 – 0.5 mm
1 light beige gravel.....0 – 1 mm

Dark color

½ lime putty
½ natural hydraulic lime NHL 3.5

1 white sand.....0 – 0.5 mm
½ beige gravel .....0 – 1 mm
½ black gravel .....0.5 – 1 mm

BINDER : AGGREGATE RATIO = 1 : 2

Parameters for the formulation of a mortar

- Non-hydraulic or hydraulic properties
- Binder-aggregate ratio
- Particle-size distribution of aggregates
- Amount of water
- Color and texture if the mortar will be visible

Infilling of lacunae – preparatory layer

Thin preparatory layer

2 lime putty

1 sand.....0 – 3 mm
1 gravel .....0 – 1 mm
1 gravel .....1 – 3 mm
2 crushed brick.....0 – 4 mm

Thick preparatory layer

2 – lime putty
4 – natural hydraulic lime NHL 3.5

3 – sand.....0 – 3 mm
3 – gravel .....1 – 3 mm
3 – gravel .....3 – 5 mm
2 – crushed brick.....0.5 – 5 mm
4 – crushed brick.....5 – 10 mm

BINDER : AGGREGATE RATIO = 1 : 2.5

Parameters for the formulation of a mortar

- Non-hydraulic or hydraulic properties
- Binder-aggregate ratio
- Particle-size distribution of aggregates
- Amount of water
- Color and texture if the mortar will be visible

Infilling of lacunae - surface layer

Small lacunae

2 lime putty

1 white sand.....0 – 1 mm
1 beige gravel .....0 – 1 mm
1 beige gravel .....1 – 3 mm
1 washed black gravel.....1 – 2 mm
1 light red gravel .....2 – 3 mm

Large lacunae

1 lime putty
1 natural hydraulic lime NHL 3.5

1 white sand.....0 – 1 mm
1 beige gravel .....0 – 1 mm
1 beige gravel .....1 – 5 mm
1 washed black gravel .....1 – 3 mm
1 light red gravel .....2 – 4 mm

BINDER : AGGREGATE RATIO = 1 : 2.5

Parameters for the formulation of a mortar

- Non-hydraulic or hydraulic properties
- Binder-aggregate ratio
- Particle-size distribution of aggregates
- Amount of water
- Color and texture if the mortar will be visible

Different tools for mixing mortar

Spatula and small bowl

Trowel and mortar bucket

Shovel and wheelbarrow

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MOSAIKON is a partnership of four institutions: the Getty Conservation Institute, the Getty Foundation, ICCROM, and ICCM. The aims of the project are to strengthen the network of professionals concerned with the conservation, restoration, maintenance, and management of mosaic heritage in the southern and eastern Mediterranean region; provide training to a variety of individuals involved in mosaics conservation and, more generally, with the management of archaeological sites and museums with mosaics; work with national and international bodies to provide a more favorable legislative, regulatory, and economic environment for the conservation of mosaics in the Mediterranean; and promote the dissemination and exchange of information.