Core
CONSERVATION

The Roman traditional lime waterproofing system

Waterproofing Old Cellars and Basements

Technical Guide

The Problem

The primary challenge in converting underground areas into a useful space is how to deal with moisture; how to keep water out from the building without causing long-term damages to the building fabric.

The main moisture sources affecting basements are:

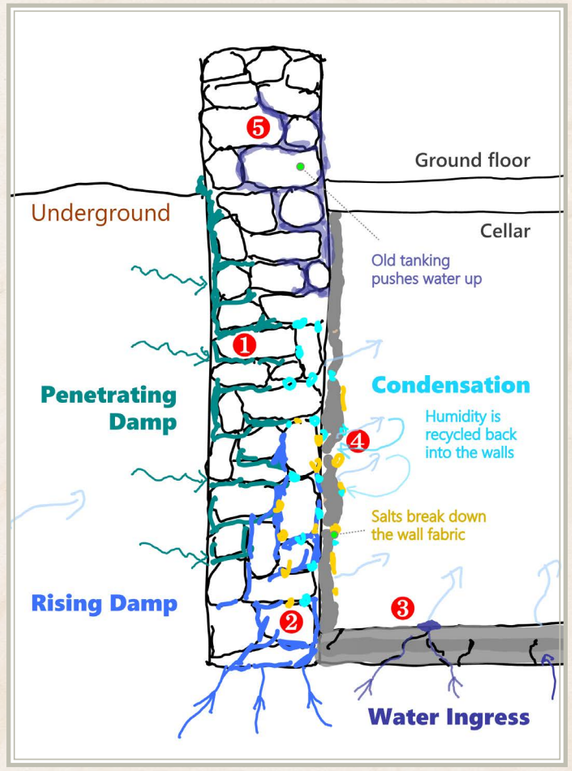
1. **Penetrating damp**: being underground, the walls are in permanent contact with the damp soil. Water penetrates the wall fabric causing ongoing evaporation on the inner face of the walls.
2. **Rising damp**: old walls absorb water and salts from the ground resulting in rising damp.
3. **Water ingress**: aging, dampness and ongoing salt crystallization break down the pointing and the building fabric, making old basements susceptible to water ingress and leaks.
4. **Condensation** (and often mould): constant evaporation from the walls and floor [1, 2 & 3] results in high air humidity. This humidity – assisted by the hygroscopic effect of salts and inadequate ventilation – condenses on the cold evaporative surfaces, being recycled back into the walls.
5. **Dampness caused by past incorrect renovations**: renovating old cellars with non-breathable materials (cement pointing, tanking, impermeable membranes etc.) makes moisture accumulate behind them, water often being "pushed up" in the building, creating further dampness problems.

Making cellars and basement watertight consists of addressing all of these points, one by one.

Because the fabric of older buildings often contains a significant amount of moisture (kept in check by *ongoing natural evaporation*), the materials used for the renovation of these buildings must permit evaporation, i.e. must be breathable.

Most waterproofing solutions on the marketplace have been developed for newer buildings. They use modern waterproofing materials – cement, tar, plastic membranes etc. – that can block water, but they are **non-breathable, trap humidity, leading to an accumulation of moisture** behind them, damaging the old, historic building fabric long-term.

Many traditional materials that can last for decades in a damp-free environment, deteriorate quickly in the presence of elevated humidity and corrosive salts, thus not being suitable for the waterproofing of old cellars.



Most common moisture sources affecting old cellars

The Right Solution

The ideal waterproofing material for cellars of old and listed buildings is a lime plaster that satisfies the following somewhat contradictory requirements:

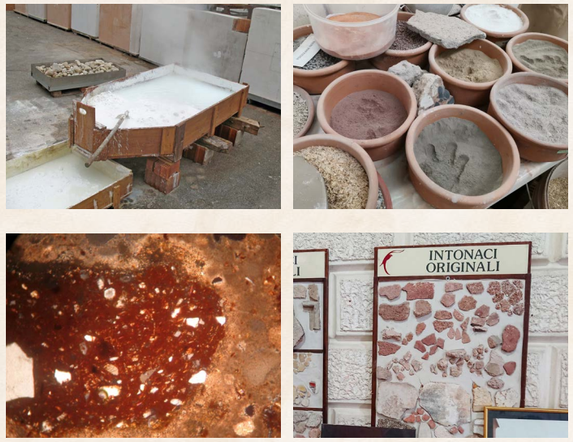
- **Be waterproof**: to completely *stop liquid water* in order to keep underground areas dry.
- **Breathable**: to let *water vapors pass through freely* to prevent the accumulation of moisture.
- **Resistant to salts**: salts are the primary reason behind the premature breakdown of lime plasters. A good lime plaster should be *able to cope with all salts* without being damaged by them.
- **Not too hard**: so it *won't damage the underlying softer building fabric* but resistant enough to withstand water pressure.
- **Long lasting**: have a long service life.

All this can be achieved with a traditional lime plaster of which origins stretch back to **ancient Rome**. Being outstanding architects and builders, the Romans have discovered that by adding **volcanic soils and other minerals** to lime, they can significantly alter its properties, especially its *mechanical strength* and *water resistance*, while *retaining its breathability*.

The materials most commonly added to lime were ***pozzolans*** *(volcanic soils or rock fragments)* and ***cocciopesto*** *(milled bricks or terracotta fragments)*. These reacted chemically with the free lime, forming *water resistant compounds*. Such mortars were able to *harden quicker* not only *in the presence of water* but even *underwater* in the total absence of air, and they are known as **pozzolanic mortars**.

It is important to understand that **the degree of porosity and breathability of lime plasters is primarily determined by the properties of lime** and not by its hydraulic additives, an important factor being the firing temperature of lime. By firing limestone at low temperatures (at around 850-900 °C), the *breathability of lime is retained*, while the carefully selected hydraulic additives make the mortar *fully waterproof*. These are different from today's NHL mortars, whose much higher firing temperatures (~1200 °C) impair their breathability.

These lime mortars have been extensively used by the

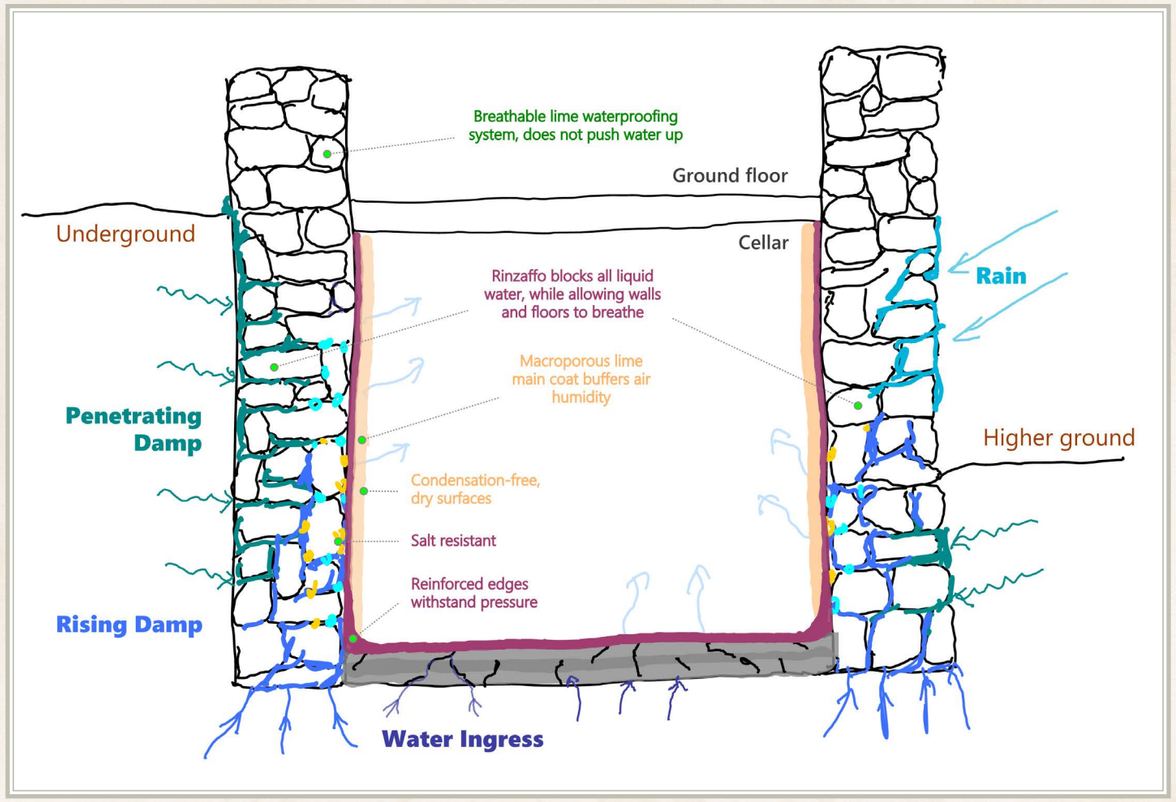


Mixing lime putty with volcanic minerals (pozzolans) can make lime renders waterproof while retaining their breathability

Romans in very demanding environments including ***sewers, ports, spas and aqueducts***. They have also been widely used in *Venice*, well suiting to the humid and aggressive environment of the Venetian lagoon.

Plastering Schedule & Application

For the waterproofing of old cellars in a building-friendly way the following action plan is recommended:

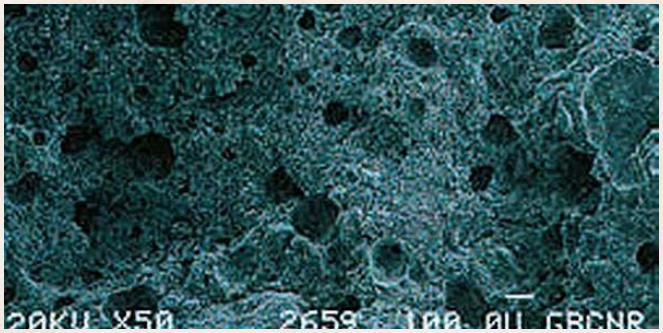


Waterproofing an old cellar with the breathable MGN lime waterproofing system

1. **Waterproofing lime base coat** [10 - 15 mm]

   Rinzaffo MGN is a microporous **breathable lime waterproof and salt-resistant base coat**. Its main role is to keep liquid water out of the basement to keep the walls dry.

   Rinzaffo's internal pore structural is formulated to stop (larger) liquid water molecules, while letting (smaller) water vapours molecules through, facilitating evaporation. This also *prevents the accumulation of vapor pressure* behind the waterproofing coat, which plays an important role in the detachment of non-breathable (e.g. cement) plasters.



Scanning electron microscope image of the Rinzaffo MGN base coat showing its unique micropore structure

   Application of the Rinzaffo MGN lime plaster alone *makes callars and basements waterproof*, resulting in dry surfaces suitable for storage. **Adequate ventilation** (e.g. extractor fan) must be put in place to ensure the discharge of water vapours.

2. **Main lime coat** [15 - 20 mm]

   When converting basements to living accommodation or public areas, the waterproofing base coat must be followed by a main (or thermal) lime plaster and a lime finish, or by plasterboard mounted on (ideally galvanized steel) battens, with an air gap behind. Dot-and-dabbing (gluing) MUST be avoided.

This solution can *withstand significant water pressure* including *hydrostatic pressure*. If the base coat is applied on both walls and *floors* it can also resolve the problem of *occasional flooding* due to rain, increased water table or flood. The floor must have enough structural rigidity so it can be made waterproof (e.g. an old concrete floor in decent condition).

Coccipesto plasters perform extremely well in basement areas regulate internal humidity very well.

Rinzaffo MGN and Cocciopesto MGN plaster for basements

Application

1. Preparation of the wall fabric

Hack off the old plaster, remove all loose parts and foreign materials (wood, tar, metals etc.). Clean the surfaces thoroughly to remove all salts, residues or loose bits.

2. Applying the Roman waterproofing base coat

Pour the contents of the package into the mixer adding **clean tap water only**. **Do not add any additives or other materials** (e.g. cement, gypsum etc.) **to the mix**. Mix it for about 3-5 minutes until a homogeneous, creamy paste is obtained.

On freestanding walls apply a 10 mm coat, covering the whole surface, **leaving no gaps**. For underground areas or subject to sideways pressure, apply two 10 mm coats with a fiberglass mesh in-between.

Darker spots of the first coat denote areas of insufficient thickness of the plaster. Patch them up with additional base coat before applying the next coat.

Dark patches: insufficient thickness

Uniform color indicates good coverage

Please contact us with any questions

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