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MASROP E – DERGİ

İMTİYAZ SAHİBİ: MASROP

The elimination of the rising damp from the walls in old buildings

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ÖZ

Eski binalarda duvarlarından yükselen nemin giderilmesi "onlar çölde inşa edilmiş olsa bile binaların nem saldırı için çeşitli yollar vardır, çünkü duvarları, nem yaşayacaktır", bu sözlerle Massari tarafından söylenmiştir adlı kitabında " Damp buildings ". Massary, eski ve yeni binalar için nem saldırı okuyor ilgi oldu ve nem sorunu olabilir nedenleri hasar büyük sorunlardan biri olarak, bu tehlikeli sorunu çözmek için çözümler bulma konusunda endişe bir İtalyan mimar ve binanın bozulmalar, ve biz mevcut su önleyebilirsiniz bu durumda, pek çok zararları ve binalara bozulmasını önleyebilirsiniz.Su çeşitli kimyasal reaksiyonlarda katalizör görevi görür ve biyolojik büyüme için önemli bir faktör olduğu gibi.

Anahtar Kelimeler: Restorasyon,Konservasyon, Nem, Taş,Yapı

ABSTRACT

"The walls will suffer from humidity even if they were built in the desert, because there are various ways for the attack of humidity to the buildings", these words were said by Massari in his book "Damp buildings".
Massary is an Italian architect who was interested in studying the attack of the humidity to the buildings, old and new, and was caring about finding solutions to solve this dangerous problem, as the problem of humidity is one of the greatest problems that can causes damages and deteriorations of the building, and in the case that we can avoid existing water, we can avoid many damages and deterioration to the buildings.
As the water acts as a catalyst in various chemical reactions, and is a key factor for the biological growth.

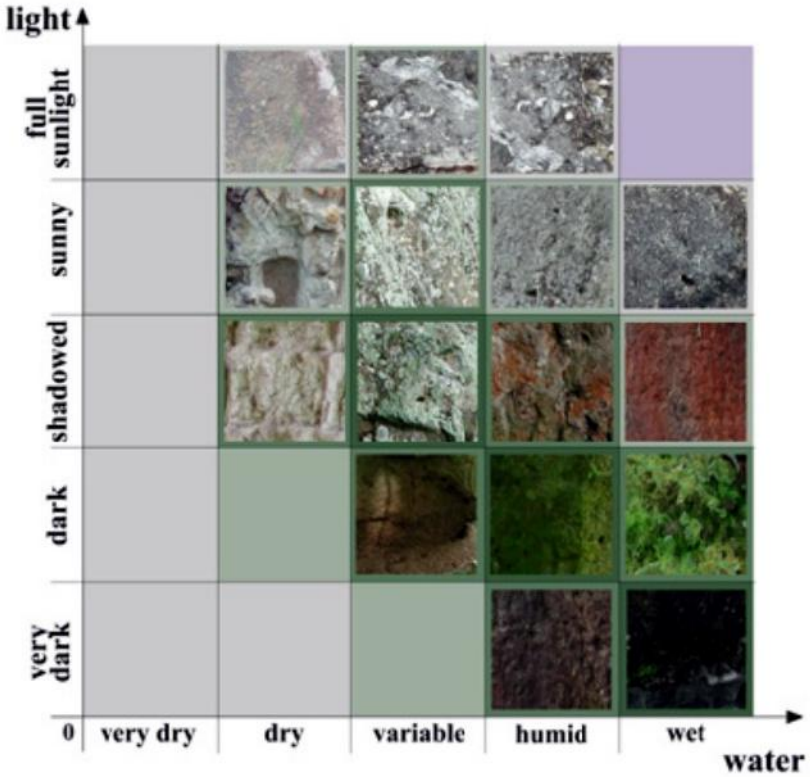
Key Words: Restoration, Conservation, Humidity,Stone,Structure

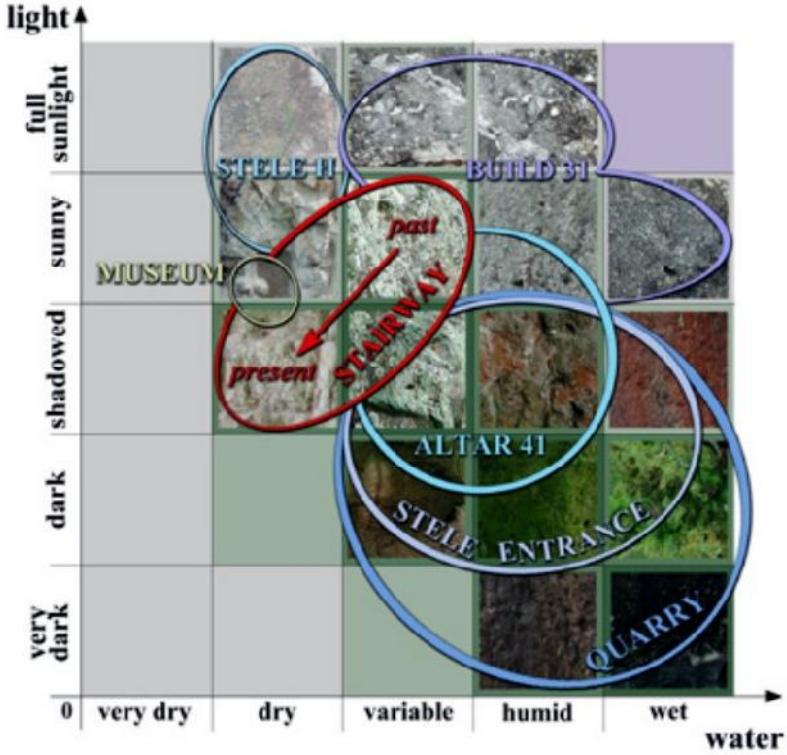
The elimination of the rising damp
from the walls in old buildings

"The walls will suffer from humidity even if they were built in the desert, because there are various ways for the attack of humidity to the buildings", these words were said by ***Massari*** in his book ***"Damp buildings"***.
Massary is an Italian architect who was interested in studying the attack of the humidity to the buildings, old and new, and was caring about finding solutions to solve this dangerous problem, as the problem of humidity is one of the greatest problems that can causes damages and deteriorations of the building, and in the case that we can avoid existing water, we can avoid many damages and deterioration to the buildings.
As the water acts as a catalyst in various chemical reactions, and is a key factor for the biological growth.

- The next 2 pictures explain a result of a research that was done by ***Giulia Caneva, Env. Biology Dep. "TRE" University , Rome, Italy .***
She had found that only in the case of the absence of the water that the biological growth will disappear completely, that means:

NO WATER = NO BIOLOGICAL GROWTH





- Classification of various types of humidity:

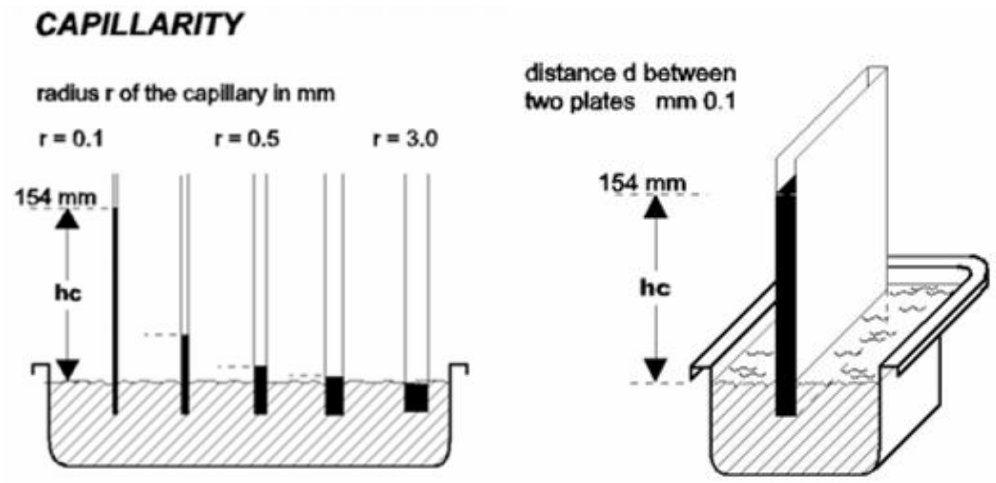
There are different ways for attacking the humidity to the buildings, so we can make classification of the types of the humidity:

1-By capillarity:

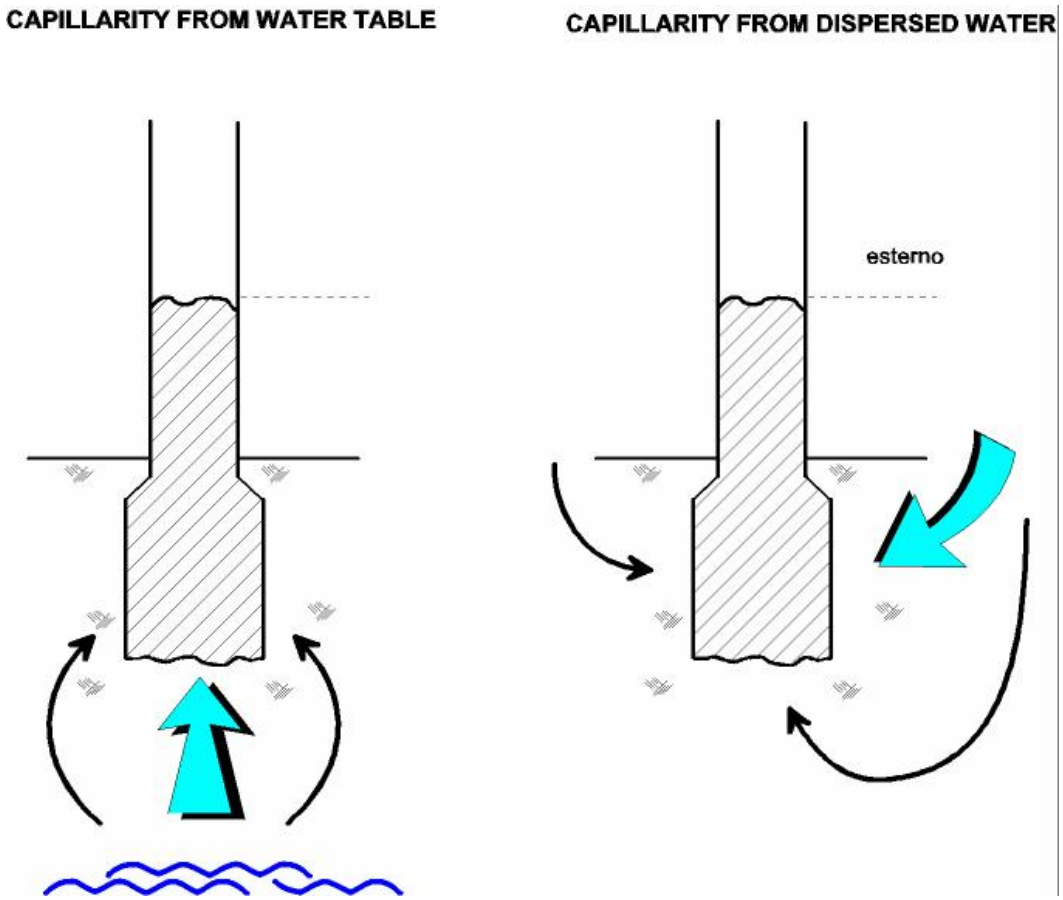
Capillary action, or capillarity, is the ability of a liquid to flow against gravity where liquid spontaneously rises in a narrow space such as a thin tube, or in porous materials such as paper or in some non-porous materials such as liquified carbon fibre. This effect can cause liquids to flow against the force of gravity or the magnetic field induction. It occurs because of inter-molecular attractive forces between the liquid and solid surrounding surfaces; If the diameter of the tube is sufficiently small,
then the combination of surface tension (which is caused by cohesion within the liquid) and forces of adhesion between the liquid and container act to lift the liquid. The height *h* of a liquid column is given by:

$$hc = \frac{42\,\delta}{D\,\rho\,g}$$

hc (m) ; δ = superficial energy (J/m²)
D = diameter of the capillary(m)
ρ = fluid density (kg/m³)
g = acc. gravity (9,8 m/sec²)

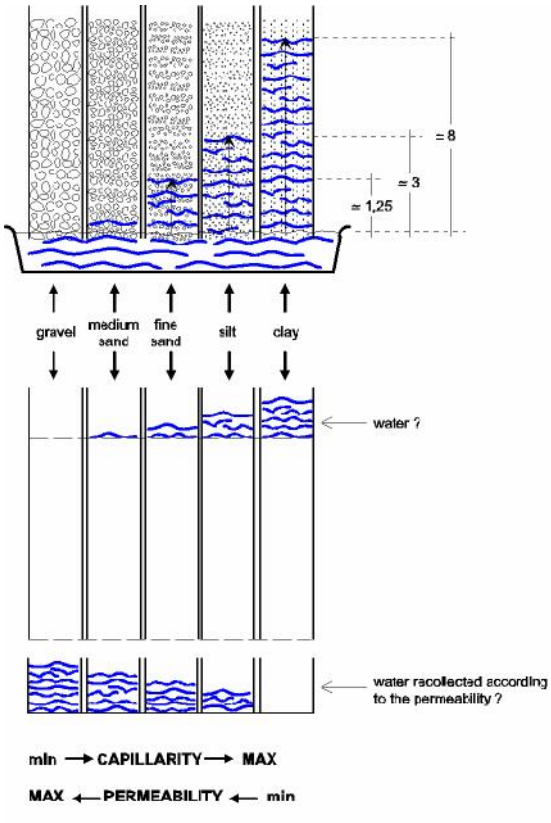


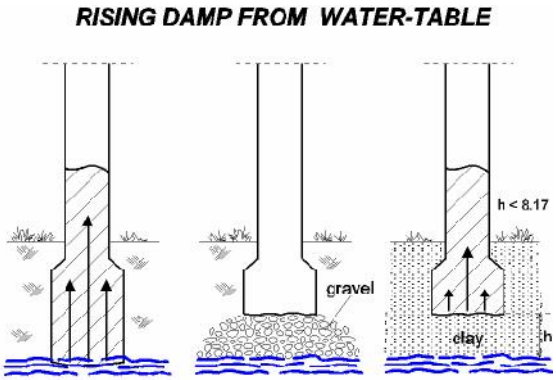
The rising damp caused by the capillarity, can be caused from the water-table or from dispersed water.

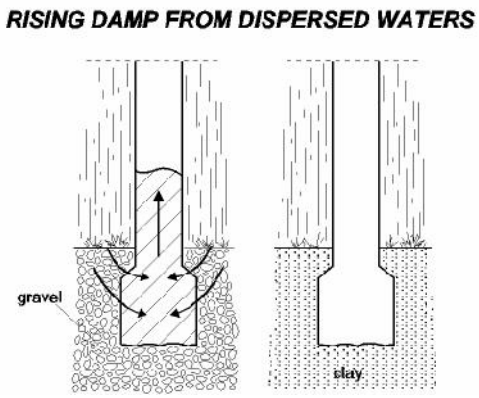


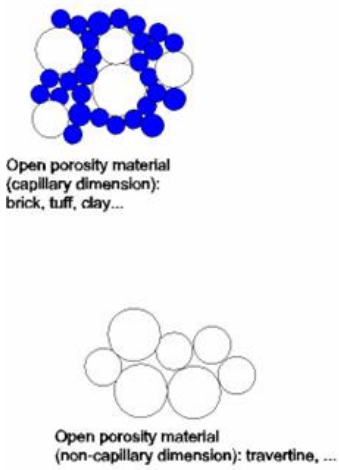
The capillarity depends on the kind of the material which was for building the walls, in the materials which have small Space between the molecular, the water will rise for a long distance instead of that, if the material have bigger Space between the molecular, the water will rise for a shorter distance.

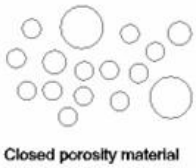
Also, the capillarity depends on the type of the soil under the buildings, the same rule of the material, small Space between the molecular, longer distance for rising water.
The design below, explain the relation of some materials and its capillarity with the rising of water in its inter-molecular, and also the soil.

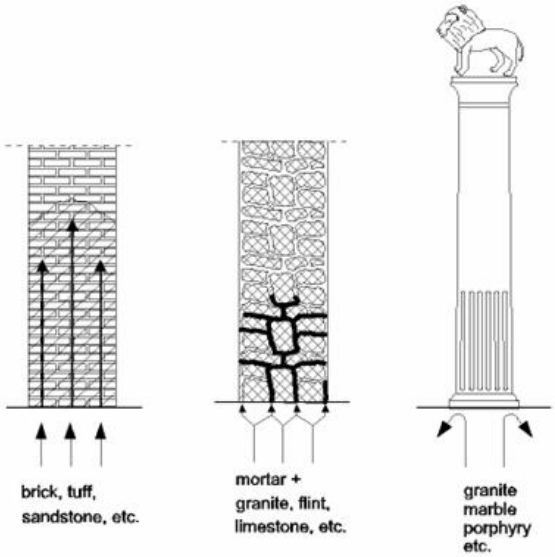




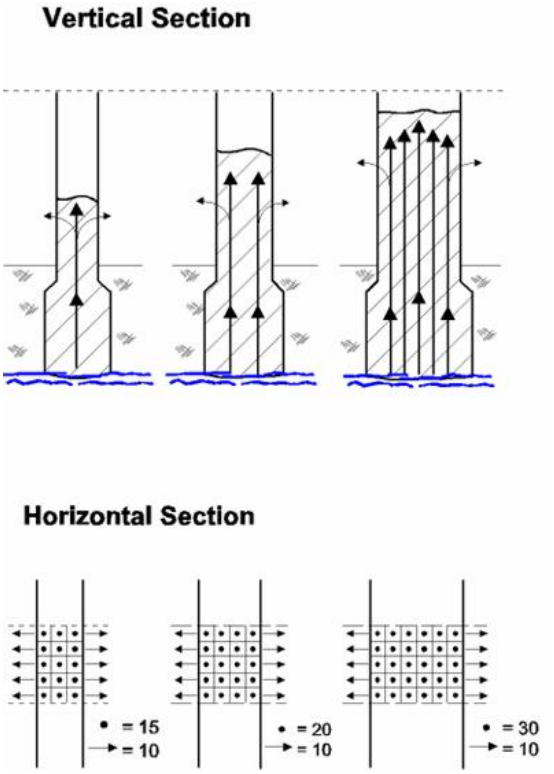


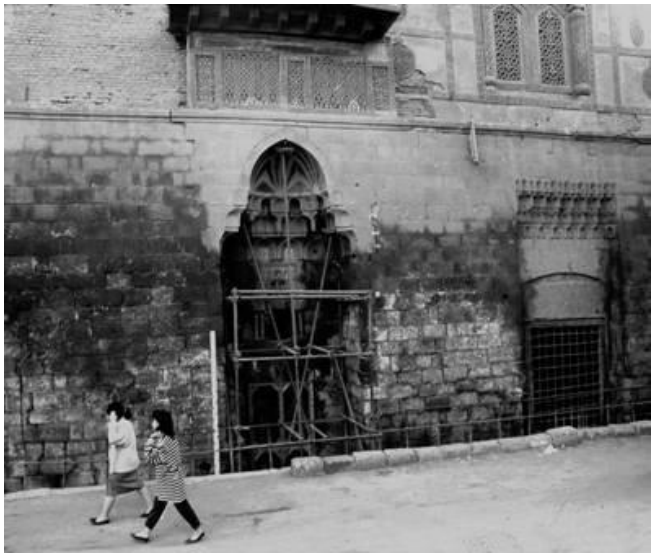




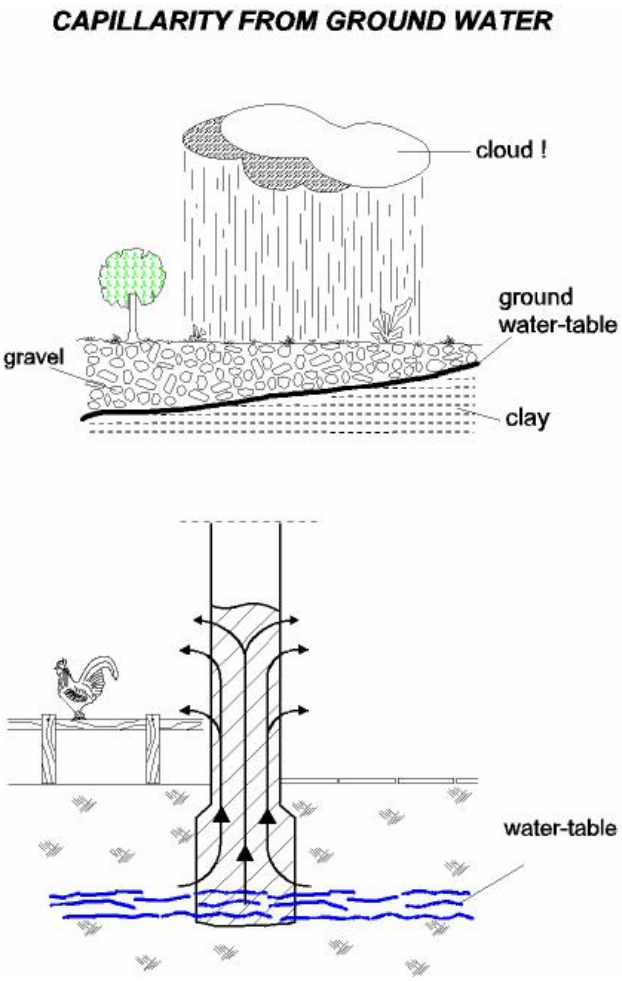


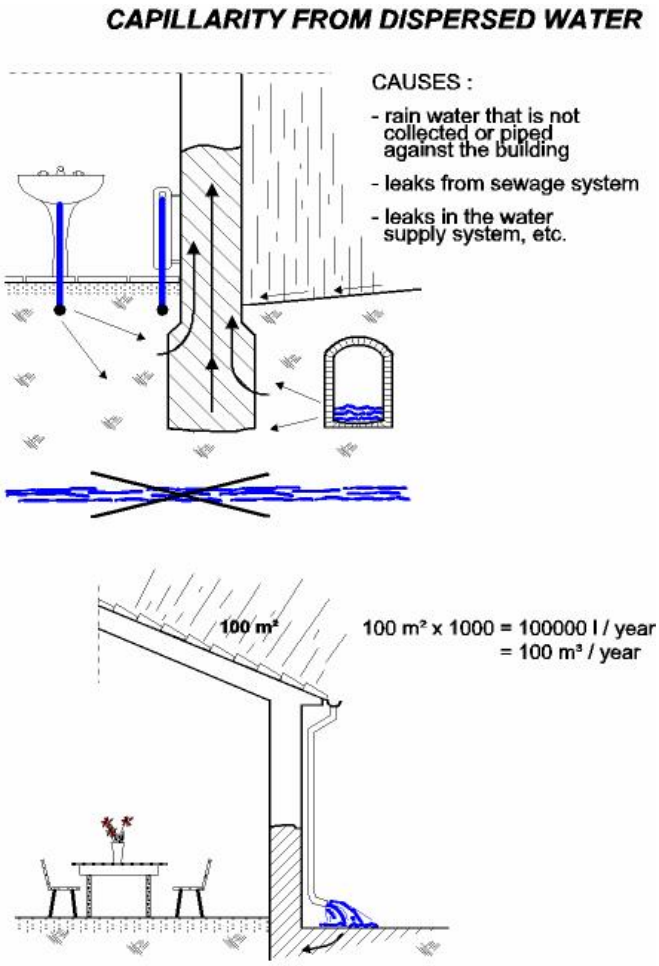
the width of the surface of the walls which is touching the soil, have an effect too on the rising damp in the walls, as when the surface is larger, it helps to increase the area of the rising damp.





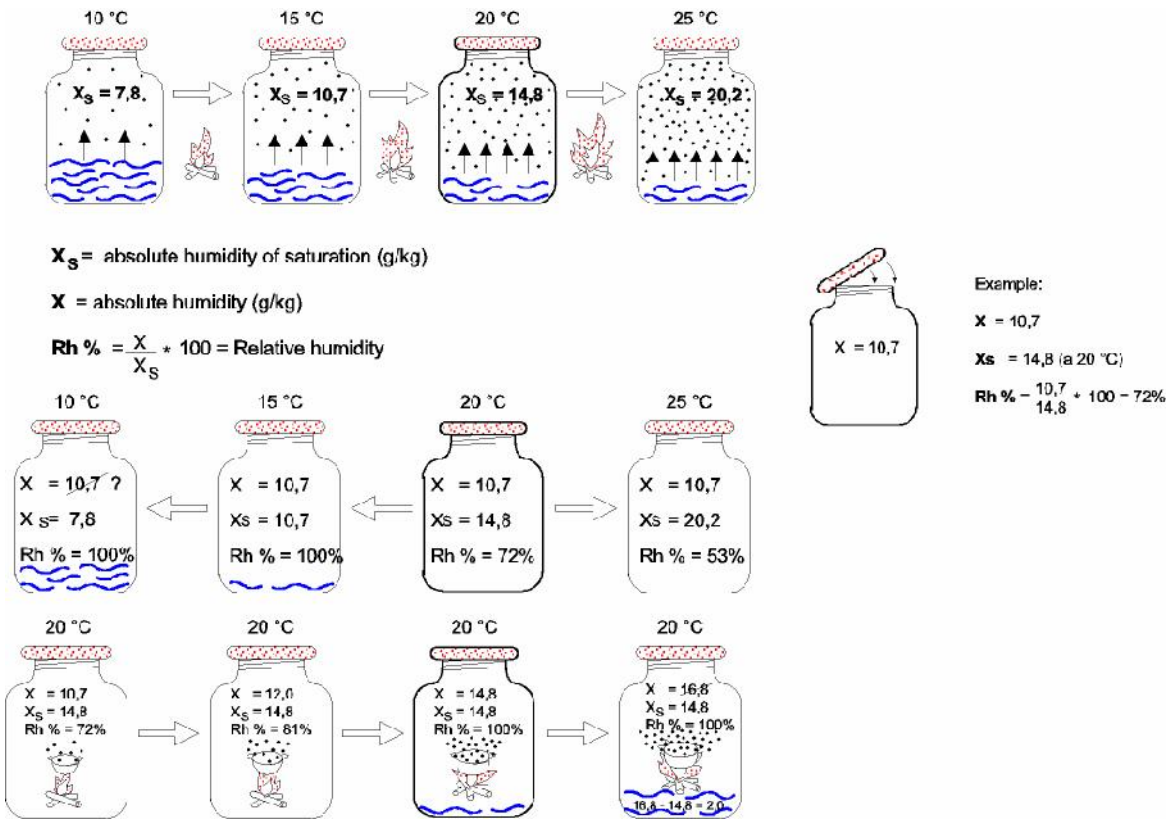
And I like to present this explanation which I took from the Italian professor Massary,



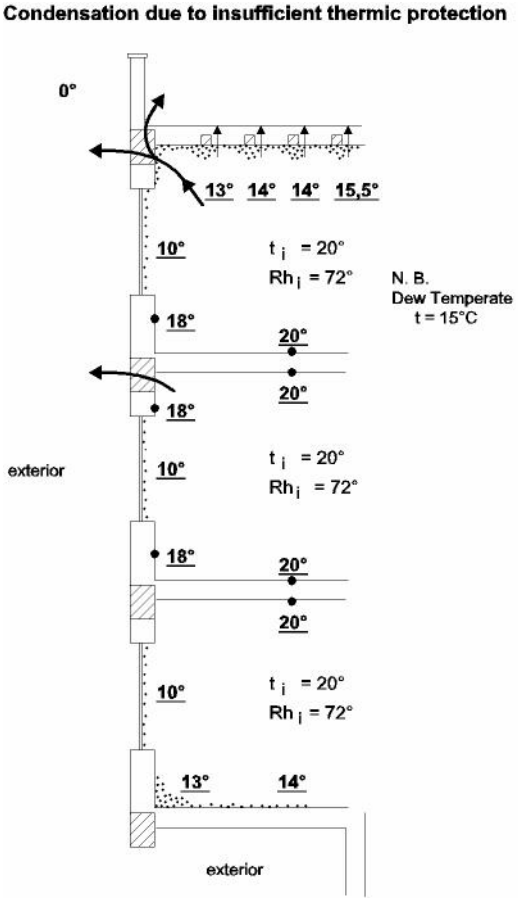


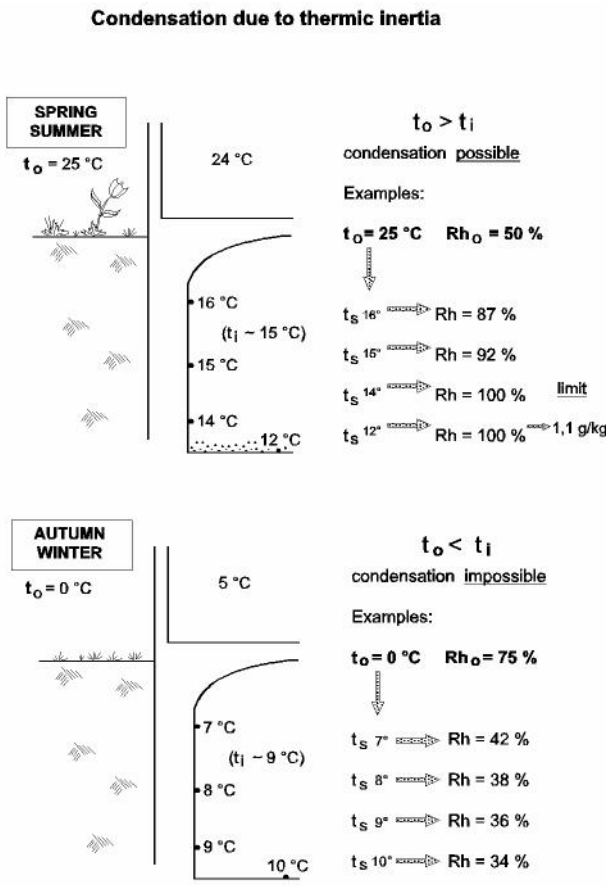
2- By condensation:

In the buildings, especially in the first hours of the morning, when the temperature changes, appears the water on the surfaces, and appears more in the corners of the rooms caused by condensation, we can say it happened through insufficient thermal protection, or through thermal inertia.
Also caused by breathing by human, and by high temperature, as in the high temperature the condensation will be more.



It's easy to solve this problem by opening the windows or the doors during the first hours of the morning to ventilate the place.

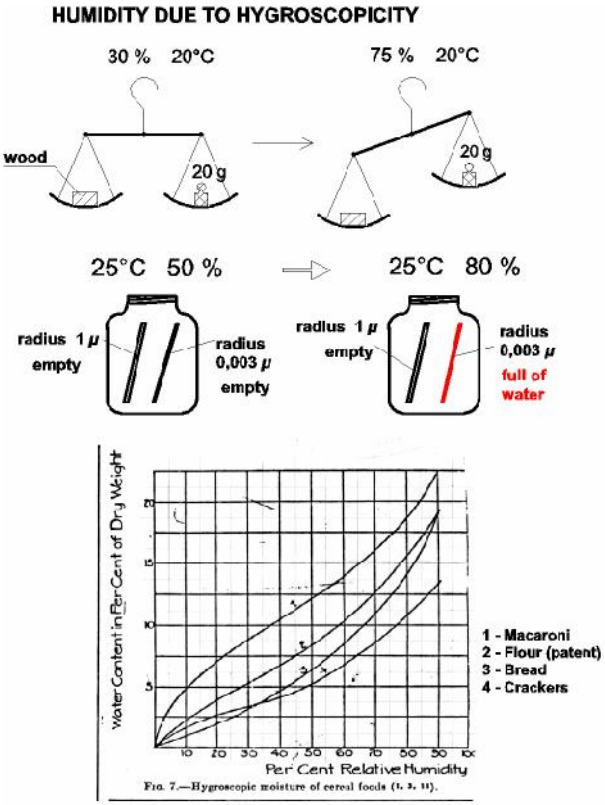


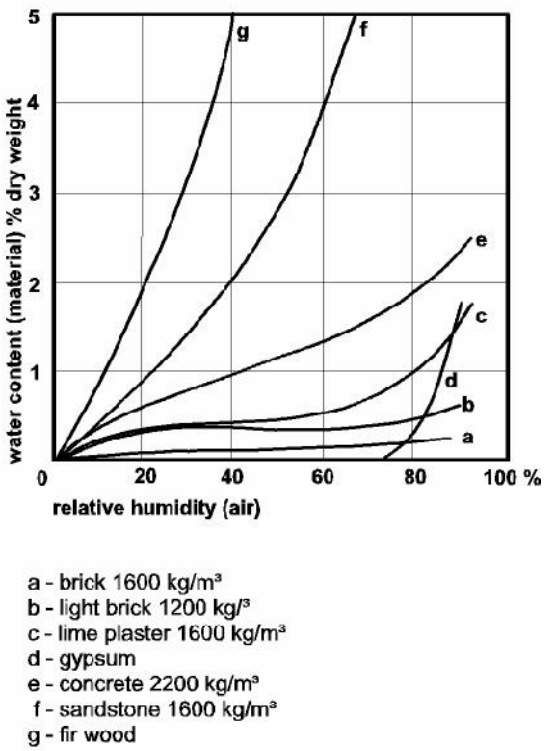


This design from prof.Ippolito Massari.

3- By Hygroscopicity.

Hygroscopicity is the ability of materials to absorb, store, and release water vapor, or we can say it is the capacity of a material to react to the moisture content of the air by absorbing or releasing water vapor.





Design from prof.Ippolito Massari

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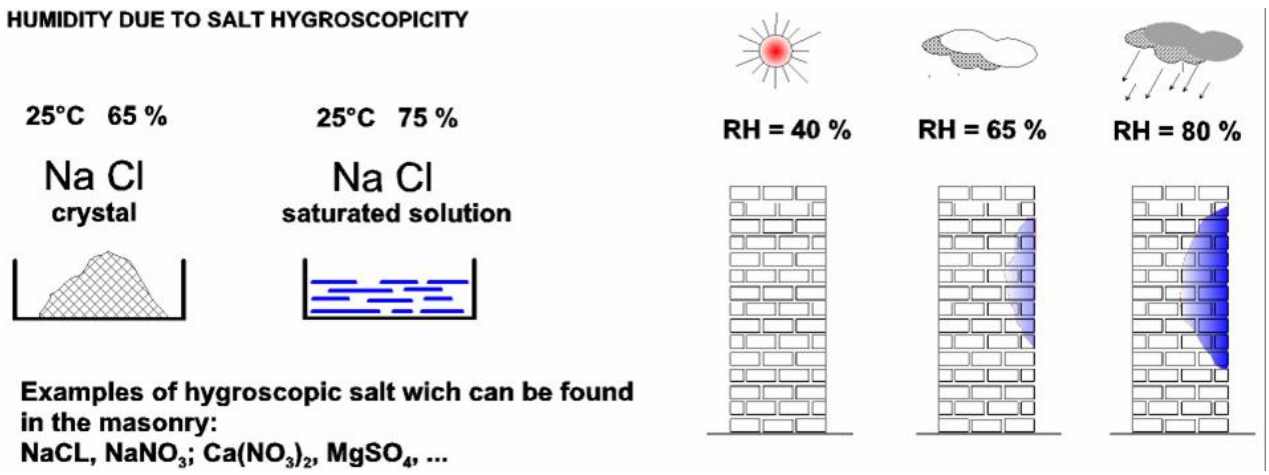
If we leave some of food salt that we use at home in the air for some days without covering it, we will find that salt is dew, if the relative humidity is high as in Venice for example, we will find the consist of water on the salt.

This is happened because the salt has the phenomenon of hygroscopicity, and this is deferent between the materials.

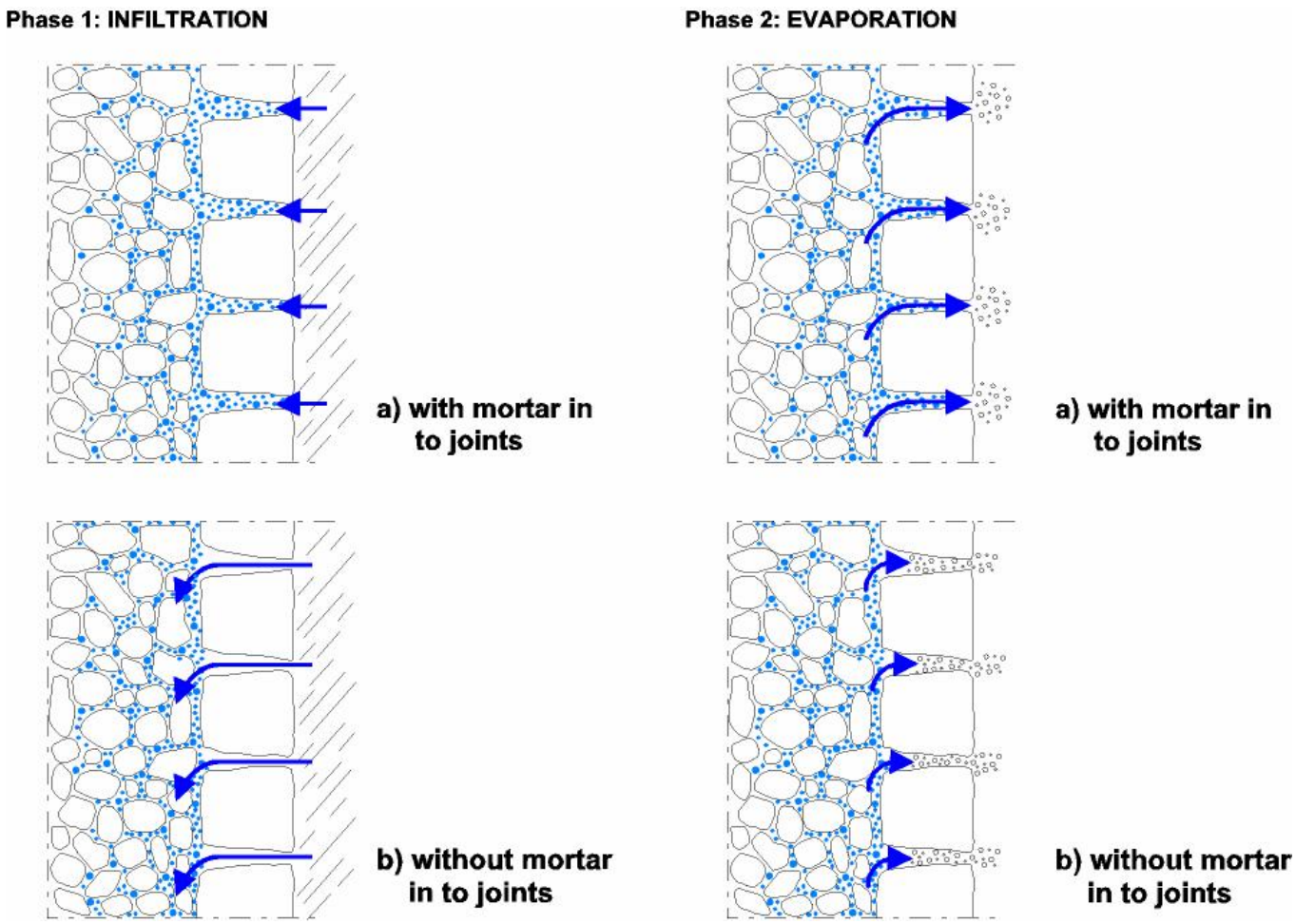
So, we can see that the monuments suffer sometimes of humidity because of hygroscopicity of the different materials which is used fro building those monuments.

The ability of adsorption increases when the relative humidity is higher.



4- By infiltration.

Infiltration process is infiltrating of water into a porous substance,



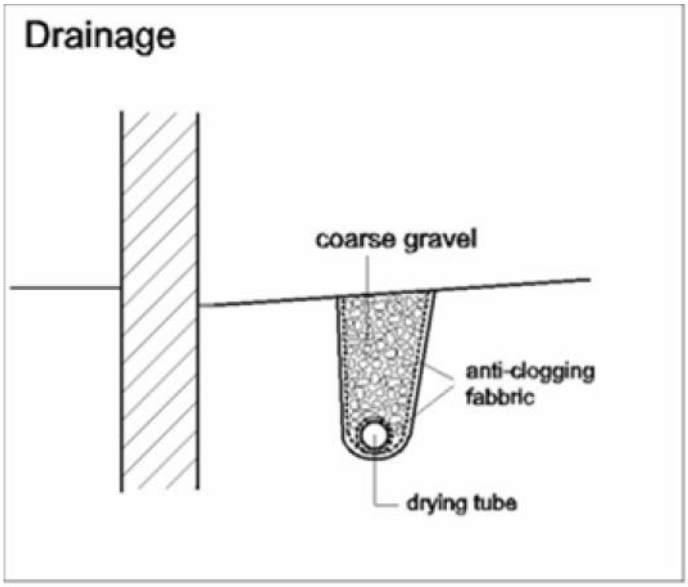
<u>The elimination of the rising damp:</u>

We can intervene to eliminate the rising damp by 2 ways, first by the intervention in the ground under the monument, and the second is the intervention in the walls of the monument.

1- The intervention in the ground:

We can intervene in 2 ways:

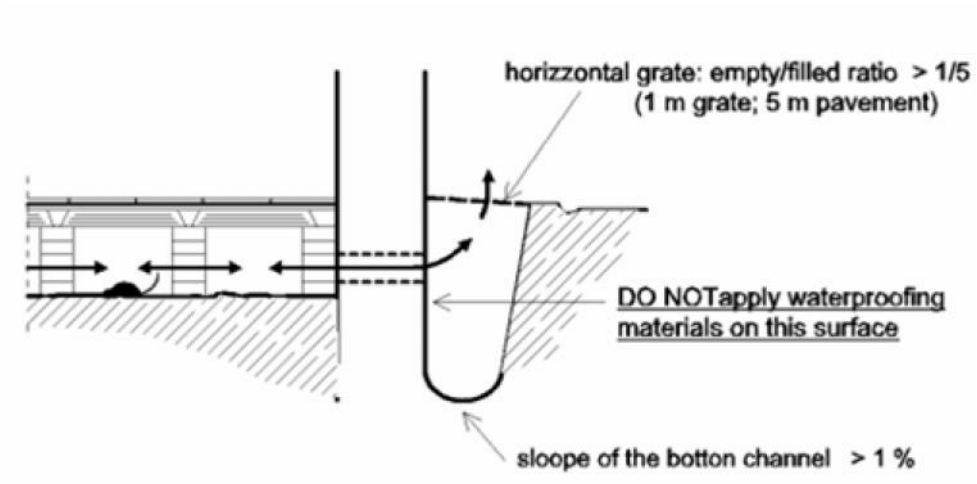
a- by making a drainage in the ground away from the walls of the monument by about 1M., with depth about 1:1.5M, a ceramic tube will be put in the drainage as in the picture, this tube will help for drying, all the space over the ceramic tube, has to be filled with anti-clogging fabric, for example like gravels.



Air spaces and ventilated floors

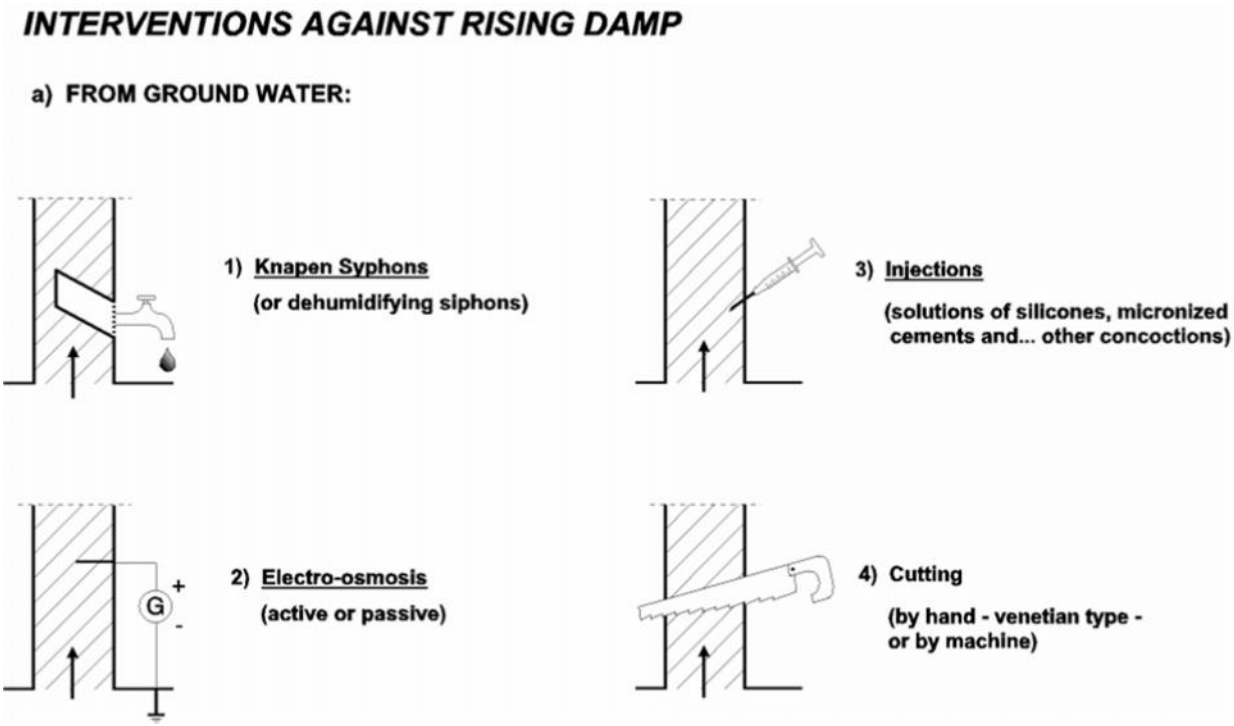
b- by making a tunnel next to the walls of the monument, and that will be covered by horizontal grate, the tunnel have to be empty.

After that a ventilation system will be done as in the picture to help for drying water.



2- The intervention in the walls of the monument.

There are 4 ways to intervene in the walls:



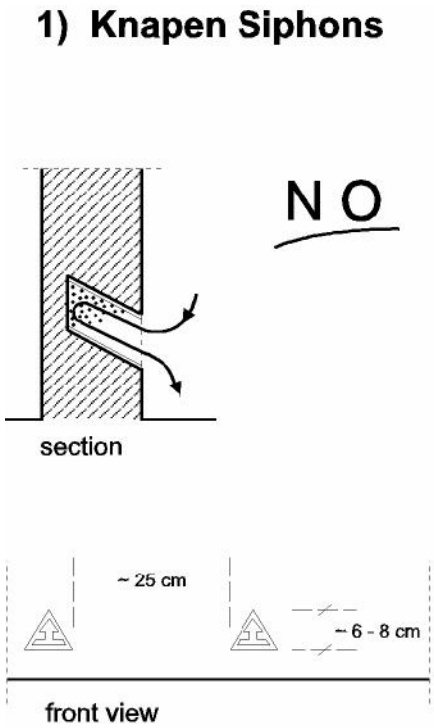
1- knapen siphons:

By making inclined holes in the walls, in specific dimension, with a height about, 5:1M from the ground.

The diameter of the hole about 6:8CMS, and the depth in the walls about 25CMS,

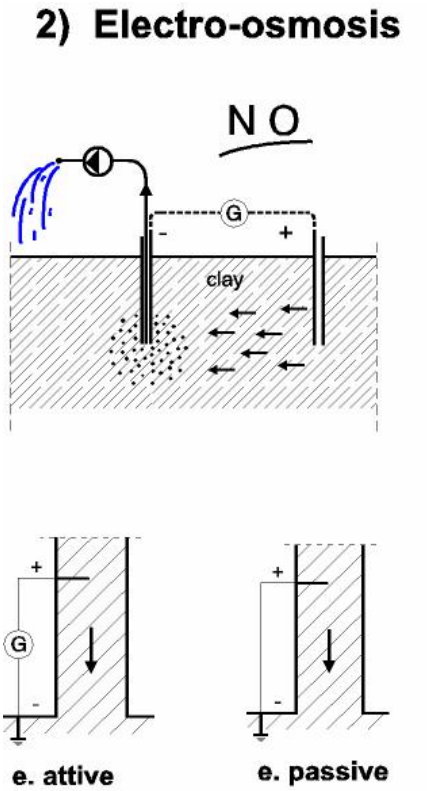
This method had been used before, but it didn't give a good result.

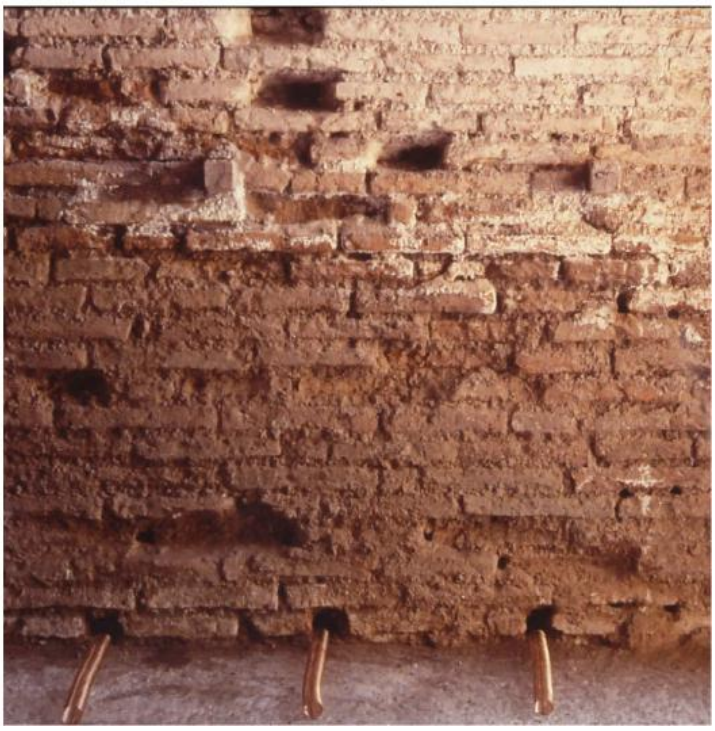
And as Ing.Ippolito Massari doesn't recommend by this method.



b- Electro-osmosis:

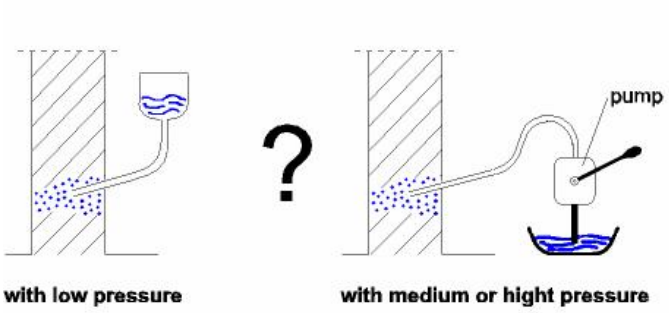
by using an electric cycle, the electric current about 12V. and as in the picture we see that the water goes out of the wall, but the quantity is very few, and it's dangerous to use it in urban areas., Massari doesn't recommend this method too.

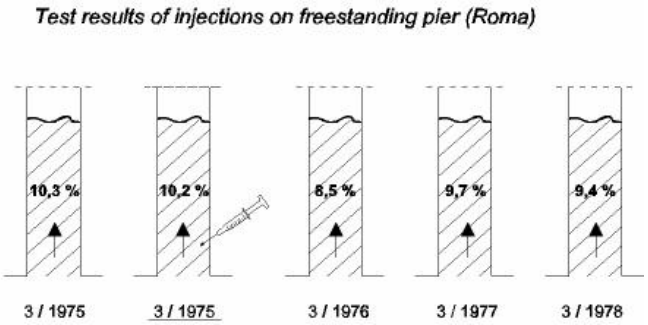




Picture by Massari

c- Injections:
In this method, chemical materials, resins or some types of mortars which have a characteristic of waterproofing are used to block the rising damp.
And there are two ways for injections, the first with low pressure, and that's can be manually or by using a pump with low pressure, the second with medium or high pressure, and in this method, a pump will be used.

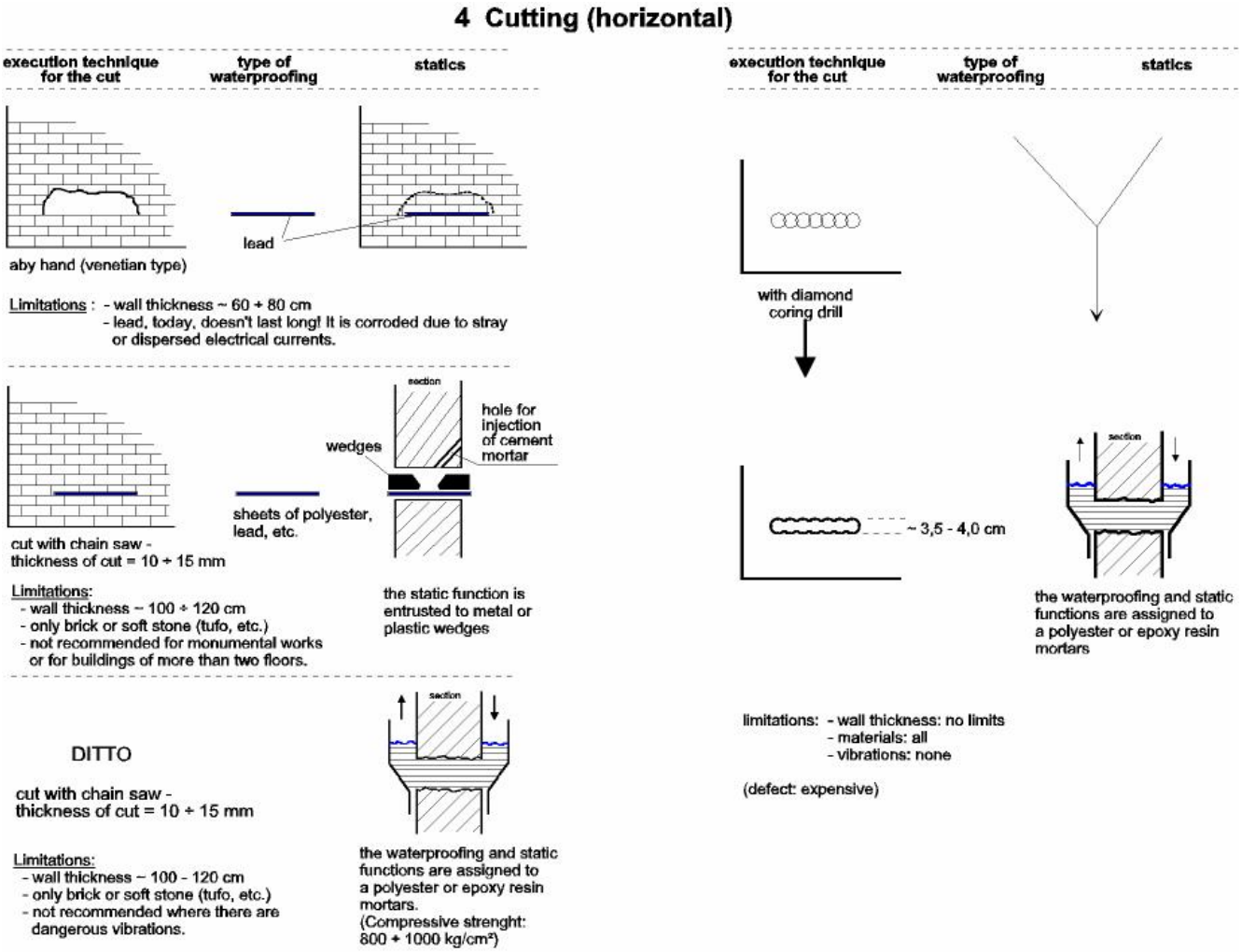




As the most of the walls of the old buildings, have a thickness not small, so it will be difficult to control the injected materials inside the walls, and will not be sure that the injected liquids distributed inside all the thickness of the wall, so many specialists in this field don't encourage the use of this way, maybe with another method as cutting the walls as we will see in the next method.

d- Cutting walls:
This method is the most important one between all the method which are used for blocking the rising damp, as it's the only method that can be applied and the result is a definite success.
There are many ways for cutting walls, the Venetian way, because it was used in Venice, and as is shown in the photo, some bricks are took off, and a sheet of lead

were put inside the walls, nowadays the lead is not used any more, the specialists prefer the PVC sheets, also because it's cheaper.
This was has limitation: wall thickness is not more 80 cms.
Another way, buy cutting the walls by a chain saw, lead or plastic sheets will be placed in the cut, after that cement mortar will be injected in holes over the cut to join the sheets with wall together.
The same way of cutting, but by putting resins in the cut is another way.
Massari way, as it’s known between the workers in this field, is that way that a core drill is used to make holes in the wall, after that resins will be placed in the cut, as it's shown in the picture.
This way is the safest one, as there are no vibrations when core drill is used.

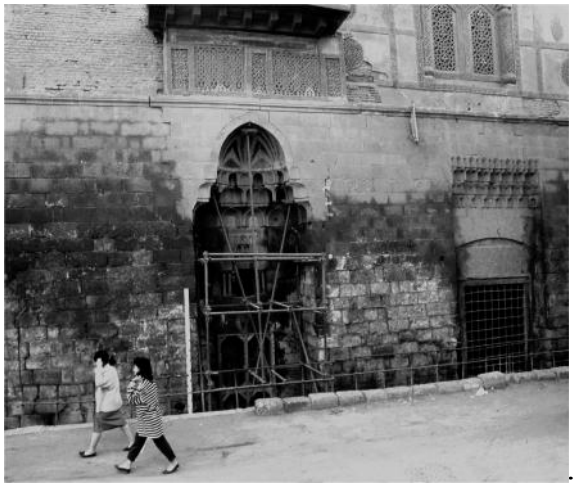


Chain saw

Case study
Blocking the rising damp in the mausoleum of Sunqur El Sa'di

The Madrasa-Mausoleum of Amir Sunqur Sa'di was built at the order of the amir between 1315 and 1321. Known today as the Tomb of Shaykh Hasan Sadaqa, this complex provides a vivid example of an architectural layering that spans a thousand years, from the ninth to the nineteenth century.
Since the late 1970s an Italian team under the direction of Dr.Giuseppe Fanfoni has been working on the building.
The main problem of the building was the rising damp, it arrived to the height of 9 meters in the walls.
Inside the mausoleum, the first frieze of the stucco was destroyed in many parts of the frieze, the rest parts which stayed it its place on the walls were dusty, means when you touch it, it falls down like powder.


inside the mausoleum


outside the mausoleum

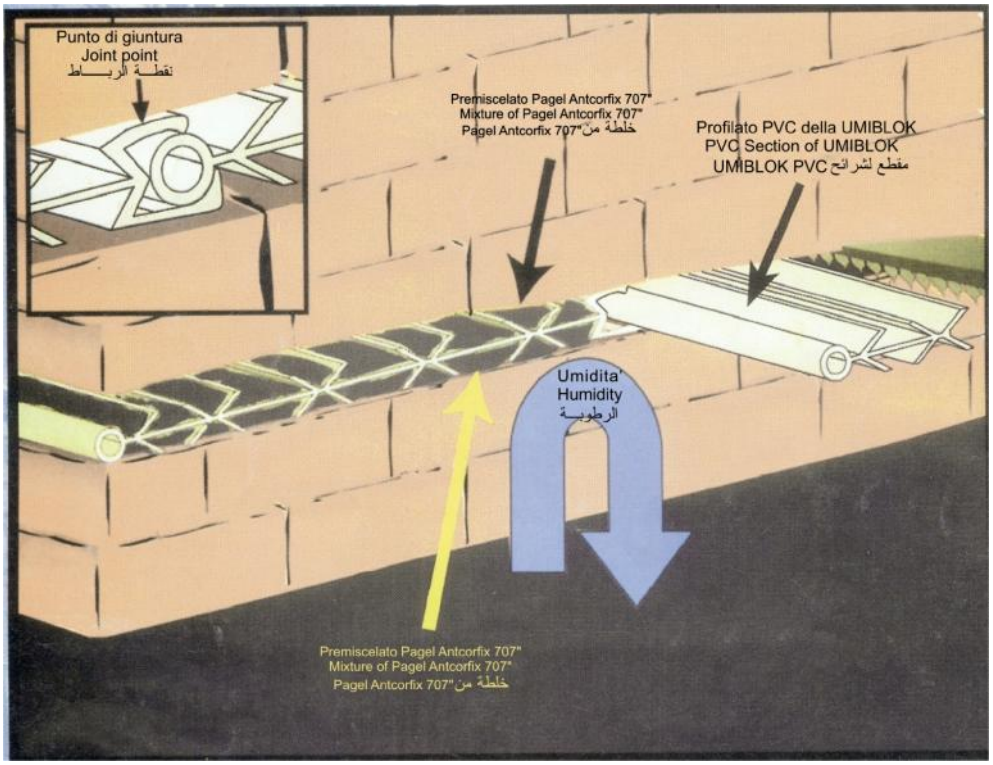
The cutting system was used to block the rising damp from the wall by using a chain saw, and by using PVC sheets with cement mortars.
The first step in this way was find a saw blade for this operation, as the thickness of the walls arrived to 3M. in some parts, and the length of the blade of the machine in this time was 1,20.M.
So the blade of the saw was made manually in Egypt, as the machine from Italy.

The next step was to put the saw horizontally next to the wall, and was fixed in the wall to avoid any movement of the machine.

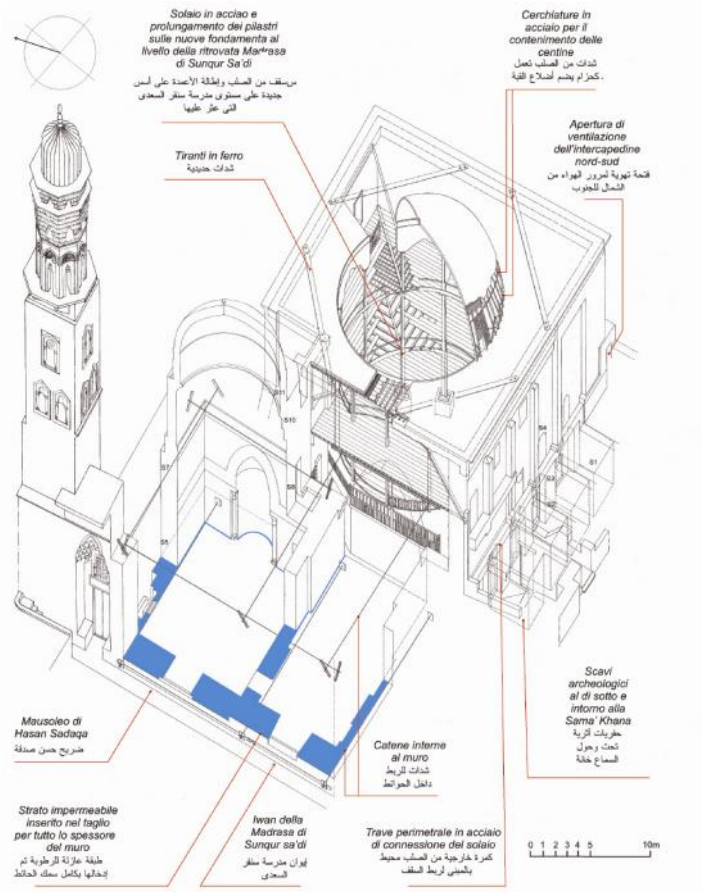
After that begins the operation of cutting, the distance of cutting depends on the state of the wall, between 20 to 50cms.

After that, PVC sheets had been placed in the cut.

Cement mortar was injected over the cutting line, by using a mixer of Pagel Antcorfix 707.

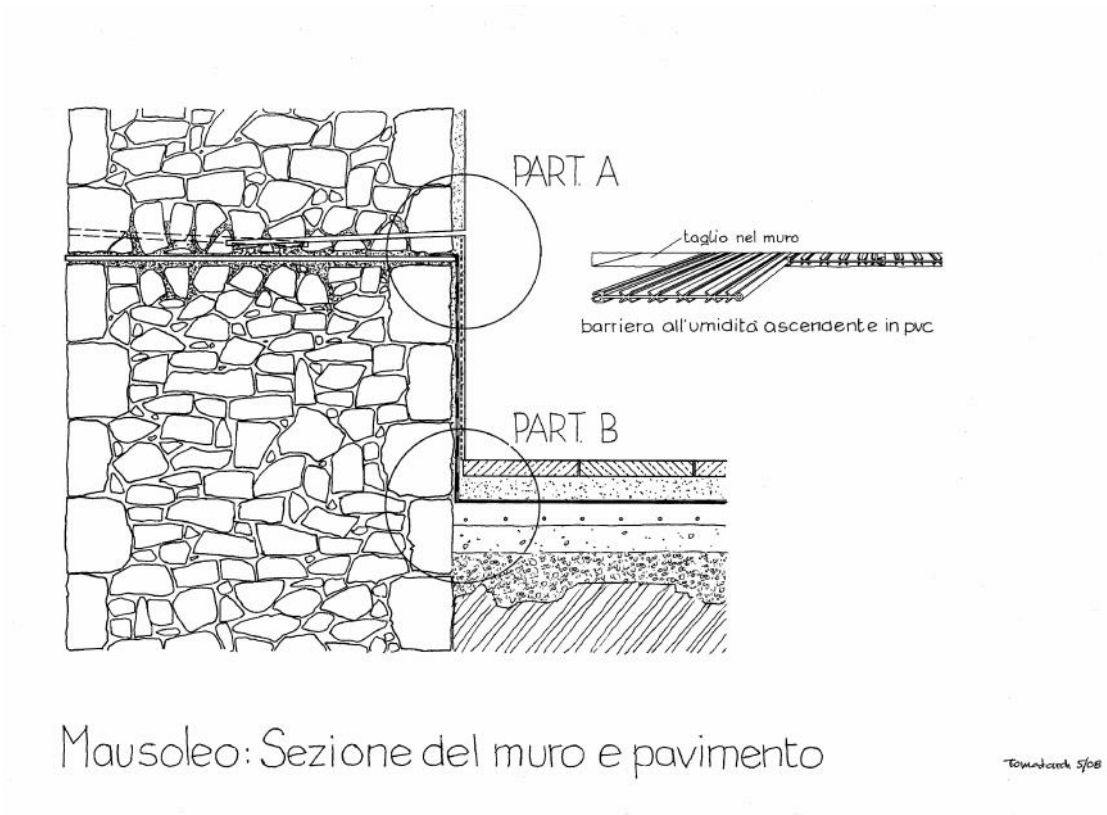


Picture explains the mechanism of cutting walls and using cement and PVC sheets.

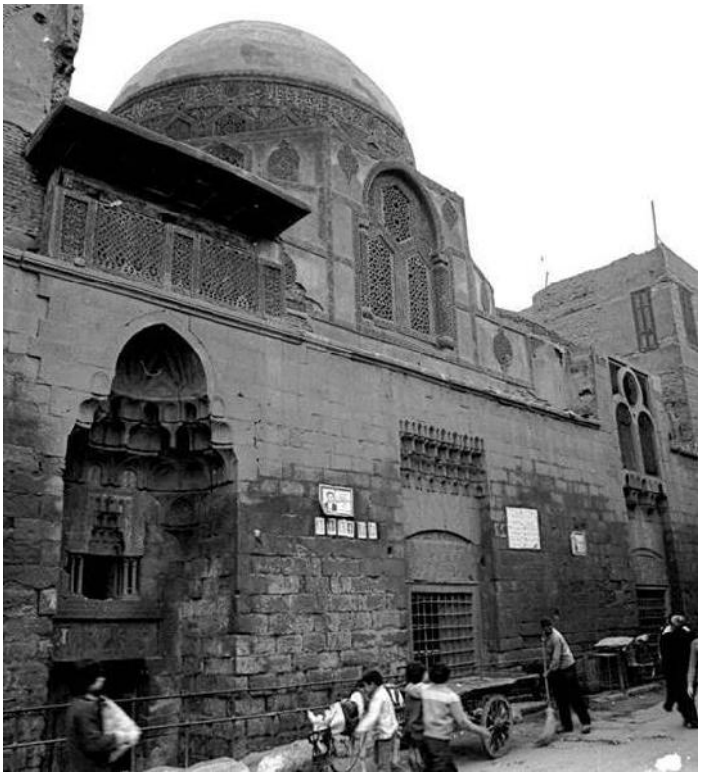


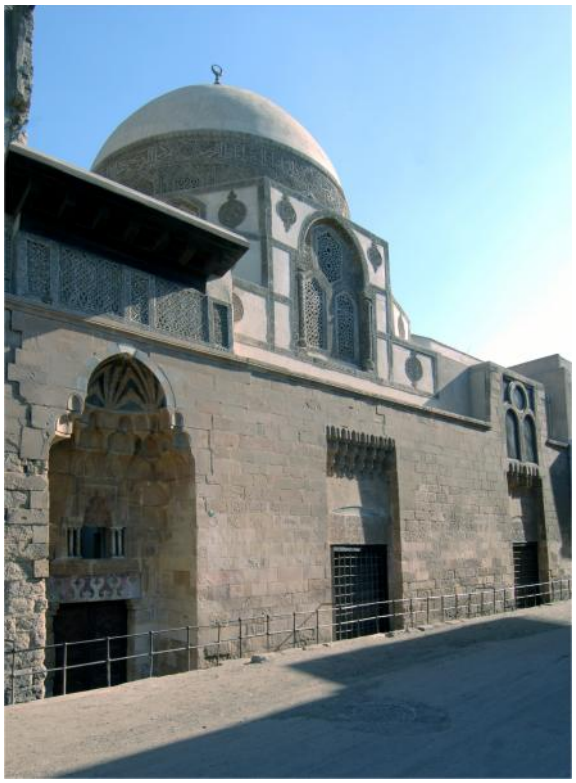
Design explains the cut place and some other intervenes

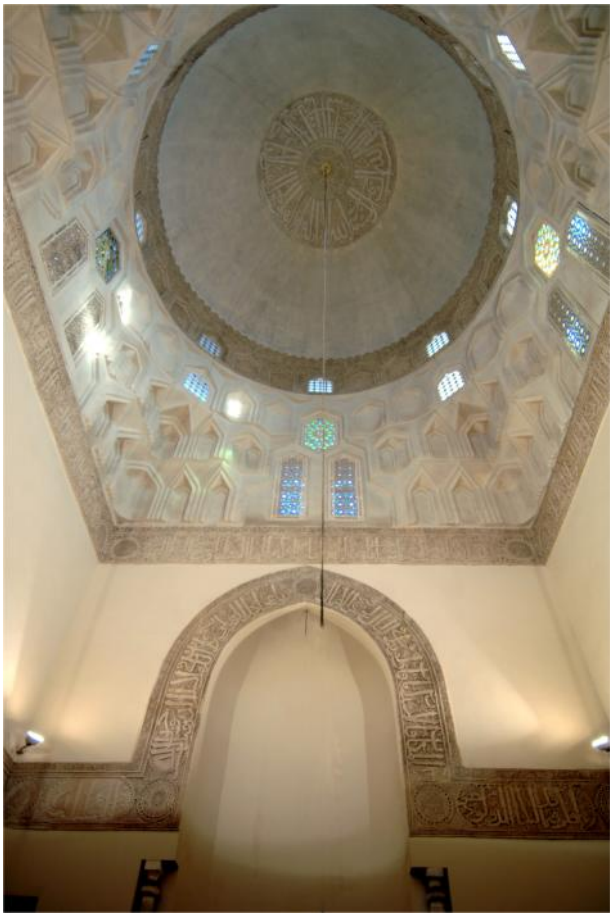
After that, waterproof sheets were put over the PVC sheets, ti the ground to cover the part under the cut line, so in this way the water will be blocked, and will not be water cycle which deteriorate the stone.
As Alfred Lucas says, three elements when gathered together, comes the deterioration of the stone, salts, water and the sun, the sun here he meant the air that helps for drying.
So for the part over the cut, the water is blocked, so there is no water, and the part under the cut there is no drying, so the state is stable.

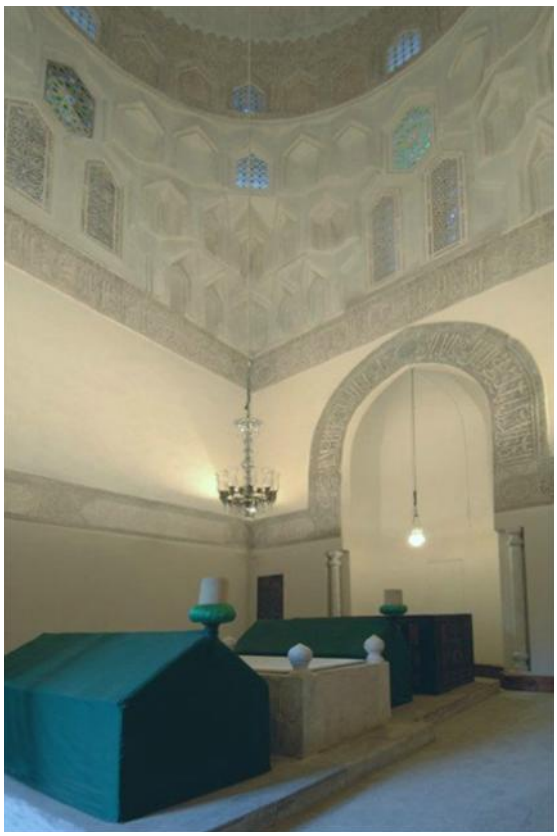


And here some photos after cutting the walls and restoration:









In the end I'd like to thank prof.ing.Ippolito Massari, that I used some figures from him.