

HISTORICAL NOTES ON THE ORIGINS OF STUCCO

In the ancient times has never been clear the difference between the words "plaster" and "stucco". Both, in fact, indicate an architectural element that in some way covers the architectural skeleton.

Plaster, Intonaco in Italian, comes from the word "Tonaca", frock, as if the exterior plaster coat was a clothing for the underneath brickwork.

In the same way the word stucco comes from the ancient Longobard word "stuhhi", which indicates the crust, the bark, the skin, again a protection for the underneath brickwork.

So we can say that from a functional point of view the two architectural elements coincide, and can be considered as synonymous.

However the meaning of the two words has changed a lot during the centuries, and today with the word stucco usually we mean an architectural element that has a self inborn aesthetical valence, by far superior than the plaster's one. So much so that architectural critics has distinguished stucco from plaster for its greater aesthetical importance, considering it as an artistic subject on its own, not necessarily related to the architectural work where is located.

The word stucco in architecture is used with two different meanings: Stucco as a plastic decorative raised element and stucco as a wall coating, so stucco indicates a decorative element which does not involve the use of stony material (marble or stones) but the use of a cheaper material assembled with refined formulas and application techniques.

Such techniques, together with the flexibility and the lightness typical of the material used, allow the execution of works hardly realizable with stone or marble.

So is undoubted that the use of stucco intended as a decorative practice has its origin in a double factor: the lower cost, in an age in which the cost of raw materials was higher than the manpower's cost, contrarily than today, and at its lightness, assessment this very important since often, in the ancient architecture was needed a lighter structure because of the limited strength of the foundation.

In this connection we mention the most famous example for stuccos: Venice, city with an underground subject to landslides, but very rich in the old days and surely able to afford stony finishing, became on the contrary the cradle for stucco.

The research in lightness has to be intended mainly as in terms of resistance to flexion needed to obtain big overhangs in plastic raised decorative stuccos, where the stony decoration cannot be used if not very thick, and for wall decoration, where a few millimeters coat works as the 3-5 centimeters of minimum thickness of marble.

From all that we deduce that stucco historically has always been used as an imitation of more expensive materials, therefore, bypassing the architectural aspect, with stucco can be obtained imitations of marble, stones, precious metals, wood, glass, etc.

For what concerns the imitation of glass, in particular, has to be pointed out that it had been actuated with gypsum stucco's slabs called "seleniti" by Greeks because the light, going through them, reminded the moon light.

To conclude this short preamble dedicated to the origin of stucco, we need to underline how the word stucco identifies whether the material obtained with the use of marble, lime or gypsum powders, or the execution technique, or the final decorative effect.

This allows to consider stucco an architectural instrument, since with the word architecture we mean the project idea, the building technique and the architectural manufacture.

STUCCOS IN THE HISTORY

The art of applying stucco on walls, meant as a protection and decoration of them, and as an homogeneous substrate for the following decorative paint jobs, is a very old technique. However were the Romans who developed the triple function of stucco: decorative, pictorial and plastic.

The Romans learned the art of stucco decoration not just from the Etruscans, but mainly from the Greeks, that used stucco both as an architectural substitution of the stony structure for their temples and as a substrate for the following wall paints.

The Roman architecture also developed proper materials, so much so that Roman stucco is still considered today the best one for strength and durability, especially the "Opus Albarium" mentioned by Vitruvio, a gypsum based stucco, and the "Opus Marmoratum", made with lime and marble powder with or without sand, procedure readopted during the Renaissance.

With the Roman empire has grown the use of stucco decoration both as a wall covering and as a plastic raised decorative element. As an evidence of that we have Pompeii and Ercolano's houses, the Coliseum, Tito's thermae and Nero's Domus Aurea whose name probably comes from the numerous gold leaves applied over the stuccos that were imitated during the sixteenth century by Raffaello and his adherents.

The product known as "Pastiglia" has a similar nature as stucco. It is a paste made of gypsum and organic glue and is used to decorate wooden substrates.

Very popular during the XII and XIII centuries was the black ornamental stucco: basically the sculptor engraved a texture in the bottom of the low relief and then filled it with black stucco to create a sort of minute gold work, with an evident color contrast.

Black stucco had a large diffusion since it made easier the laborious stony tarsia job.

The highest point of its beauty has been touched by stucco in Venice, where great masters of decoration studied mixtures of plasters based on lime and cocchiopesto, to give more breathability and permeability to the substrate, and stuccos resistant to the moisture and the saltiness typical of Venice.

Those masters, modifying the ancient recipes inherited from the Greeks, the Etruscan and the Romans, prepare a stucco resistant to the environmental city's conditions. Their continuous research on the resistance to aggressive atmospheric agents brought them in turning Venetians stucco to an unique product for its formulation, combining durability and aesthetical effects unique in the history of stuccos.

The use of lime based stuccos and of Venetian stucco as a decoration for indoor and outdoor jobs had a wide diffusion in the highest classes until the XIX century. During the XX century the stucco technique had been replaced by industrial techniques used on decorative products, and natural products like marble powder or lime had been used less and less, replaced by organic synthetic product.

Only at the end of XX century architecture rediscovered natural products and began to develop classical products and to recover the antique colors lost with the use of synthetic products.

During these years Safra started a capillary research of ancient recipes and a meticulous study of their reproduction, offering on the market natural products with high architectural value. Furthermore, Safra developed in the years products with the same chromatic effect and materials of the ancient stuccos and paints, but formulated in order to apply them on modern substrates, where walls are not able to receive the original recipes.

ArteNova is the decorative line of in which Safra has gone close to the limit of the impossible to respect and keep the old recipes and, where technology gives the chance, to reproduce them with modern materials.

This double line makes possible to satisfy all the needs, both in restoration and in modern architecture.

The top products of ArteNova line are the mineral pure lime based stuccos and the marmorinos, the same as the ones used by Palladio for his beautiful villas and by the great decorative masters to decorate the Serenissima's palaces and, at the same time the Stucco Veneziano and the modified lime product, suitable for concrete and gypsum substrates.

FROM PLASTER TO DECORATION

Plasters and their evolution

The composition of plasters remained nearly unchanged from the Greeks. The only variations have taken place in the number of coats and in the finishing of the plaster. A plaster application at the Roman's time for a patrician house was composed in 7 layers:

Rinzaffo	Pozzolana, lime and coarse sand
Arriccio	Pozzolana, lime and mid-size sand
Velo	Lime and fine sand
Velo	Lime and fine sand
Stucco	Lime and marble dust
Stucco	Lime and marble dust
Stucco	Lime and marble dust

Nowadays plaster is composed in usually 3 layers:

Rinzaffo	Hydraulic lime, cement, gross and rough sand (from 2 to 8 mm)
Arriccio	Hydraulic lime, hydrate lime and mid size sand (0,6-2 mm)
Velo	Hydrate lime or slaked lime and fine sand (0,08-0,6 mm)

Lime stuccos and their evolution

In lime based stuccos the changes are not so evident, the only elements that during the centuries has been replaced are the organic components that are not durable and could, when present in high percentage, bring the all surface to rot.

From the Roman empire age to the Renaissance, stuccos were lime based and made of:

Slaked lime and Hydrate lime
 Marble powder*
 Earth pigments
 Organic binder in minimum part (fish glue, rabbit glue, milk coagulates, beeswax, soap, olive oil, linen oil)

Today's lime stuccos are composed of:

Slaked lime and Hydrate lime
 Marble powder*
 Inorganic colorants and earth pigments
 Organic binder in minimum part (oil, cellulose ethers, acrylic resin)

* According to the different size of the grains and the presence of sand we have three different lime stuccos:

Grassello stucco	Fine marble powder
Marmorino stucco	Mid-size marble powder
Travertine stucco	Gross marble powder and sand

Lime paints and their evolution

As well as for stuccos, the only changes for lime based paints are in their organic component.

In the ancient times, their composition was:

Slaked lime

Meudon white (amorphous charge with good covering power)

Earth pigments

Organic binder in minimum part (Bone glue, fish glue, flour glue, rice glue, potato flour, milk casein, egg yolk, egg white, fig milk, nut oil, olive oil, raw and cooked linen oil.)

Today they are composed by:

Lime grassello or hydrated Lime

Calcium carbonate

Earth Pigments

Iron Oxides

Titanium Oxide (Cellulose ethers, Acrylic resins, Linen oil)

Distempers and their evolution

While in the ancient times usually lime paints were used for wide surfaces, distemper paints were used for decorative details. Distempers were used normally inside and occasionally outside, were unreachable from rain.

Traditionally, tempers were made of:

Very fine marble dust

Earth pigments

Organic binder (Egg yolk, egg white, bones glue, rabbit glue, fish glue, flour glue, rice glue)

During the centuries, the organic binders easier to rot were replaced with others more resistant to bacterial degradation, up to a solution of casein blended in lime-milk added with linen oil.

Nowadays distempers are made of:

Calcium carbonate

Titanium dioxide

Organic and inorganic colorants

Organic binder (Cellulose ethers, Acrylic resins, Ethylene resins, Vinylversathate resins, styrol-acrylic resins according to the wished performances and characteristics)

Fresco Paint

Fresco painting is a quite simple kind of painting. It must be made on lime-based plaster before the plaster dries. Normally such techniques are used with natural pigments like earth pigments, washed and blended with milk.

The wet substrate allows for the colors to penetrate deeply and become one with the plaster.

Encausto Paint

Encausto paint, used by Egyptians, Greeks and Romans, has been formulated in many different, often contrasting, ways. Even today's analysis on different works leads to stunningly different results.

One of the few raw materials which remained common to all those formulations is the bees-wax.

Encausto comes from the ancient Greek language and means "to burn". In painting "Encausto" refers to a technique of blending pigments and wax through heat.

In a nutshell, Encausto is a wax or a distemper using wax as its main binder. It's difference with the "cold wax technique" is given by the fact that the former is obtained by applying the pigmented wax through heat, on a heated wall, after that the pigment and wax have been blended through heat. On the contrary, the "cold wax technique" wax is blended with a solvent (turpentine) and applied on a cold wall.

Today many people refer to Encausto in an inappropriate way, referring to shiny finishing plaster, both lime-based and synthetic.

HISTORY OF COLORANTS

The first colorants used in paints were earth pigments; they are available in nature and change colour according to the place they come from and the kind of sediment. The best known earth pigments, presently used in restoration jobs are the following:

Vine black	Obtained by the cooking of grapevine wood
Manganese black	Composed of Manganese dioxide
Ochre and yellow earths	Composed of clay and silica. Famous among them is Sienna earth
Burnt Umber browns	Composed of Manganese dioxide with Iron dioxide, Burnt Umber obtained from cooked raw umber.
Kassel earth	A kind of bituminous earth
Red earths	Verona red, Pozzuoli red, Nuremberg red, with nuances from orange red to violet red according to the oxidation degree of the iron oxide in the mineral.
Green earths	Iron hydrosilicate with magnesium salts and potassium originated by sea clay. The most appreciated one is the Brentonico green.
Blue earths	With their well known weak resistance to clay alkalinity. For that reason blues in frescoes were usually made only with distempers. Giotto's skies are quite famous even today.

Earth pigments were ground and dispersed in water before use. They were left separate from the water which was changed a few times to take away as much impurities as possible. After that phase they were blended with milk and thus used in frescoes or blended with distempers or lime paints.

In ancient times bright colours were obtained from organic materials like leaves, flowers, fruit, insects, and clams.

Following this phase, oxides became most used. They had similar shades to the earth pigments but were obtained from the metals: iron oxide for yellow and red, chromium oxide for green, etc.

Today, together with oxides, organic colorants are widely used. They are obtained from metals (e.g.: green and blue from copper) or from chemical synthesis (reds, yellows) which, unlike standard oxides, result in very bright shades.

THE MATERIALS

Aerial lime

Aerial lime is obtained cooking in special ovens at the temperature of 800-900°C calcareous rocks constituted of calcium carbonate and clay for a maximum rate of 5%.

After the cooking process we have quicklime, that can be ground into a powder to obtain Hydrate lime dust.

The cooked rock is deducted of water, and once dehydrated is wet again with water that it absorbs quickly giving a strong exothermic reaction which can reach 200°C. This reaction increases the volume of the mass converting it into hydrated lime, a white mush named lime grassello. Such materials harden only under the action of air.

Hydraulic lime

Hydraulic lime is obtained cooking in special ovens at the temperature of 900-1000°C calcareous rocks constituted of calcium carbonate and clay in a percentage between 5 to 22% or more. Hydraulic lime hardens even in water presence.

Cement

Cement is obtained by cooking calcareous rocks containing 20-22% of clay, at a temperature of about 1500°C. The process is more complex than the lime one, in fact the rock is crushed first, then dried at a temperature of 700°C, then calcined or decarbonated at a temperature between 900 and 1000°C, then finally clinkered at a temperature between 1000 and 1500°C.

Gypsum

Gypsum comes from sedimentary rocks made of calcium sulfate dihydrate. After cooking at 170°C, releasing water, becomes Calcium sulfate anhydrous, basically gypsum stucco.

Calcium carbonate

Calcium carbonate or marble powder is obtained crushing and milling limestones. According to the amount of clay contained, it can be more or less white and has different water absorption and covering power.