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## Historical plaster-techniques

The masonry and plasterwork throughout the various architectural periods have their own individual characteristics and when cautiously evaluated even their own stylistic elements. The differentiation between historical and modern plaster techniques came into use after the standardisation of the systematic examination of historical buildings before their renovation by conservators and restaurators assisted by scientific methods.

A study of the literature about plaster gives mostly information about the required technical qualities of plaster e.g. aggregate grading, binders, fillers, recipes etc. It is not generally known that ancient renderings were not simply applied, their surface were mostly modelled to attain the desired surface effect.

Today historical buildings are plastered according to contemporary building standards. Such regulations allow the use of ready made plasters and mortars which have advantages for the modern building trade, but not for historical buildings which require individual solutions to their problems.

The use of ready made products on historic facades in accord to DIN-regulations which define the stratigraphy the plaster layers e.g. splatterdash, render and floating coats (Arriccio) and finishing layers (Intonaco), a felt rubbed-finish appears monoton and tedious.

This appearance is not a result of dilettante or indifferent plasterers but a result of the increasing rationalisation of the building trade and contemporary handicrafts false pride in attaining perfection. The applied plaster must be plumbed, the floated surface homogeneous and even, scaffold levels (Pontate) or other joints are evened out, thus eradicating any individual "signature" of the plasterer.

Lamentable is that the rationalisation of the building trade and increased use of ready made products have turned the trades and handicrafts into non-thinking applicators and users of products and their centuries of knowledge and experience with historical materials slip into oblivion.

Generally it can be said that: the appearance of the plaster work depends on the type of masonry supporting it. The surface of the plaster was up to the end of the gothic thus (so) determined and often serves as a support for wallpaintings. From the late gothic on and especially in the late renaissance plaster rendering became an individual medium of expression for surface decoration.

Although historically as in this century, plaster works primary function is as a protective layer for the masonry and secondly a decorative element.

The following results are the outcome of systematic "insitu" studies during the last twenty-five years. Many of the objects studied have lost their historical renderings which have been



replaced by monotone ready-made products as almost everywhere in Europe. The following results define twentyeight different plaster renderings and illustrate the individual decorative possibilities of enriching a facade.

This should not be interpreted as an incentive to replace historical plaster work because we know how to reconstruct them, but rather help to save historical renderings by being able to differentiate between qualitative and less qualitative renderings and aid practical conservation methods.

### **Masonry**

Masonry can be very irregular depending on its date of construction, the capability of its constructors, material availability and the financial restrictions of its commissioners. Usually building materials obtained from local sources around the building site and depending on the transport infrastructure sometimes from further afield. Longer transports were reserved for more valuable building materials intended for special decorative purposes. When financial restriction prohibited the purchase of more exotic building materials, they were perfectly imitated by painters (marbling) or in moulded and formed in stucco e.g. Tuff. The painted and stuccoed imitations left no boundaries for the artistic fantasy and they often surpassed the colour of natural materials. The building material is not the only criterion to define masonry, their working is just as important e.g. quarry stone, selected stone, dressed stone and brick only to mention the most common methods.

Masonry can be further classified by its bonding coursing (uncoursed or irregular coursed) and tying of the bricks and stones.

The construction of the masonry e.g. solid or cavity walling and dry stone walling is another criterion. Dry stone masonry has by definition no binding medium in the joints and is made by carefully and exactly heaping selected stones from a wall e.g. Cyclopean and megalithic masonry of the antiquity and walling common in the southern alpine regions used for economical building e.g. farm houses.

A rough break-down can be made of the important chronological phases of the development and decadence of masonry as follows:

The masonry techniques of the early and late medieval period as certain culture centers of the renaissance are based on the handicraft traditions of the antiquity. Buildings of the prehistoric up to the romanesque times are characterized by the quality and seriousness of construction principles. They are featured by masonry which is laid in regular courses (Lagerrechtes Mauerwerk). This can be attributed to the careful choice of the size of the stones. Compared with the construction of a wall of hewn stone or brick a wall made of quarry stone or sorted stones requires patience and more labor.

Apart from isolated cultural centers or where brickwork was traditional, in the 13th century the masonry techniques begin to slip into decadence. The stones are of different sizes and the coursing becomes irregular.

The increasing indifference to the coursing and tying leads to the need for static anchoring e.g. corner buttresses. This development can especially be seen where quarry stone and



foundlings and pebbles are used in the alpine regions. The irregular wall surface is roughly compensated with a rendering. From the late gothic and especially into the renaissance there is a decline in the masonry quality. Almost any kind of stone is simply piled in irregular courses.

In the baroque period apart from where Ashler or brick masonry was custom, the masonry was more or less piled between the corner stones. Openings in the walls, e.g. windows and doors, required the additional support of discharging arches.

### **Pointing or Pietra rasa with and without trowel drawn lines**

Pietra rasa is characterized by the mortar which is smoothed out around the joining. The tapping of the freshly laid stone into its mortar bed forces the surplus mortar out of the head and stretch joints. This surplus mortar is not removed as in contemporary walling but is evened out around the edge of the stone to form a chamfer with surrounding stones. The head of the stones remain more or less visibly in the masonry surface, protruding stones are mostly chiselled off.

Wall constructions of very irregular sizes of stone, e.g. quarry stone or stone boulders, the surface irregularities are evened with an extra application of mortar, applied and smoothed analog to the joining. The Pietra rasa is often accented with lines scratched with the trowel edge into the fresh mortar. These are called trowel lines (Kellenstriche) or trowel drawings (Kellenzüge).

These trowel drawn lines can be vertical, horizontal or by herring bone walling diagonally accentuated. Examples of late romanesque trowel lining show only horizontal lines occasionally triangular or romboid forms have also been found. The trowel drawing is often further accentuated with red ocker paint. The so drawn patterns depend on the size of the stones used. Buildings made of Ashler or brick have regular patterning, quarry or boulder stone have wavy irregular patterns which are directly related to the stone form.

Usually the trowel lines are so skillfully and explicitly drawn that the shape of the stones imitate Ashlered masonry. There has been endless discussions about trowel-drawing: were they a finish and what function did they have, if any, before they were covered? The examination of a large number of objects has shown that the trowel-drawing were covered with rendering during the building phase.

These questions cannot be answered with any certainty. Perhaps the scratched lines served to improve the adhesion of the rendering that inevitably followed.

Pietra rasa with trowel-drawing is found throughout Europe and its bordering areas of influence, Asia Minor and North Africa. Pietra rasa belongs to the normal and necessary work processes of masonry building from the antiquity to the present day. During the late romanesque period, trowel drawing begins to disappear and returns once more during the 19th and 20th century on garden and containing walls.

Noteworthy is the increased occurrence of just horizontal trowel lining during the 12th and 13th century.



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To answer the question about masonry with Pietra rasa and trowel drawing conceived as a finish is extremely difficult to answer and requires experience and often the support of scientific methods.

The following criteria should help to solve this problem:

- a) The Pietra rasa mortar shows a patina or signs of weathering, that can only occur when the surface of the masonry has been exposed for a longer period of time e.g. when the aggregate has components containing iron which can be leached out and cause discolouring of the mortar. The light red-yellow discolouring is caused by the formation of ironhydroxide. Misleading can be the early loss of the finish-rendering and thus exposing the Pietra rasa to the weathering for a longer period of time.
- b) The trowel lining work of the Pietra rasa has been accentuated with painted colour e.g. existing roman and romanesque examples.
- c) The application of the Pietra rasa mortar is so thick that it gives an appearance of Ashler and the horizontal and vertical joints are accentuated with trowel-lining.

Another possibility, which has only been verified by archive studies, is that the building was in use before its completion e.g. financial difficulties prohibited its completion. Equally difficult is the judgement of the situation when in other epochs, (especially the 19<sup>th</sup> century) the complete polychromy and plaster rendering have been removed from the masonry, thus exposing the Pietra rasa.

A choice of typical examples will be presented in chronological order below. Especially impressive are the finds in the roman thermal baths from the 1st - 2nd century in Badenweiler/Germany. The find is a wall built with small lime stone blocks on which two layers of Pietra rasa from two different periods can be seen. The exactly executed horizontal and vertical trowel line lies directly on the head and stretcher joints.

The first layer of mortar is little wider than the joints between the stones and forms a bonding for the second layer of mortar. The second layer was the finishing layer and the trowel drawing has been emphasized with a red ochre in fresco technique which rests on a 70 cm, red painted pedestal.

The pedestal mortar was carefully plum lined, well smoothed and contains a 4-8 mm brick aggregate.

Another example, but not a finish, is roman in Martigny in the Ause Morasse/Switzerland in the Octodurus that was excavated in 1978. There is a Pietra rasa, in not quite regular intervals, only in the horizontal, that almost covers the stones and is painted over with a lime wash.

Hermann Phelps also mentions in "Die farbige Architektur bei den Römern und im Mittelalter" roman examples e.g. Cologne on the watch tower of the city wall on the right Rhein river bank, a finish with Pietra rasa, white washed and emphasized with red ochre paint.

In the Swiss Cloister Church St. Johann in Müstair there are horizontal trowel lines over the stretcher joints, on the quoins and window arches.



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Three examples represent the 11th century. The entrance-hall of the church in Oberzelle on the island Reichenau (D). The Pietra rasa is on a wall consisting of sorted and field stones (Feldsteine), whose mortar is well smoothed towards the middle of the stone with trowel drawing in the fresh mortar. The trowel lines are drawn horizontally, vertically and diagonally.

The second, very similar example, can be found in the Swiss Hospitzkapelle, San Romero near Poschiavo.

There is no direct evidence for both objects that would suppose that the Pietra rasa was a finish.

The third object is the staircase to the "Norbertsaal" in the Monastery in Müstair (CH). The finish is in roughly 16 x 10 cm with trowel lines defined mortar squares were intended to be seen. The stones are almost completely covered by the mortar. One of the most impressive examples from the 11th century can be seen on the Stadtkirche in Stein am Rhein (CH). On an external wall (obere Gnadenwand) under the decoration of the 14th, 17th and 18th century are extensive remains of the original facade decoration. The masonry is of sorted stones with Pietra rasa with trowel lines that precisely follows the bonding and the window arches that are built in hewn tuff. The trowel lines are emphasized with a whitewashed.

The corbel-tables are in tuff and as the consoles, have a red painted intonaco. The undersides of the corbel arches are also painted red, which would be complete when the later paint layers of the 14th century could be removed (which would be irresponsible).

Representative for the 12th century is the Ulrich Chapel in the cloister Müstair and the Pfarrkirche in Zillis, both in the Kanton of Graubünden (CH). Here the Pietra rasa and trowel drawing was distinctly intended to be finish and the lines are accentuated with whitewash.

From the same period is the church in Pitasch (Graubünden, CH), with a rectangular nave, a flat ceiling and ends in an semicircular aspe.

The exterior of the aspe is decorated with two blind arcades resting on half-round piers. The masonry is regular with areas in herringbone work in river boulders and quarry stone. Only the important architectural elements are carefully hewn in tuff. The up to 80% original masonry has Pietra rasa with trowel drawing on the interior and exterior surfaces in horizontal, vertical and in the herringbone work diagonally drawn lines.

The trowel lines on the hewn tuff joining are accentuated with a whitewash. Parts of the westwall, tympanum, aspe and shouldering walls became, during the 15th century, an Intonaco with mural painting.

By repair work carried out on damaged areas of the outside walls during the middle ages the Pietra rasa was reconstructed.

The trowel lining was only reconstructed but not directly on the coursing.

An excellent example of trowel-drawing that directly follows the head and stretcher bonding can be seen on the outside walls of the grave yard chapel, in Oberstenfeld/Baden Württemberg (D). Representative for the 13th century is the impressive Katharinenkirche in Lübeck



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(D). The interior walls are brick and head and stretcher bonding are covered with a network of trowel-lining. The covering of the thick lime splatter dash verifies that the Pietra rasa was not intended as a finish. Equally, is the Pietra rasa with trowel lining on the exterior walls of the hospice Chapella in Sassauna /Engadin and the former cloister church Churwalden (both in Graubünden, CH) were immediately covered with a single-layered rendering.

A treasure trove of examples can also be found in Castel Seprio/Lombard from the 11th and 12th century. The question of open or covered Pietra rasa must in this case remain unanswered. In a small town in Ober Veltlin, are rows of houses with Pietra rasa and trowel-drawing from the 12th and 13th century, and were evidently a finish as they imitate an Ashler which covers the irregular supporting masonry.

### **Modelled Mortar Joining**

The joining in Pietra rasa technique are covered with an extra application of mortar. The thickness of this layer varies from 5 to 15 mm, depending on the walls surface irregularities. The mortar is well smoothed out and cut to the desired width. Sometimes these modelled mortar bonds are painted with a lime wash or the lime content of the mortar is so high that no accentuation is required.

In Asia Minor there are objects where by this precise modelling technique were immediately covered with a plaster rendering. Two such objects deserve to be mentioned here, the oldest is in Hah (Eastern Turkey) in the ruins of an early christian church from the 5th century. The second object is from the 13th century on the exterior walls of the Rock Monestery Summe-la near Trapezzint (TR). A similar example can also be seen on the walls of the cloisters of the Dominikaner Church in Bozen/South Tirol (I). In contrast to Asian Minor objects in alpine areas and Eastern Europe have been worked for the visual impact. They are typified by a regular masonry and the modelled pointing work is so precise that an illusionary Ashler masonry completely covers the quarry stone masonry beneath it. This modelling of the joints is a further development of the Pietra rasa with trowel drawing. Whilst generally the modelled pointing work covers the whole surface of the facade, during the 13th and 15th centuries, there are examples where only the quoins have been decorated in this manner.

A particular impressive and early example modelling as a finish from the 7-8th century is on the masonry of the early medieval church of St. Martin/Cazis in the Kanton Graubünden (CH). On the west work, the remains of the applied, modelled and cut pointing, high lighted with lime wash can be seen.

The masonry and architectural elements are built in quarry stone and the discharging arches in tuff.

The masonry surfaces are worked with a Pietra rasa and horizontal and vertikal trowel-drawing. The lesene (Pilaster) abutments and wall columes are covered with a 5-8 mm thick application of mortar rendering on which a further application of lime plaster has been modelled and cut such that only the horizontal modelled jointing corresponds with the courses of the supporting masonry. The abutments have been decorated with symbols. The mortar application of the modelled bonding is ca. 5 mm thick, smoothed and cut exactly to a width of 15 mm and covered with a lime wash.



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In Stalden, in the Kanton Wallis (CH), on the domicile tower of the house "Venzin" from the 14th century, is a modelled coursing which has been worked in a relative rough and little smoothed manner. The only vertical modelled jointing is to be seen on the quoins. The up to 15 mm thick and ca. 40 mm wide modelled joints have not been cut into shape. The edges are to some extent chamfered with a light grooving which originates from the trowel edge working. The Demitrios Cloister, also called Marco Cloister, built between 1376 and 1381 in Skopje (YU) has a facade worked in quarry stone with tileing as a leveling layer. The masonry jointing is ca. 10 mm wide and covered with a 50 mm wide application of mortar which has survived in small areas on the north facade. On two other objects in Poschiavo in Kanton Graubünden (CH) the modelled bonding has also survived: the tower of the parish church Vittore and the Facade of the "Torre Camunale". The former is from the 13th century with an extra storey added in 1947 which remained unplastered up to the frieze.

The older parts of the tower have a very irregular course widths of quarried stone, whose horizontal bonding has been worked in Pietra rasa.

A similar situation can be seen on the north end of the neighboring building, now the town-hall, on the former domicile tower situated at the north end. Its facade is unrendered and the jointing is worked over in Pietra rasa with horizontal and vertical trowel drawing. In the 15/16th century the original Pietra rasa has been covered with a network of 10-15 mm thick and cut to on average 50 mm wide modelled bonding. The mortar bonding corresponds approximately with the masonry joints only where an attempt was made to imitate Ashler.

### **The Rendering; its Construction and Surface Structure**

What is not going to be presented here is quantitative data about aggregate grades, fillers, mortar mixtures and recipes, but rather an empirical approach to how the surface structure of the Intonaco is formed as a decorative element in its own right, the way and manner the rendering must be applied to achieve the desired surface effect.

The possibilities of forming and modelling the plaster work are many fold and dependent on many factors.

The optical impact is influenced by the binder and other components of the rendering e.g. pigment, charcoal or brick particles as the grain size distribution of the sand used. The way in which the mortar is applied has a particular stylistic influence on the surface structure e.g. trowel thrown or brush applied slurry.

The variations of surface forming and modelling, as the tooling are almost unlimited and each surface working carries the individual signature of the plasterer.

Single - and multi-layered renderings define the two main groups of plaster work. Up to the early roman periods in Europe single layered plaster were almost exclusively used. During later roman periods in Europe multi-layered renderings became popular with the parallel refinement and developing of the fresco technique. A multi-layered rendering, applied wet in wet is the paramount factor to ensure the optimal carbonization of a paint layer with the Intonaco.



From the early christian to the late romanesque periods a single layered rendering was in use again, especially in alpine regions and Northern Europe. The exception is Byzantium and its area of influence, where the traditions of fresco painting prevailed. The multi-layered plaster work returned once more during the 13th century, particularly in the southern alpine and mediterranean regions.

This can be attributed to two main factors:

- 1) The prevailing tradition of mural painting in these areas
- 2) Multi-layered rendering meets the requirements to level the irregular masonry surface built in quarry and sorted stone.

Thus, the masonry is an important factor, determining the stratigraphy of its rendering.

- A single layered rendering on cobble and boulder masonry leads to a wavy surface, through which the bonding can be clearly seen.
- On quarry stone work the surface of the single layered renderings appears irregular, but the bonding is hardly visible.
- On brick work and Ashler, the single layered Intonaco appears very even.
- A multi-layered plaster working consisting of Arriccio and Intonaco layers which almost covers the character of the underlying masonry completely.

The first European wide use of multi-layered plaster work came during the baroque period.

During the middle ages the plaster was used as a support for mural paintings and as a protective layer against weathering. The rarely surviving and rougher renderings of gothic were only a bonding layer for following layers of plaster. It is not surprising that the four most common plaster structures in the middle ages were a simple result of regular and technically necessary methods of mortar application.

These are, throwing on the mortar, removing the excess with a trowel such the surface is leveled, so called pre-smoothing. All of these three methods of working have been in use since the 15th century and are technically necessary and determine the surface structure. The fourth method, is the continuation of the smoothing of Intonaco which was either left untreated or painted whitewashed. From the late gothic onwards and particularly in the renaissance these simple surface structures were used as a decorative element, the architectural disposition of the facade. The plaster on lesenes, tranverses and friezing and window moulding were smoothed and whitewashed to contrast with rougher, unpainted and rustical wall rendering. The rendering surfaces reflect the application methods, whose surface structures are principally different. At the same time south of the Alps the Scraffito technique became popular and can also be related to this general trend to decorative renderings.

During the baroque period the structural design of the finish was developed further. Expensive or difficult to procure building materials were imitated. Facades in rusticated masonry, not in stone, but in mortar worked with tools especially designed for this purpose. Thus in addition to the traditional trowel, in the 16/17th century nail boards and bound brush came



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into use. These new tools allowed an accurate surface imitation of tuff and porous dolomite. Such natural stone imitations can be often seen in Veltlin (I), the Brescia region (I), in the southern valleys of the Kanton Graubünden (CH) and especially in Unterengadin (CH) and in Puschlav (CH), on churches, patrician and other town houses. An individual centre of this form of facade decoration appears to have developed around Wallis (CH). In the towns of Lenk, Salgenen, Turtmann, Visp and Gampinen are many dated examples of natural stone imitation built between 1615 and 1625.

This new concept of facade disposition with plaster work was carried into northern and eastern Europe with the baroque architectural forms and interiors. An important role in the mediation of these methods were the architects and stuccoers of Mesolcina, Tessin and the so called "Comasken". They were all influenced by the works of Palladio and Borromini.

The scratch-comb was used to imitate stone tools marking, as used in 1504 on the plastered ribs of the vaulting in the Regula-Church in Chur (CH), to imitate dressed stone. The use of spatula, griffons, toothed scratchers and fine chisels have been verified on the plaster work of two 18th century residences of the Salis family in Bregaglia/Graubünden (CH).

The use of jute-balls was already in use in the 16th century to smooth by rolling and rubbing over the wet plaster. Jute-rubbing was commonly used on single-layered rendering, on irregular masonry, as it was easier to work over the irregular surface, as with the wooden float.

An important discovery in the manner of plaster application was the splatter-dash or dashing technique (Besenwurf). The oldest Swiss examples originate from the middle of the 19th century on and are occasionally coloured red ochre. Dashing is the most common method of mortar application of the 19th and early 20th century north of the Alps. Trowel-working, jute-finishing, floating, nudging with the nail-board, bound brushing or combed scratcher used for the surface forming of the Intonaco all require to be worked in fresh plaster. It is not surprising the mechanical age of the 19th century developed the "Wormser", a dashing machine. The manner application with the "Wormser" is as follows: the Arriccio must be applied and floated such the structure of the dashing can be well seen. To attain the best bonding the dashing must be applied wet in wet.

A wet in wet application on a fresh Arriccio would result in drying cracks. The so called "Riesel" (trickle) or "Kieselwurf" (pebble-dash) were developed in Italy Grottos of the 16th and 17th century and can be compared with modern "Waschbeton" (pebbled concrete). These techniques were used from the 16th to the beginning of the 20th century to dress walls and imitate hewn stones and requires only a moist Arriccio underground.

### **Catalogue of verified historical plaster-structuring**

#### 1) Trowel thrown and otherwise unworked

Trowel thrown rendering can be found from the second half of the 15th century onwards and can only be found on a few objects in the middle and southern alpine regions. Its smooth and at times rough surface depends on the aggregate sizing. All found examples are unpainted and single layered.

#### 2) Trowel thrown, excess mortar removed and otherwise unworked



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This type of plaster work can be found in the whole alpine region from the end of the 15th century on late gothic churches and on into the 19th century on castles, patrician and other town houses. From the 16th to the 18th century a rough structured and natural coloured plaster (unpainted) is favoured and is an ideal contrast to the well smoothed and line washed architectural elements. There is no other plaster rendering that differs so greatly from object to object. This is a result of the individual manner of each plasterer and the different properties of the local sand. On facades with this plaster work the Pontate, Gionate and the trowel working can be especially well seen. The excess mortar was removed by scrapping the trowel at right angles to the wall. Most of the examined objects had a single-layered rendering.

3) Trowel thrown, excess mortar removed, trowelled and otherwise unworked

From the middle of the 15th century onwards this type of plaster work can be found through-out Europe as a single- or multi-layered rendering. In the 16th and 17th century it can be found in the whole alpine region on wall surfaces, mostly unpainted, as comparison to the whitewashed architectural mouldings and scraffiti. The method is as follows: the mortar is applied and excess removed (as in 1 and 2) immediately after which the trowel is floated almost parallel with the wall and thus lightly smoothing the plaster. This plaster work also allows the Pontate, Gionate and the signature of the plasterer to be seen. The working portions of plaster (four to five trowel portions) are immediately flattened and worked together with already applied areas. The plaster technique is often used to-day with ready made products to produce a rustical plaster.

4) Spread with the trowel and otherwise unworked

This type of plaster-work is similar and can be easily mistaken for the surface structure of Type 3. The difference basically the angle in which the trowel is held, it is less scrapped, but it is a spread and smoothed working in which the diagonal and some times the horizontal working of the trowel can be seen. The pattern of the trowel markings are dependent on the height of the area being worked on respect to the plasterer e.g. above or below chest level. This method was in use since the 16th century in the whole alpine region the plasterer-work appears rather dilettantish. The mortar is layed on in small portions with the back of the trowel and spread upwards over the masonry surface.

5) Trowel thrown, excess mortar removed, trowelled and smoothed (floated)

By definition, this type of plaster-work requires four phases of working in which each individual can represent an already defined manner of working (Type 1-3). It occurs in single- and multi-layered rendering and is usually whitewashed and rarely unpainted. The smoothed plaster surfaces have been in use since antiquity up to the early renaissance. In Byzantium and its area of influence it has been traditionally used up to the beginning of the 20th century.

The smoothing of the surface of the Intonaco follows a period of time after the trowelling-work has been completed. When smoothed too soon after the trowelling, before the mortar has started to stiffen, too much calcium hydroxide and the finest aggregate particles are transported to the surface and fill the surface pores. This hinders



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the penetration of carbon dioxide into the deeper layers of the rendering, thus weakening the mortar-bonding because of a reduced carbonization of the lime. A well smoothed surface can only be achieved with a trowel which has a well rounded tip.

6) Trowelled or smoothed Intonaco with lime-brush brushing

This plaster structure can often be found from the middle of the 16th century onwards in the northern alpine regions. It has also been found on a dated choir screen from 1437 in the Valeria church in Sion, Kanton Wallis (CH). When the Intonaco has some what stiffen, it is dressed with a lime-brush using a strongly thinned lime-putty. This plaster surface is often mistaken for a rubbed surface working.

7) Trowelled or smoothed Intonaco and rubbed with jute-sacking

This manner of structuring also requires a partially stiffen Intonaco that is rubbed over with a wet ball of jute-sacking. The rubbed structure is similar to that of a floated finish, which levels the surface in contrast to jute-working, which follows the natural surface irregularities.

8) Historical rubbed surfaces

Finished surfaces (Intonaco) with this structure first appear in the 17th century. Although they have been found in Herculaneum (I) and Pompeji (I) on Arriccio rendering layers.

This method of working requires a multi-layered rendering with a relatively well levelled surface, the Arriccio must not be fresh, but only wet, when the Intonaco is applied. Further more, the Intonaco must be smoothed before the rubbing down with the jute-ball. The historical surface is not comparable with the modern felt-floating.

9) The modern rubbed plaster

The modern plaster binders do not have the same properties as the historical binders (Pos. 13). The modern plaster-binders shrink as they bind. Thus the Intonaco must be applied on a already bound Arriccio. This is the reason why the structure of modern rubbed plaster differ to the historic examples. During the rubbed floating the sand grains roll over the hardened Arriccio and cause a grooved surface structure.

10) Trowelled Intonaco rendered with a lime slurry

This manner of plastering can be found from the beginning of the 16th century north of the Alpes. Currently no examples have been found south of the Alpes. On the trowelled and fresh, but slightly hardened Intonaco, a wet in wet lime slurry is brush applied in up to two layers. The lime and sand slurry is so thin that it cannot be trowel applied, but thick enough to be brushed on. The plaster slurry is intended to level the otherwise rustical trowelled surface.

11) Dashing



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Dashing is first found from the middle of the 18th century onwards and wide spread north of the Alpes. The dashing is applied with a broom of beech twigs on a levelled, smoothed or rubbed Arriccio. To achieve a regular surface the process must be repeated 2-3 times. The mortar contains a fine sand (0-1 mm in size). Red ochre coloured mortar of the dashing is not uncommon, usually the Intonaco remains unpainted.

12) Wormser or mechanical Dashing

The same but thinner mortar-mix is used because of the mechanical application. The Wormser consists of a mortar through in which feathered metal strips run. The latter are attached to a crank, which on turning, the strips move and pick up and throw mortar on the wall. This method is less time consuming and has a very similar structure to hand dashing.

13) Pebbled surfaces

The following examples all originate from the 19th and beginning of the 20th century. Ashler was imitated at the base of walls and on lisenen. As dashed pebbling requires a levelled Arriccio on which a mortar of coarse sand (8 to 10 mm) or pebbles (18-22 mm) mixed sand (1:4) is applied. The sand and binder are the adhesive mass for the coarse sand and pebbles which form the surface structure. Lime putty was the binder in the 19th century. Towards the end of the 19th century hydraulic lime was used and during the 1930's a hydraulic lime-cement mixture was increasingly used. Rarely was chipped stone used, but rather rounded pebbles. This very decorative pebbled plaster is a rational replacement of the individual hand placed pebbles in the wet mortar and has a very similar appearance.

14) Imitation of Tuff and porus dolomite

The plaster structure was used in the late gothic and can be found on many houses in Ravensburg (D), which have described by Pursche. The most common dated examples originate from the late 16th and beginning of the 17th century. Very few examples can be found in the 18th century. Most examples of the 19th and 20th century on stately homes are mostly reconstructions of baroque prototypes.

The nail-board is worked into the fresh and thickly applied Intonaco. Examined objects have shown that the nail board was a 4-6 cm board, in which 20 to 25 hand made nails were hammered. Some surfaces were also modelled not with the nail heads but with the nail points. It is important to remember that on all examples of the 16th, 17th and 18th century tuff imitations the Intonaco was thrown on and the excess scrapped off. The rough and nail board modelled surfaces were used to imitate hewn tuff. The examples of the 19th and 20th century show a well smoothed Intonaco, exactly Ashlered and nail-board-modelling which results in a boring and stereotype surface.

15) Tuff imitation with twig brooms

Although most examples appear in the late 16th and 17th century and in Ravensburg (D) from the 16th, 17th and 18th century and even from the late gothic (Pursche). The



manner of working is as with the nail board which is replaced by a broom of twigs.

#### 16) Stone-tooling imitation

The zenite of plaster structuring must be the imitation of masons tooling. Masoners tools were used and exclusively developed modelling tools, whose shapes can only be speculated. Tooling imitations are rare and only limited research results are available. The first finds were in 15th century, late gothic churches in the Kanton Graubünden (CH). On vaulting ribs, chore arches, a thin lime slurry has been applied in which with scratch combs (Regulakirche, Chur 1504, CH) or with fine pointed tools (Cloister Chur of Cazis, late 15th century, CH), masons tooling were imitated. These architectural elements were painted according to tradition grey or some times yellow. The hatchet, spatel and small hammers with cutting edges are further instruments of the 17th and 18th century used to structure the Intonaco.

Some perfect examples of tool imitation of the 17th century can be found on the facades of two Pallazzi der Herren von Salis, one in Bondio, the other in Soglio, both in Bergell (Graubünden, CH).

The quoins and friezes are modelled in mortar, are 18 mm thick, smoothed and white-washed. Load bearing elements of the facade are in a grey hewn Gneis e.g. door and window jambs. In the stiff but wet plaster was chiseled to form the Ashler edges and their surfaces worked with other tools in the same manner as a mason. The tooling imitation is so convincing that it can only be distinguished at a short distance from masons-tooling. This perfection was carried on into the 19th century as the last example illustrates. On the main wing of the Eidgenössische Technische Hochschule in Zürich, built by Semper in a neo-renaissance style, with a disposition in Ashler and running moulding in mortar. They are indistinguishable from the local "Molassesandstein".

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### **Abstract**

Historical plaster-work is completely over shadowed by mural painting and the common opinion is that all renderings are replacable. After all, what is so special about plaster? Its importance becomes apparent by the observation of modern repairs in the historical Intonaco of facades.

The difference in surface structure of the repair and its surroundings are mostly unacceptable, if not disfiguring. Since the systematical examination of historical buildings before their renovation by conservators and restorers, a comparison of the manner of modern and historical rendering had been made possible. The data were collected and studied. The results were fascinating, but sobering, when considered how much historical material has been lost through misunderstanding and ignorance.

The literature about plaster yields mostly technical information about aggregate grading, fillers and recipes etc. Collected results of plaster examinations over the last 20 years show clearly that plaster-work was not only a protective coating for masonry but a decorative element in its own right.



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The autor explains the manner and art of making various surfaces on rendering and includes a catalogue of 13 different methods of structuring using towel, lime-brush, jute-balling, nail-boards, dashing, pebbleing etc.

The author has observed and defined 28 historical surface structurings. The 16th century is rich in variations of plaster-working which imitate Ashler and natural stone surfaces. They formed the disposition of facades and replaced the more expensive stone working. Naturally the facade surface and decoration cannot be compared to a mural painting. Never-the-less, when the historical finish of even a significant building is lost, the building is stripped of its contemporary expression and ambienta and thus reducing ist value as a historic document.

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