Composition and application of cimorné finish: an interwar cement render decorated with coloured opalescent glass granules

Liesbeth Dekeyser[1], Laurent Fontaine[2], Ann Verdonck[1] and Hilde De Clercq[2]

1. *Department of Architectural Engineering, Vrije Universiteit Brussel, Belgium, liesbeth.dekeyser@vub.ac.be, ann.verdonck@vub.ac.be*
2. *Monument laboratory, Royal Institute for Cultural Heritage (KIK-IRPA), Brussels, Belgium, laurent.fontaine@kikirpa.be, hilde.declercq@kikirpa.be*

Abstract

A Walloon entrepreneur developed and patented *Cimorné* cement render at the beginning of the 1930s in Braine-l'Alleud (south of Brussels, Belgium). This peculiar façade finish consists of a pigmented multilayer cement mortar onto which opalescent and mass coloured glass granules were projected. Cimorné became popular in the interwar period and was available in a variety of (very bright) colours, depending on the global hue of the added opalescent glass granules. Local craftsmen developed in their characteristic manner application techniques, mixing the mortar of the cimorné render, based on a Portland cement mortar, on-site. Minor information is available about the cimorné technique, a regional applied finish of which the characteristics, formula and application method were mainly orally transmitted between craftsmen. Hence, knowledge about the cement mortar, its cement-sand ratio, granulometry, etc. is crucial and prior to durable repair and restoration campaigns. Interviews with retired plasterers revealed relevant information about the original formula, preparation on-site and application method. The information related to the cimorné craftsmanship was compared to data found in archival records, patents and interwar plastering and masonry manuals on the one hand and to results from laboratory analyses of mortar samples lifted on-site on the other hand. The overall results form the basis for restoration trials, which will be carried out on-site, in order to enable future durable and sustainable repair interventions of this peculiar Art Deco cement render.

Keywords: cement render, interwar period, opalescent glass, mason manuals, laboratory analyses.

1. Cimorné render and the reconstruction of its formula

The second half of the nineteenth century was characterized by the development and application of Portland cement renders on several buildings. Initially cement façades were appreciated because of their resemblance to blue stone, but only after some decades this perception changed drastically in favour of more coloured façades (Van der Heiden 2010). Grey cement finishes were considered unattractive and transformed into white stone-like plasters or more coloured ones by the addition of alkali-resistant pigments like metal oxides. But pigments washed out and the colours faded over time. Around 1928, Pierre Pétroons (1897-1969) came up with the creation of a coloured and textured finish, based on the projection of opalescent coloured glass particles onto a Portland cement mortar render. The cimorné finish was born. Etymologically, cimorné is the combination of two French words *ciment* and *orné* literally meaning 'decorated cement'. This suggests the principle of cimorné: a decorative façade finish composed of a cement render with opalescent glass granules projected onto it. Portland cement and Marbrite opalescent glass were both manufactured in the province of Hainaut (Walloon Region, Belgium) and thus easily accessible for Pétroons, whose company was located in Braine-l'Alleud.

Pétroons launched his cimorné finish at the *World's Fair* of 1931 in Liège (Belgium) and patented it later on in Belgium, UK and France (Dekeyser et al. 2012). According to these patents, cimorné was commercialised as being 'rainproof', requiring 'little or no maintenance'(AAM 1932). Both renovated cottages and new villas were decorated with cimorné render in a variety of colours and patterns (figure 1). Despite the fact that cimorné was applied all over Belgium, this craftsmanship was a rather local custom and its formula and application technique were passed on between contractors.

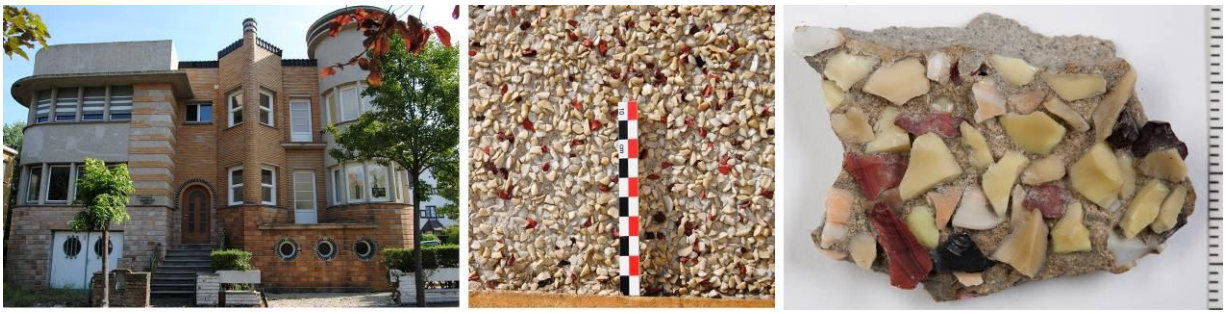

Figure 1: Façade with grey cimorné zones (De Panne, Arch. L. Legein, 1936) - detailed picture of this cimorné finish with white, beige, yellow, black and dark red glass fragments – picture of the onsite lifted sample M1 (KIK-IRPA).

An information letter from the cimorné company addressed to contractors and architects (AAM 193?) explained the cimorné technique and states, cited, '…once the cement render is executed, a technician is at your disposal to teach the projection technique during one or two days…' (*'…après cimentagé executé, un téchnicien est à sa disposition pour l'apprentissage de la projection, pendant un ou deux jours…'*)(AAM 193?). In order to facilitate the application and therefore the choice of this type of cladding, Pierre Pétroons sent his staff to architects and entrepreneurs to show the manual projection method (figure 2). Hence, written or iconographical data about the constituents or composition of the cement mortar are lacking. To compensate for this lacuna, retired plasterers were interviewed and their testimonies became of primary importance for the reconstruction of the cimorné formula and application method.

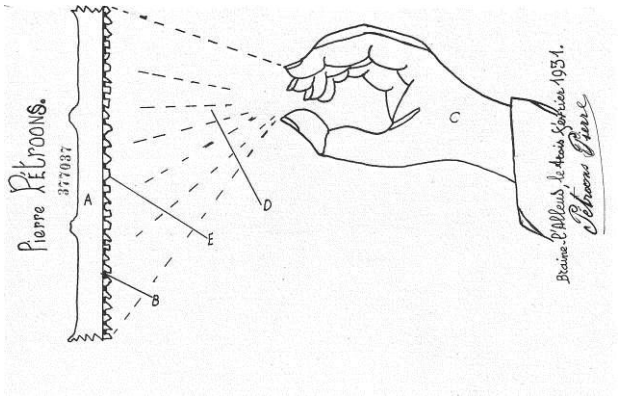

Figure 2: Patent 377037 applied by Pierre Pétroons and demonstrates a manual projection method in order to apply the opalescent glass fragments onto the wet cement mortar. (Patent BE377037, General State Archives, Brussels)

Despite the development of ready-mix plasters in the 1930s local entrepreneurs, consisting of masons as well as plasterers, mixed their cimorné mortar on-site, based on their personal experience and valid knowledge published in handbooks. The mason and plasterer manuals illustrate e.g. how to built a scaffolding, how to prepare a façade for rendering, how to apply mortars, which tools to use, different compositions for various purposes, etc. French, Belgian and Dutch manuals from the first decades of the twentieth century were consulted to expand the knowledge of application techniques and formulas of

cement mortars. Although none of them mentions cimorné finish, decorative plasters based on Portland cement mortar in general are well described. These were compared to data resulting from testimonies of former practitioners and to results of laboratory analyses.

Table 1: overview of data found in different French, Dutch and Belgian manuals of the 1920s and 1930s related to the compositions of cement mortars for outside use.

Manual	p.	Remarks	Trass	Lime	Cement	Sand	Water
Van Der Kloes, J.A., *Onze bouwmaterialen, deel III, Mortels en beton*, L.J. Veen, Amsterdam, 1908	143			1 part	1 part	3 parts	
Van Der Kloes, J.A., *Handleiding Voor Den Metselaar*, E.J. Brill, Leiden, 1923	150 150 240	to plaster for bricklaying for exterior use			1 part 1 part 1 part	2 parts 3 parts 3 parts	
Champly, R., *Béton armé enduits et agglomérés*, Desforges, Girardot et cie, Paris, 1931	15	for exterior use			100 kg	200 kg	
Poirson, *Encyclopéde Roret, Chaux, ciments, platre*, Paris, 1931	239	cement mortar for coating			500-600 kg	1 m³	
Oosterhof, *handboek voor den stucadoor*, van mantgem & de does, Amsterdam, 1932	58		½ - 1 part		1 part	3 – 5 parts	
Hannouille E., *Pour le Maçon et le Plâtrier*, Dunod, Paris, 1934	35 35 37	renders vertical rendering, very fat mortar		1 part /	/ 1 part 1 part	2 parts 2 parts 1 parts	 0.4l
Merciot, A., *Manuel du cimentier*, libr. Garnier frères, Paris, 1934	71 71	Exterior use Humid conditions			350-500 kg 660-800 kg	1 m³ 1 m³	
Chaplet, A., *Pour le cimentier*, Dunod, Paris, 1938	24				1400 kg	1000 l	410 l
Nachtergal, A., *constructions civiles, matériaux de construction*, Rowart, Bruxelles, 1938	141				300-500 kg	1 m³	
Poptie, *Handboek voor den stucadoor deel 1*, technische uitgeverij H. Stam, 1950	121	Rendering layer (1cm thick)			1 part	3 parts	
Poptie, *Handboek voor den stucadoor deel 2*, technische uitgeverij H. Stam, 1950	19	Rendering layer			1 part	3 parts	
Beausoleil, O., *Les livres jaunes, n°2, maçonnerie, platre, ciment, carrelage*, La librairie du Midi, Bruxelles, 1966	22	Rendering layer Top layer			1 part 1 part	3 parts 2 parts	
Geldof, G.P., Stukadoren, technische uitgeverij H. Stam N.V., 1969	3 5 8 124	 Rendering Rendering layer Float layer		 1 1	1 part 1 part 1 part 1 part 2 parts	3 parts 5 parts 3 parts 3 parts 9 parts	

2. Plasterer and mason manuals

Regional available materials like Marbrite glass that was manufactured and commercialised by the S.A. Verreries de Fauquez in Braine-le-Comte (Belgium) and cement possibly coming from a cement factory in Hainaut (Stenvert 2010), were used to create cimorné finish. Being probably applied only in Belgium and the North of France, manuals published in both countries were searched. Although no sources of applications of cimorné façades in The Netherlands were found, some important manuals written by Van der Kloes, Oosterhof and Poptie were consulted (table 1). The consulted manuals are related to a restricted publication period, the 1920s and 1930s, as cimorné was mainly applied in the period from 1932 until 1938. Thirteen manuals were found and thus selected for further research: bad mortars (with both lime and cement as binding agents) were omitted and only data concerning cement mortars was selected. An overview of data found in different French, Dutch and Belgian manuals of the 1920s and 1930s related to the composition of cement mortars for outside use are summarized in Table 1.

The Dutch architect Van der Kloes (1845-1935) stated that the application of plaster is situated in between the expertise of the plasterer and this of the mason. He was the author of some important manuals about building materials in general, more specific about Portland cement mortars and their characteristics. Portland cement adheres well and possesses strong hydraulic properties, explaining the need for attenuation. The supplement of gypsum to a Portland cement mortar must be avoided, since it was considered to be 'a depraved admixture' by Van der Kloes (Van der Kloes 1923, p. 144). Bad mortars were created by the addition of lime, making the mortar cheaper, easier to apply and thus very popular in use. Too much lime added to cement was considered as reducing the watertightness and favouring shrinkage of the mortar. A mixture of 1 part cement, 1 part lime and 3 parts sand guaranteed a waterproof character (Van der Kloes 1908, p. 143). Mortars for exterior use were generally a mixture of 1 part cement to 3 parts sand. In general Portland cement was quite difficult to smear, but this 1:1:3 composition was quite easily applied according to Van der Kloes. It created a dull, sandy and unsightly look, but remained free of shrinkage and thus also crazing could be limited. At that time cement mortars were chosen over bad mortars. All manuals mention Portland cement as being a 'miracle' product. Cement mortars were preferred for outside finishes and used to cover up entire façades as well as only plinths or details.

In general, a cement-sand ratio of 1 to 3 parts is advised for outside use in most of the manuals. Some of them prescribe a 'fat mortar' consisting of 1 part cement to 2 parts sand or even 1:1 proportions (Hanouille 1934 and Chaplet 1938). Like Van der Kloes mentioned, this mixture is just enough waterproof. Hardly anything was documented about additives or retarders, which were often added on a trial-and-error basis. Moreover, this kind of information remained secret and was part of the mysteries of craftsmanship of the 1930s. To unveil these mysteries, former plasterers were interviewed.

3. Testimonies of former plasterers

Recently, architects, owners and heritage agencies are confronted with a crucial need for information on how to conserve and restore cimorné plasters subject to several types of degradation phenomena. Hence, recently a growing interest in this local cimorné craftsmanship is noticed. Because of the limited knowledge found in the manuals and the lack of information about cimorné as a decorative finish, other sources had to be sought. The cimorné technique was mainly orally transmitted between Pierre Pétroons and other contractors. Retired plasterer Laurent Pays, who is 85 years old, carried out some demonstrations of the cimorné technique (figure 3). He was contacted and interviewed. Since his father was a former business partner of Pierre Pétroons, his testimony was very valuable for this study. Other retired plasterers were found via a call for information in local journals. In total, three retired plasterers communicated their experience with cimorné, its formula and application method. Each of them worked in a different region: the company of Gilbert Schoonheydt and his father was established in Halle, Romano Tondat and his father in Eeklo and Laurent Pays in Braine-l'Alleud.

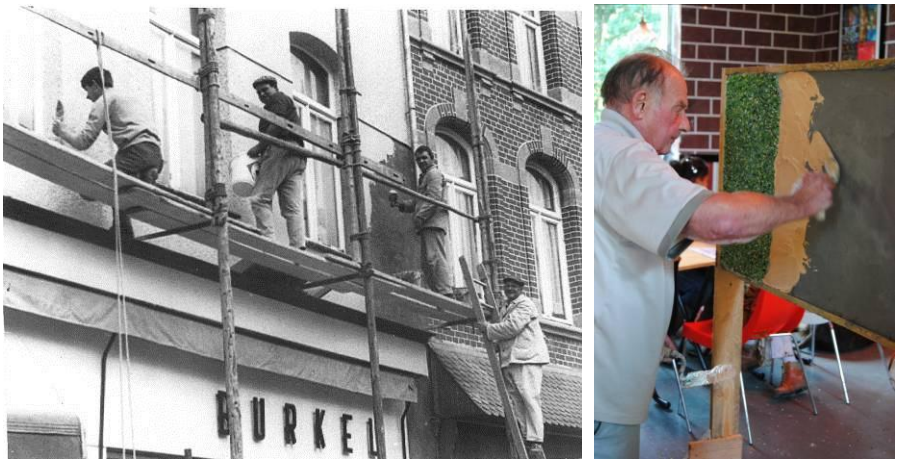

Figure 3: Left: Laurent Pays (middle) and his team carrying out a cimorné finish in the 1960s. Right: Laurent Pays has reached the age of 85 and demonstrated his technique in 2011.

According to their customs, the applied Portland mortar was composed of two or three rendering layers, depending on the condition of the masonry or concrete support. The rendering consisted of 1 part grey Portland cement and 2 parts sand. In contrast to the 1:3 composition described in the manuals, a 'fat mortar' was used and a top layer of about three to four millimetres was applied on the rewetted rendering layer. The cement to sand proportion is 2:1 and thus not consistent with the previous results. Occasionally dry pigments were added to this top layer in order to create a suitable matrix for imbedding the projected coloured glass particles. This cement-rich layer must be sticky enough to favour the adhesion of the glass fragments that will be later on thrown into the wet mortar. So the formula of the top layer was chosen according to its adherence properties. To avoid quick drying of the top layer and consequently to extend the operating time for the projection of the glass particles, a commercial water repellent product named 'Pollux' was added to the rendering layer. (Interview and workshop Laurent Pays, 20.12.2012) The addition of water retaining products to the rendering groundlayer was however not recommended by Geldof, who suggested adding waterproof agents only to the top layer. (Geldof 1969, p. 124) According to his book 'stukadoren', the rendering groundlayer of decorative plasters needed uniform and minor 'suction' properties to avoid differences in structure, texture and colour of the top layer. When the water repellent was added to the rendering layer, it 'burned' in case of extreme heat or sunlight (ultra-violet).

Occasionally Pays used linseed oil soap to improve the workability, but not retarders. The top layer was coloured by means of dry pigments added to the white cement and sand mixed in a 2:1 proportion. Chaplet described in 1938 'ciment blanc' (white cement) commercialised like 'hermine' and 'glyptolithe' (Chaplet, 1938, p. 7). In contrast to Portland cement, a white cement based on white clay hardens rather quickly (Hannouille, 1934, p. 27). He also mentioned the use of a small amount (< 2%) of gypsum (plâtre) to enhance and sugar (like honey, dextrin, sucrose, lactose) to reduce the hardening time (p. 48) and discusses the coloration technique of mortars (p. 62). Laurent Pays himself applied pigments of *Stoopen &Meeûs* and *Bleu d'Outremer* (in Belgium also known as 'blauwselfabriek'), two Belgian companies situated near Antwerp and Ghent.

4. Results of laboratory analyses

To complete the data of manuals and oral testimonies, samples were lifted on-site and transmitted for further laboratory analyse (Table 2). Prior to the chemical and mineralogical analyses, the cimorné mortar samples were prepared according to a specific sample preparation method. Thin sections of mortar samples were prepared for further petrographical investigation to examine the type and characteristics of the binder, aggregate and additives of the mortar sample. The yellow dye added to the resin used for the preparation of the thin section enables the analysis of the pore structure. Further, mortar specimens were imbedded in an inert epoxy resin and polished down to 1 µm grade using diamond pastes prior to the investigation with the optical microscope and SEM-EDX. At first the mortar samples were visually

inspected under an optical microscope (ZEISS, Axioplan, reflection) to detect the number of layers, the homogeneity, impurities, etc. Subsequently the same samples, coated with a gold layer, were examined by SEM-EDX in order to examine the structure on a micro-level. The energy dispersive X-ray spectroscopy (EDX) enables the analysis of the constituting elements. Since the silicon content can be regarded as an indication for the hydraulicity of the binder, EDX analyses were performed to determine the average weight percentage of SiO_2 (silica) in relation to the total amount of SiO_2 and CaO. Finally, a chemical analysis was conducted to define the cement/sand ratio by pouring the mortar sample in a hydrochloric acid solution to dissolve the binder. In total, 5 samples of cimorné mortar lifted from the façades of different buildings have been investigated. The properties of the cement layers of the cimorné mortar are presented in Table 2.

Table 2: Properties of the cement layers of the cimorné mortars.

Code	Provenance	Layer	Colour	Thickness (mm)	Binder	Sand (type and size)	Binder/sand-volume ratio
M1	House, Corner Dumontlaan-Visserslaan, De Panne (1937)	Rendering	Grey	3	Cement	Coarse, quartz, 1.38 mm	5:4
		Top	Brown	2	Cement	Coarse, quartz 1.17 mm	11:2
M2	House, Visserslaan 28, De Panne (1936)	Rendering	Grey	8	Cement	Coarse, quartz 0.93mm	1:1
		Top	Brown	2	Cement	Coarse, quartz 1.32 mm	7:2
M3	House, Corner Dumontlaan-Visserslaan, De Panne (1937)	Rendering	Grey	3	Cement	Medium, quartz 0.90 mm	7:6
		Top	Brown	2	Cement	Fine, quartz 0.39mm	14:3
M5	Pétroons' house, Braine-l'Alleud (1935)	Rendering	Grey	3	Cement	Medium, quartz 0.52 mm	4:3
		Top	Pale grey	2	Cement	Medium, quartz 0.52 mm	13:3
M6	House, Molenbeek (Brussels) (1937)	Rendering	Grey	15	Cement	Coarse, quartz 1.73 mm	1:1
		Top	Grey	2	Cement	Coarse, quartz 1.13 mm	7:2

From the results presented in Table 2 the use of cement as binding agent, with a silica content varying between 21.1 and 30 wt.%, is noticed for both the rendering and the top layers. According to the colour, grey cement was used for the rendering layer while a lighter cement (probably white cement), appearing pale grey, was used for the top layer (the brownish hue of the three first cimorné samples in Table 2 can be explained by the addition of a small amount of iron as revealed by EDX analyses). The laboratory results are thus in agreement with Pays's testimony. The sand consists of quartz grains of which the size ranges from 80 µm to 1.73 mm (M6). The first three samples in Table 2 originate from Art Deco houses in De Panne, located South-East of the Belgian coast line, and contain a coarse quartz sand as aggregate with some lithics (sandstone, limestone and flintstone), as well as feldspar and glauconite grains (figure 4 & 5). The aggregate of the Pétroons' house sample on the other hand appears to be very pure quartz and only medium coarse. This villa was built around 1935 and covered with cimorné according to the 'standards' of cimorné's inventor. In the Molenbeek (Brussels) sample again a coarse quartz sand is found but with a different composition since only feldspar grains can be identified.

Figure 4: Samples M1, M2, M3, M5, M6. (KIK-IRPA)

The cement:sand volume ratio for the rendering layer can be generalized to 1:1, although the abovementioned sources reveal a 1:2 proportion. Chaplet and Hannouille mentioned this proportion for a 'vertical rendering' and 'very fat mortar' (Table 1). The cement:sand ratio of the top layer (without the glass fragments) can hardly be precisely determined because of its limited thickness. The cement content is estimated as 3 to 6 times the sand content. The cement content determined analytically is hence considerably higher than the 2:1 ratio applied by Laurent Pays. Again a very fat mortar was applied in order to create a sticky surface onto which the projected glass would properly stick.

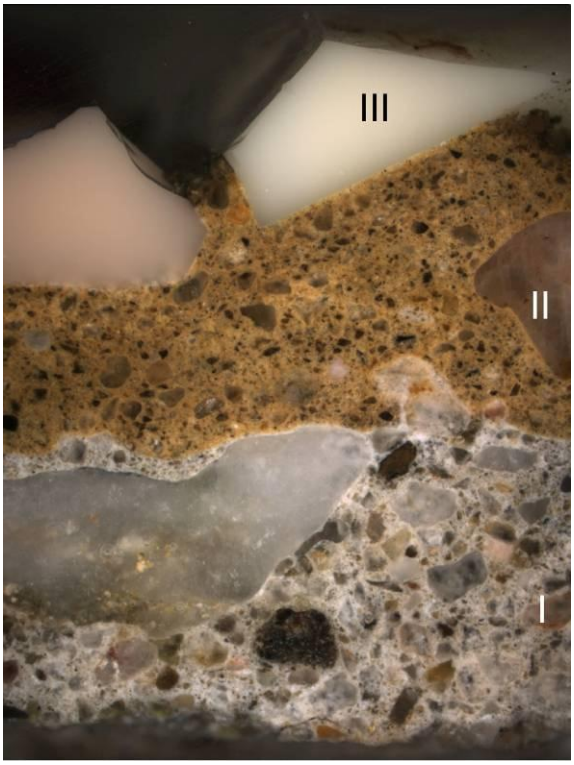

Figure 5: Optical microscopic captured image of cimorné sample M1 with rendering layer (I), brownish top layer (II) and white opalescent glass fragments (III). (KIK-IRPA)

5. Restoration challenges: beyond cimorné formulas

Little information about the cimorné's formula was available. In an attempt to reconstruct this formula, a range of crucial sources was consulted and manuals of the interwar period were searched for instructions about the used binder and aggregates. They remain vague and only mention some cement-sand ratios. Because of its local development and application, cimorné is not included in these manuals. Hence guidelines for decorative plasters in general were listed. Former craftsmen were interrogated about their experiences with cimorné and the overall applied mixtures. Only three of them were traced and interviewed. Furthermore, contractors had their characteristic trade secrets and habits. Since cimorné technique was orally transmitted and passed on from father to son, a general formula does not exist and cannot be searched for. However, the results of laboratory analyses confirmed the use of a cement-sand

mortar (grey cement for the rendering layer and probably white cement for the top layer, the latter being sometimes coloured) and indicated the use of a medium to coarse quartz sand. Presumably contractors opted for raw materials that were easily available and built up their know-how based on experimenting and trial-and-error processes.

The obtained results are not exact, but provide insight into the composition of cimorné façades. Reconstructing the cimorné formula is only a minor step towards future restoration of this peculiar façade finish. The damage pathologies need to be mapped and further monitored in order to succeed in the conservation and restauration of damaged cimorné façades. The application methodology for the reparation of the cimorné plaster is crucial to contribute to a durable and sustainable restoration strategy. Therefore demonstrations and a workshop where Laurent Pays showed and transmitted his know-how to a team of restorers were organised. Once the original formula, the application technique and the damage patterns are known, on-site restoration trials will be carried out. Since marbrite glass production stopped in the 1960s, hardly any marbrite glass is left and thus a substitute material need to be defined. Further research an on-site test strips are essential, not only to reconstruct cimorné's formula, but to define correct restoration stratigies for cimorné finish.

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