

Materials Used for the Conservation of Mural Paintings in Austria: Past – Present – Future

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Abstract

Due to the complexity of varying damage functions, together with the restricted range of possibilities of intervention, the conservation and restoration of mural paintings is one of the most challenging tasks of preservation. A review of the history of conservation and restoration reveals a wide variety of materials and techniques used for consolidation. Above all, the evaluation of earlier conservation treatment processes shows highly damaged surfaces having suffered from the application of unsuitable materials. However, these treatments reflect the technological know-how of that time and have to be evaluated from a retrospective point of view. This presentation gives a short overview of materials used as consolidates in the past as well as in present times and shows their influence on some important Austrian mural paintings. Reviewing 200 years of conservation history teaches that the methods used in former times need not be necessarily denounced, although we should benefit from the experience and the knowledge and learn from previous mistakes for a better future for monument conservation.

Keywords: mural paintings, technology of conservation, consolidation, ethyl silicate, soluble glass

Klíčová slova: nástěnné malby, technologie konzervování, konsolidace, ethylsilikáty, vodní sklo

1. Introduction

From the technological point of view, history of the conservation and restoration of wall paintings reveals the chronology of its destruction. The fact that at present the restoration of mural paintings deals mainly with “restoration of restoration” and conservation of former treatment processes raises a question regarding earlier operational methods¹. However, the processes applied in the past have to be associated with the level of knowledge of that time and evaluated from a retrospective point of view.

Written reports concerning the conservation and restoration of wall paintings are very scarce. Despite the existence of an enormous amount of undocumented treatments, there is an example found in the parish archive of Schwaz in the Tyrol. Extracts of the report by painters Georg and Andreas Höttinger, translated into English, are cited as follows: In 1652, father and son Höttinger restored the mural paintings from 1520 in the cloister of the Franciscan Abbey in Schwaz: “*Firstly, take a hot and highly concentrated base and wash the entire surface, additionally rub with soap, salt and straw. [...] As soon as the painting has dried, grind with a knife. [...] Afterwards rub with a cloth made of wool and nut oil. [...] Then lubricate the surface with egg white in order to improve the glossy appearance and to prevent the settlement of dust. [...]*”². According to the report, it is not surprising that nowadays the mentioned mural paintings are in a very poor condition as it can be seen in [Fig. 1]. Additionally, it should be mentioned that such a procedure was not the only torment mural paintings suffered from; treatments with wax and oil were also reported in the 19th century.

While the procedures described above usually derive from the lack of knowledge, an evaluation has to be accomplished from today’s point of view. Therefore, reviews of the conservation treatment processes of former times should also include a historical and art historical perspective of treating artworks then³. Scientific literature describes a number of examples, where so-called “wrong” conservation treatments of the past meant challenging problems for contemporary conservators.^{4, 5, 6, 7, 8}

2. Historical development up to 1900

The great variety of inorganic consolidants, mentioned in the literature of the 19th and 20th centuries, includes mainly lime, lime water, gypsum, hydraulic-setting binding media as well as

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- 1 KOLLER, Manfred. Mittelalterliche Wandmalereien in Österreich – 150 Jahre Restaurierung. In EXNER, Matthias; SCHÄDLER-SAUB, Ursula (eds.). *Restaurierung der Restaurierung? ICOMOS Hefte des Deutschen Nationalkomitees XXXVII*, Munich 2002, ISBN 3-87490-681-7, p. 103–118.
 - 2 *Kunstgeschichtliches Jahrbuch der k.k. Zentralkommission*, Vienna, 1908, p. 147–148.
 - 3 PURSCHE, Jürgen. Ursache und Wirkung. Die Problematik reaktiver Konservierungsmethoden bei Wandmalereien. In *Arbeitsblätter des Bayerischen Landesamtes für Denkmalpflege* 104, 2011. Munich, p. 11–29.
 - 4 Konservierung von Wandmalerei, *Arbeitshefte des bayerischen Landesamtes für Denkmalpflege* 104, Munich 2001. ISBN 3-87490-711-2.
 - 5 *Restauratorenblätter* 9. ISSN 1017-6373, Vienna 1978/88.
 - 6 *Barockberichte*, 34/35. ISSN 1029-3205, 2003.
 - 7 EXNER, Matthias; SCHÄDLER-SAUB, Ursula (eds.). Die Restaurierung der Restaurierung? Zum Umgang mit Wandmalereien und Architekturfassungen des Mittelalters im 19. und 20. Jahrhundert, *ICOMOS Hefte des Deutschen Nationalkomitees XXXVII*, Hildesheim.
 - 8 FELDTKELLER, Julia. *Wandmalereirestauration: Eine Geschichte Ihrer Motive und Methoden*, Münster : Lit Verlag, 2010. ISBN 978-3825818319.

Fig. 1 Faded murals in the cloister of Schwarz in the Tyrol.



their corresponding mixtures. Organic materials contain principally natural resins⁹, oils¹⁰, waxes¹¹, wax-related materials¹², proteins^{13, 14}, Arabic gum, but also unusual components such as beer, wheat starch, honey or sugar. As Julia Feldtkeller mentioned in her review¹⁵, nearly everything with the ability to adhere had been experimented with as consolidant in a desperate effort to stop degradation and decay. Due to their instability and usually not a sufficient amount of sample material, the scientific detection of historic organic consolidants is frequently a challenge.

Mural paintings discovered as part of archaeological excavations were mainly affected by coatings with paraffin, natural waxes or natural resins as well as mixtures of the compounds. Such treatment processes worked on the wrong presumption that ancient wall paintings, which usually show strikingly smooth surface, were polished with organic materials. As a matter of fact, these smooth surfaces were produced by the so-called “marmorino-technology”, where a number of layers of lime wash were applied and polished by hand without any additions of organic materials. Customarily, these materials were applied in order to increase the colour effect or to inhibit the blushing caused by salification – nevertheless, without eliminating the cause of damage. In consequence of the surface coatings the colour saturation of the commonly pale lime paintings was enhanced – followed by yellowing caused by the degradation of the organic material. Additionally, moisture content of the surface was heavily influenced, leading to problems such as moisture, salt efflorescence or brittleness, which are the predominant problems in the contemporary conservation treatment.

9 Mastic, shellac, colophony, copaiba balm.

10 Turpentine oil mixed with Venice turpentine, boiled linseed oil.

11 Bees wax.

12 Ceresine, paraffin, „Ölwachslack“

13 AMANN, Johannes. *Casein in der Konservierung von Wandmalerei*. Diploma thesis Fachhochschule Köln, 1990.

14 Egg white, egg tempera, casein, glue.

15 FELDTKELLER, Julia. *Wandmalerei restaurierung, Eine Geschichte ihrer Motive und Methoden*. Wien-Berlin : Lit Verlag, 2008, ISBN 9783700009146, p. 475–495, Anhang 2: Techniken, Methoden und Materialien der restauratorischen Praxis.



Fig. 2 (left) Mural paintings on the gallery of the collegiate church in Lambach. Foto: Bundesdenkmalamt Wien.

Fig. 3 (bottom) Recovered fragments of mural paintings in the fresco hall at the Gozzoburg in Krems.



A number of early murals, dating from the time before the end of the baroque period, were covered with lime plaster, lime wash or lime painting due to their stylistic renovations. On the other hand, therefore the paintings were protected from any further harmful surface treatment. In Austria there exists only a very limited number of initially untreated lime paintings such as the paintings from the collegiate church in Lambach,¹⁶ Upper Austria [Figure 2], which were

16 WİBİRAL, Norbert; WALLİSER, Franz; REİCHART, Bernhard. Die Freilegungsarbeiten im chema-

discovered in the 1960s by conservator Franz Walliser. Another example from Austria, showing the initial brilliance of lime paintings, was found in 2006 in the roof truss of the Gozzoburg in Krems, Lower Austria [Figure 3].¹⁷

According to the spirit of the age up to the mid-19th century in Austria, the majority of murals were removed or covered with lime wash at best, which gave a great chance of survival to lots of wall paintings. Thereby, the paintings were protected from environmental influences such as harmful gas, dust, carbon-particulate matter, biological infestation, vandalism and non-professional art historians. Apart from “hiding” and protecting the paintings from harmful interventions, lime wash has the advantage of a buffer layer. Two or three layers of lime wash of an average thickness of approximately 100 µm are sufficient to shift the area of evaporation and therefore also the area of salt crystallisation to the surface above the original painting. By crystallisation within this lime wash, the particular layer becomes sacrificial, but it is obvious that due to varying degrees of solubility the effect of salt deposition differs according to its composition. An ideal method to preserve damageable surfaces is plastering, frequently applied in the past. Such a protection layer allows buffering against harmful gases as well as deposition of salts¹⁸. While until the 1980s sulfation was one of the main causes of damage, nowadays the reaction does not mean such a problem in the conservation and restoration due to several measures taken to protect the environment.

Contemporaneously with the aforementioned methods of covering, from the second half of the 19th century on, a number of mural paintings were rediscovered. As a result of motivation increased by an exploratory urge and stoked by art historians, a number of murals were uncovered again and overpainted with inappropriate and irreversible binding media. Frequently, such treatments motivated by the spirit of the time, were connected to massive material loss. The inscription on a house in Horn (Lower Austria) with sgraffito decoration, built in 1583, which says “uncovered 1900, restored 1904 [...], 1937, 1962, reconstruction 1979 [...]” [Figure 4], could be regarded as a symbol of such a treatment of important monuments.

Mainly secco paintings suffered when uncovered, as the binding to the plaster surface is not as tight as in murals carried out in the fresco technique. In consequence, most of recently rediscovered wall paintings were destroyed or reduced due to their inappropriate conservation treatments. One of the most common cleaning techniques of that time was washing with vinegar and rubbing with bread, followed by wax or natural resin coating, which reflects the condition of the artwork or lack of expertise, especially in the conservation science. Impregnations carried out with wax or resins resulted in highly saturated colours in originally pale lime paintings, reflecting the “style of the time”. The effects of these treatment processes are quite familiar nowadays as they have already employed generations of restorers and conservators.

Additionally, in the 19th century conservation treatments were mainly dominated by religious or artistic objectives, yielding to extensive overpainting carried out with the use of unsuitable binding media, such as oils or proteins. In Austria, a number of examples from the 19th

ligen Westchor der Stiftskirche von Lambach. *Österreichische Zeitschrift für Kunst und Denkmalpflege* 14, 1960, p. 1–24.

17 BLASCHITZ, Gertrud. Wandmalereien im Freskensaal der „Gozzoburg“ Krems Josaphat und Ottokar II. Premysl? *Österreichische Zeitschrift für Kunst und Denkmalpflege* 62(4), 2008. ISSN 0029-9626, p.565–582.

18 KOLLER, Manfred. Denkmal-Pflege mit „Opferschichten“. *Österreichische Zeitschrift für Kunst und Denkmalpflege* 43, 1989. ISSN 0029-9626, p. 48–53.

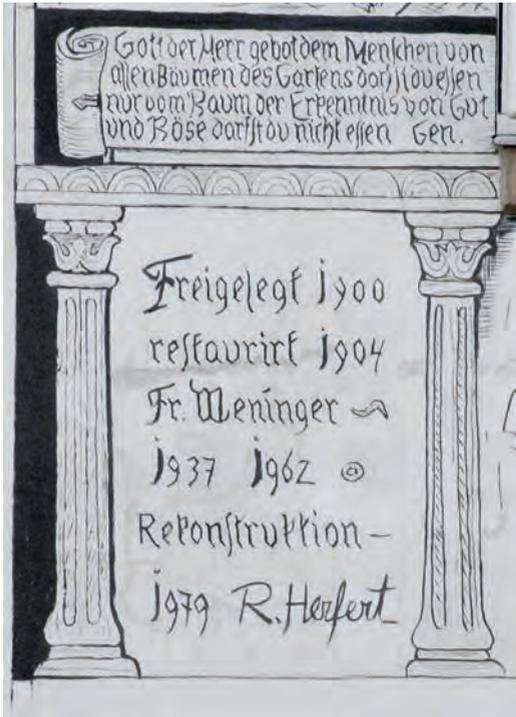


Fig. 4 Inscription on the Renaissance house from 1583.

Fig. 5 (bottom) Campione of the initial overpainting at the St. John's chapel of Pürgg.



century can be found, such as the recently discovered murals from the Romanesque and Gothic periods, which were overpainted, including also completely new stylistic interpretations and even additions. Figure 5 shows a detail of a late Romanesque wall painting at the chapel of St. John in Pürgg (Styria), where a so-called campione on the right hand side gives an impression of a decoration of the 19th century. Theophil Melicher, one of the most employed artists of that time, carried out a number of conservation treatments in Austria and Bohemia using casein tempera, including Austria's most important murals in Thörl-Maglern, Maria Saal, Brixen, Hartberg, Millstatt etc.¹⁹. As we know today, such a technique not only changed the appearance of the original painting, but also increased the degradation processes due to mould infestation. In comparison, the area on the left hand side shows some residues of the original Romanesque paintings, which were preserved in 1947/48 by Franz Walliser.

Consequently, at present the majority of conservation treatments deals with the removal of former harmful additions, which again leads to material loss. According to the new perception of art history, overpainting used to increase the artistic value of wall paintings, is nowadays associated with their debasement. While restoration of the 19th century complied above all with an aesthetic point of view, at the beginning of the 20th century, the monument preservation focused on the original surface including all traces of ageing. The first initiatives were set at the First International Congress of Art History in Vienna in 1873, where the postulation "conservation instead of restoration" was claimed and which was also followed by John Ruskin's critics on reconstruction from 1849. Around the turn of the century, leading personalities such as Alois Riegl, Max Dvořák and Georg Dehio put a lot of effort into a new definition of conservation and restoration, expressing their refusal of restoration connected to new interpretations. Contrary to the spirit of Historism, any additions were refused and the frequently quoted principle of "reversibility" was stated for the first time.

3. Development in the 20th century

At the beginning of the 20th century, the first scientific research dealing with the sources of damage was conducted, thus rejection of natural organic consolidants followed²⁰. At that time, the results claimed compliance of consolidants having similar characteristics as the original ones, which led not only to the application of lime, but hydraulic binders as well. Moreover, synthetic materials were applied for the first time.

In reaction to a number of setbacks, caused by the use of organic consolidants, the conservation science of that time focused on materials permeable to moisture. One of the first synthetic mineral adhesives was soluble glass. Compared to natural resins and the majority of synthetic resins, soluble glass has the advantage of being quite stable against yellowing. At the beginning of the 20th century, soluble glass was commonly in use for conservation of mural paintings²¹. A conservator's dream of eternal conservation promoted soluble glass for being a panacea in heritage protection. In connection with its wide application, it is remarkable that

19 HARNONCOURT, Alice. *Restaurierung mittelalterlicher Wandmalerei um 1900*. Diploma thesis. Vienna University 1999.

20 SCHMUDERER, Josef. Über Konservierung von Fresken und Wandmalereien. In LILL, Georg (ed.). *Praktische Denkmalpflege*, Munich 1941, p. 47–57.

21 CHRIST, Anke. Der Einsatz von Wasserglas in der Konservierung von Wandmalereien. Untersuchungen an ausgesuchten Beispielen des Rheinlandes. In *Zeitschrift für Kunsttechnologie und Konservierung* 8(1), 1994. ISSN 0931-7198, p. 25–77.

A. W. Keim himself warned of using soluble glass for the conservation of lime paintings²². Compared to lime, soluble glass is extremely hard and not hygric, causing pressure and material loss. In conclusion, soluble glass has a number of disadvantages such as blushing, gloss, opaqueness, irreversibility and hardening of the surface. Therefore, conservation of old soluble glass treatments is one of the most challenging tasks of today's restoration²³. While potassium silicate and sodium silicate were used initially, lithium silicate has been recently introduced for having better consolidating characteristics without blooming effects. In Austria there has been no experience with the material so far.



Fig. 6 Application of "Monumentique" on the mural paintings of Lambach in 1979. (Photo Bundesdenkmalamt)

Based on the experience with methyl silicate in the stone conservation in the 1960s, Austrian chemist Theodor Chavatal modified a product for the conservation of wall paintings and mortars. Dissolved in acetone, tetramethyl orthosilicate was sold as "Monumentique"^{24, 25}. The first applications and further development took place in the 1970s²⁶. Figure 6 shows the application of "Monumentique" in 1979 by spraying.

22 KEIM, Adolf Wilhelm. Anmerkungen zu dem Beitrag „Über die Konservierung altertümlicher Wandmalereien“. In: *Technische Mitteilungen für Malerei* 4 (69), 39, 1889.

23 PURSCHE, Jürgen. Betrachtungen zur Malerei mit Alkalisilikaten, Geschichte, Maltechnik und Restaurierung. In WOHLLEBEN, Marion; SIGEL, Brigitt (red.). *Mineralfarben, Beiträge zur Geschichte und Restaurierung von Fassadenmalereien und Anstrichen. Festschrift zum 120jährigen Bestehen der Firma KEIMEFARBEN*. Zürich 1998, ISBN 3-7281-2651-9. p. 53–66.

24 CHVATAL, Theodor. Vergleichende Untersuchung der wichtigsten modernen Steinkonservierungsmittel. In *Maltechnik-Restaur* 2, 1974. ISSN 0342-3719, p. 87–97.

25 CHVATAL, Theodor. Die Festigung von Stein. Chemische Grundlagen und praktische Erfahrungen mit Kieselsäureestern, *Arbeitsblätter für Restauratoren* 1, 1974. ISSN 0066-5738, 40–51.

26 WEHNER, Heike; WÖRZ, Stephan; HAMMER, Ivo. Wirksamkeit und Verhalten von Festigungen bindemittelreduzierter Malschichten mit Produkten auf Kieselsäurebasis. In *Arbeitsblätter des Bayerischen Landesamtes für Denkmalpflege* 104, 2001, Munich, p. 157–167.

Compared to ethyl silicate, methyl silicate is characterised by better properties of penetration, vapour diffusion and rate of hydrolysis. On the other hand, methyl silicate was taken off the market in the late 1980s due to its toxicity. One of the main advantages of ethyl silicate is – in theory – the preservation of porosity as well as its hygric properties. In order to prevent surface from hardening, the so-called elastified ethyl silicates were introduced in the 1990s and are well established nowadays²⁷. At present, modified developed substances, such as aqueous dispersions (“Syton X 30”, “Ludox PX30”) are also widely used in practice.

After World War II and mainly in the 1960s, the application of synthetic resins boomed in Austria. While consolidations with silicates proved to be disadvantageous due to hard surfaces, conservation technology then focused on “soft” synthetic resins and their easy applicability. Among a huge variety of plastics, only a limited number is appropriate for conservation of mural paintings, such as polyvinyl acetates, polyamides, epoxy resins and polyacrylates²⁸. While the application of silicates is neither correctable nor removable, great efforts were put into the development of removable resins. Among all types, nowadays mainly polyacrylates are used for consolidation purposes due to their dissolubility and durability. In the mid-1980s, when the application of Paraloid was widely spread in Austria, the question of reversibility of synthetic resins was discussed. The “principle of reversibility”, postulated in 1968 in the “Code of Ethics for Art Conservators”, could not be fully implemented and thus it was replaced by the term of “reduction of degradation process”.

Mainly large-area applications caused extensive damage to wall paintings, such as in the recently evaluated case of the façade of a Renaissance house in Krems (Lower Austria). There was a heated debate on the use of synthetic resins in conservation, as setbacks during the conservation process of Egyptian mural paintings in Thebes (Egypt) with liquid nylon occurred. While nylon has the advantage of drying mat, the surfaces showed strong yellowing effects of the insoluble polyamide²⁹, which meant irreversible destruction.

Among mineral binders, mainly lime but also gypsum and cement were used as consolidants and fillers. Nowadays, modified mortars including a number of additives are widely used for conservation, enabling highly sophisticated applications.

In parallel with the application of synthetic resins and hydraulic binders, the Austrian conservation science focused on lime, which has given the best long-term results out of all treatments so far.³⁰

One of the main disadvantages of using hydrated lime for consolidation of wall paintings is low dissolubility of $\text{CaH}(\text{CO}_3)_2$ and $\text{Ca}(\text{OH})_2$ or, in fact, the requirement for high amounts of water. Therefore, further development of lime technology yielded to the product commonly known as “nano lime”³¹. Compared to aqueous systems, these materials can be characterised by

27 HILBERT, Georg; BOOS, Markus. Arbeiten zur Entwicklung des „elastifizierten“ Kieselsäureesters. In Konservierung von Wandmalerei, *Arbeitshefte des Bayerischen Landesamtes für Denkmalpflege* 104, 2001, Munich, p. 168–182.

28 HAMMER, Ivo. Organisch oder Anorganisch? Probleme der Konsolidierung und Fixierung von Wandmalerei. In *Restauratorenblätter* 9, 1977/1978. ISSN 1017-6373, p. 59–72.

29 RIEDERER, Josef. Die Erhaltung ägyptischer Baudenkmäler. In *Maltechnik Restaura* 1, 1974. ISSN 0342-3719, p. 43–52.

30 Kalk in der Denkmalpflege, Bindemittel in der Restaurierung Erfahrungsberichte aus der Praxis, *Schriftenreihe des Bayerischen Landesamtes* Nr. 4, Munich 2012.

31 GIORGI, Rodoricp; DEI, Luigi; BAGLIONI, Pietro. A new method for consolidating wall paintings

high stability and satisfying consolidating properties. By using alcohol instead of water, these systems are also suitable for salt loaded surfaces and, by varying the concentrations or the solvents, the penetration depth can also be determined (in theory). Anyhow, these products have never become firmly established in Austria – probably due to their relatively high price.

Above all in Germany and Italy, the loss of know-how in the technology of production and application of lime putty has led to the development of dispersed hydrated lime, where quicklime is thoroughly ground and dispersed in water³². Several tests have shown that this product, used as mortar, has good fluidity and mechanical properties, which could be thanks to several additives. Contrary to other countries, in Austria the classical lime technology was used at a stretch. Therefore, products such as “nano lime” or dispersed hydrated lime have not been really established in Austria so far. Additionally, the higher price and lack of declaration of all the ingredients have increased the doubts.

4. Summary

Due to the its complexity of varying damage functions together with the restricted range of possibilities of intervention, the conservation and restoration of mural paintings is one of the most challenging tasks of preservation. While in the past, conservation treatments mainly dealt with the restoration or refurbishment of damage, nowadays the conservation and restoration projects focus on a holistic treatment, in which the choice of a suitable consolidation agent represents just a small part of the whole package. Therefore, essential prerequisites are art technological as well as scientific investigations, which enable a specific therapy in preservation. A retrospective view of centuries of the conservation of mural paintings in Austria shows that the aim of any treatment has always been connected to the art historical point of view. The evaluation of earlier conservation treatment processes shows especially highly damaged surfaces, which suffered from the application of unsuitable materials. However, these treatments reflect the technological know-how of that time and have to be evaluated from a retrospective point of view. Reviewing 200 years of conservation history teaches that the methods used in former times need not to be necessarily denounced, although we should benefit from the experience and the knowledge, and learn from the previous mistakes for a better future for monument conservation.

Above all, the present-day ethics of the monument preservation focuses on the history of an object, referring to all of its changes and traces of alteration, which might result in neglecting the essential needs of the object. Natural Science serves as a base for decisions on conservation strategies, therefore should be respected as an emancipated partner in the cultural heritage preservation. However, only a detailed examination of practical experience provides for a specific therapy.

based on dispersions of lime alcohol. In *Studies in Conservation* 45, 2000. ISSN 0039-3630, p. 154–161.

32 JÄGERS, Elisabeth. *Dispergiertes Weißkalkhydrat für die Restaurierung und Denkmalpflege -Altes Bindemittel - Neue Möglichkeiten*, Petersberg: Imhof, 2000. ISBN 3932526589.

*Resumé***Materiály používané při restaurování-konzervování nástěnných maleb v Rakousku: minulost – přítomnost – budoucnost**

Konzervování a restaurování nástěnných maleb je díky různorodosti poškození a omezeným možnostem zásahů jedním z nejnáročnějších úkolů ochrany památek. Pohled do historie konzervování a restaurování nástěnných maleb nám odkrývá celou řadu různých materiálů a technik používaných ke zpevnění. Při hodnocení restaurátorských zásahů z minulosti pak objevíme mnoho případů, kdy došlo použitím nevhodného materiálu k těžkému poškození povrchu restaurovaného díla. Tyto zásahy nicméně odrážejí technologické znalosti tehdejší doby a z tohoto hlediska musejí být také hodnoceny. Do konce baroka bylo mnoho nástěnných maleb překryto vápenným nátěrem a jejich povrch byl tak chráněn před jakýmkoli nevhodným zásahem. Některé z těchto nástěnných maleb byly v touze po nových objevech, podněcované historiky umění, znovu odkryty a přemalovány s využitím nereverzibilních pojiv. Takové zásahy, podnícené vkusem doby, často znamenaly značné ztráty materiálu. Tento text uvádí krátký přehled materiálů používaných jako konsolidanty v minulosti i dnes a poukazuje na dopad jejich použití při obnově některých významných nástěnných maleb v Rakousku.

Ve 20. století byly běžně používány vodní sklo a ethyl silikát, jež způsobily vytvoření tvrdých povrchů. Staly se zdrojem nejen problémů, ale i výzev současné restaurátorské praxe. Po druhé světové válce byly jako reakce vyvíjeny a aplikovány syntetické pryskyřice. Byly považovány za „kámen mudrců“ pro ochranu nástěnných maleb a měly je chránit před jakýmkoliv dalším poškozením – následky těchto zásahů jsou dnes velmi dobře známy.

Posouzením 200-leté historie konzervování-restaurování vede k poznání, že bychom neměli odsuzovat metody kdysi používané, ale v zájmu budoucnosti památkové péče bychom měli využít zkušeností a poznatků a poučit se z minulých chyb.

