Appendix 1:

Wood Preservation through Fumigation with Hydrogen Cyanide: Blue Discoloration of Lime- and Cement-Based Interior Plaster

HELMUT WEBER, WITH COMMENTS BY GERMAR RUDOLF

Water- and oil-based substances are not the only means for preserving wood; for a long time wood has also been fumigated with toxins, such as hydrogen cyanide.

Hydrogen cyanide, or hydrogen cyanide, is a weak acid, which reacts with moist, very alkaline plasters through the process of neutralization: the product is calcium cyanide. The highly reactive cyanide ion combines with iron ions to form, among other things, the complex salt known as Prussian Blue. This is why, in the case of the architectural damage described herein, the iron-rich plaster became discolored blue.

Background

Approximately three years ago [1976] *a church of average size was extensively restored. Aside from drying out the brickwork and removing salt deposits, a fumigation with hydrogen cyanide (of the Zyklon B type) was also performed. This method was used to treat parts of the gallery as well as the structural woodwork for the choir section, which had been infested by various wood pests. It is important to note that this method does not provide protection against reoccurrence; it is not a preventative measure and serves strictly to eradicate the pests already present.*

In such fumigations, gaseous toxins are distributed throughout the space in question. They are left to react for an appropriate period of time, and then the space is aired out and the toxins are removed to the outside world. Of course it is important that the facilities to be fumigated are sealed off as tightly as possible during the procedure.

In the case under investigation here, fumigation was carried out after the outside walls of the building had been dried out with an electro-osmotic device and after the plaster in the interior had been restored. In this context it is important to note that the plaster used was a porous hydrophobic kind with moisture-damming properties: such restoration plasters are characterized by low capillary water absorption and greatest possible permeability to water vapor; limit values may be set at $A \leq 0.3\ kg/m^2h^{0.5}$ *and* $s_d \leq 2\ m$. *The plaster contained perlite as filler and, as later analyses showed, had a relatively high iron content, exceeding 1% by weight on average. The plaster was bound with lime and cement and consequently was highly alkaline.*

Several weeks' time elapsed between replastering and the fumigation. The fumigation was carried out by an expert firm, which had already successfully treated several hundred other facilities. And at first there were no problems in this case either. Following the fumigation the remaining work was carried out without complications. The work consisted in the main of re-

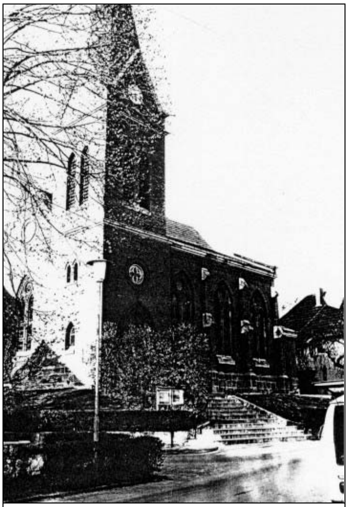


Illustration 1: *The Protestant church in D-96484 Meeder-Wiesenfeld (near Coburg), which in 1976 became the victim of a Zyklon B fumigation.*

painting various parts of the interior, which were of art-historical value, as well as of the application of a coat of paint onto the new plaster surfaces. The paint used was a pure lime-based paint.

Several months after the building was opened to the public, small ink-blue spots appeared at various places on the newly plastered surfaces. Little attention was paid to them at first; it was assumed that they were ink stains or the like. But the spots grew larger, and in some parts of the building discolored patches up to about a square meter (10 sq.ft.) in size developed. The persons in charge were helpless. The specialists who had been called in from the appropriate firms could not explain this phenomenon, and not even the subject literature contained anything pertinent.

Causes

It took chemical analyses of the plaster to determine the causes of this blue discoloration. These analyses confirmed the initial suspicion that the substance known as Berlin Blue had formed.

Chemically speaking, hydrogen cyanide (HCN) is a very weak acid. It is bound by damp, highly alkaline brickwork through neutralization. This produces calcium cyanide ($Ca(CN)_2$), for example:

$$2\ HCN + Ca(OH)_2 \Rightarrow Ca(CN)_2 + 2\ H_2O$$

The cyanide ion is a highly reactive ion, which joins with metals to form very stable complex salts. The best-known complex salts are the yellow and red iron cyanides. These compounds form when iron ions combine with cyanide: with the iron(II) ion, the yellow ferrocyanide forms, and with the iron(III) ion, the red ferricyanide is produced:

$$6\ CN^- + Fe^{2+} \Rightarrow [Fe(CN)_6]^{4-}$$

$$6\ CN^- + Fe^{3+} \Rightarrow [Fe(CN)_6]^{3-}$$

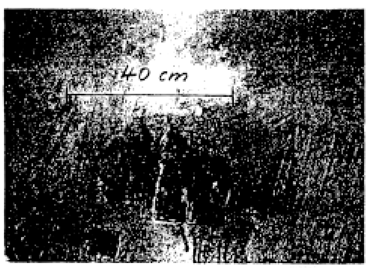
In the presence of excess iron(II) or iron(III) ions, the yellow or red iron cyanide then reacts to form blue compounds which are described in the literature as Berlin Blue and Turnbull's Blue, respectively:

Holzschutz durch Blausäure-Begasung

Blaufärbung von Kalkzement-Innenputz

Holz kann nicht nur mit wässerigen und öligen Systemen geschützt werden, seit längerem wird Holz auch mit Giftstoffen wie z.B. mit Blausäure begast.

Blausäure ist eine schwache Säure, die durch feuchten, stark alkalischen Putz durch Neutralisation gebunden wird: es entsteht Calciumcyanid. Das sehr reaktionsfähige Cyanidion bildet mit Eisenionen u.a. das Komplexsatz Berliner Blau. Dadurch verfärbte sich im hier beschriebenen Schadensfall der stark eisenhaltige Putz blau.



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Sachverhalt

Vor etwa drei Jahren wurde eine Kirche mittlerer Größe umfassend restauriert. Neben der Trockenlegung des Mauerwerks und einer Salzsanierung wurde auch eine Begasung mit Blausäure (System Zyklon B) durchgeführt. Dadurch sollten die von verschiedenen Holzschädlingen befallenen Bauteile der Emporen und das Chorgestühl behandelt werden. Es sei vermerkt, daß sich ein vorbeugender Schutz mit diesem Verfahren nicht erzielen läßt. Es dient ausschließlich der Bekämpfung von Schädlingen.

Bei solchen Begasungen werden gasförmige Giftstoffe im Raum verteilt. Man läßt sie eine entsprechende Zeit einwirken und anschließend werden die Gifte durch Belüftung an die Außenwelt abgegeben. Wichtig ist natürlich, daß eine möglichst gute Abdichtung des Objektes vorgenommen wird.

Im vorliegenden Fall erfolgte die Begasung nach der Trockenlegung der Außenmauern des Bauwerks mit einer elektroosmotischen Anlage und nach einer Putzsanierung im Inneren. Wichtig ist in diesem Zusammenhang der Hinweis, daß für die Putzsanierung ein porenhydrophober Putz mit dämmenden Eigenschaften eingesetzt wurde: Solche Sanierputze sind Putze mit möglichst geringer kapillarer Wasseraufnahme und möglichst hoher Wasserdampfdurchlässigkeit; als Grenzwerte können angegeben werden A ≤ 0,3 kg/m²h^0,5 und s_d ≤ 2 m. Der Putz enthielt als Füllstoff Perlite und hatte, wie spätere Analysen zeigten, einen relativ hohen Eisengehalt. Der Eisengehalt lag im Mittel über 1 Gew.%. Der Putz war gebunden mit Kalk und Zement und war demzufolge stark alkalisch.

Der Zeitraum zwischen Neuverputz und Begasung betrug einige Wochen. Die Begasung wurde von einem Fachbetrieb durchgeführt, der bereits an mehreren hundert Objekten mit Erfolg tätig geworden ist. Es traten auch im vorliegenden Falle zunächst keinerlei Probleme auf. Nach der Begasung wurden die weiteren Arbeiten ohne Schwierigkeiten durchgeführt. Sie bestanden hauptsächlich in der farblichen Fassung verschiedener kunsthistorisch wertvoller Teile des Innenraumes sowie im Aufbringen eines neuen Farbenstriches auf den Putzflächen. Als Farbanstrich wurde eine reine Sumpfkalkfarbe verwendet.

Einige Monate nach der Übergabe des Bauwerkes traten – zunächst wenig beachtet – an einzelnen Stellen im neu verputzten Bereich kleine tintenblaue Flecken auf. Man glaubte zunächst, diese seien auf Verunreinigung mit Tinte oder ähnlichem zurückzuführen. Die Flecken vergrößerten sich und in einzelnen Bereichen des Objektes traten Verfärbungen auf bis zu einer Größe von etwa einem Quadratmeter. Man stand dem Problem ratlos gegenüber. Die zu Hilfe gerufenen Spezialisten der einschlägigen Firmen konnten sich diesen Effekt nicht erklären. Ähnliches war auch in der Literatur nicht beschrieben.

***Illustration 2:** First two pages of the quoted article, including a b/w photo of the patchy iron blue staining on the plasterwork of the Protestant church of Wiesenfeld.*

$[Fe(CN)_6]^{4-} + Fe^{3+} \Rightarrow [Fe^{II}Fe^{III}(CN)_6]^-$
$[Fe(CN)_6]^{3-} + Fe^{2+} \Rightarrow [Fe^{III}Fe^{II}(CN)_6]^-$

The formation of these compounds was what had caused the discoloration at the plaster's surface in the church. Conclusive proof of this was easily furnished. Spraying plaster surfaces which had not yet turned blue with a solution of iron(II) or iron(III) salts, respectively, produced a spontaneous blue discoloration, which otherwise would have formed only slowly, as the reaction progressed by itself.

Clean-Up and Restoration

A waiting time of about two years was allowed before attempts were made to rectify the damage, so that, quantitatively speaking, the reaction would have largely run its course. It turned out that even after one-and-a-half years new blue discolorations still formed in some places. Clean-up and restoration itself is costly; all the new plaster that was applied must be removed again. This is all the more regrettable because it necessitates protective measures for all wood paneling in the gallery and for the organ, since otherwise the dust generated by the clean-up activities would inevitably do damage.

After the plaster has been removed, a new plaster as free of iron components as possible will be applied. Either a lime-based mortar or a so-called restoration plaster may be used. After the plaster has hardened, the entire interior must be color-matched to the remaining parts of the church. This is always problematic, since all paints – even lime-based paint – undergo a certain aging process, and mixing the paint to match the ground color present will likely prove difficult.

It is safe to assume that the problem will then be cleared up and that no new blue discolorations will appear. In the areas still bearing the original plaster, i.e., in the upper regions of the church, this is not to be expected anyhow, since the alkalinity required for neutralizing the hydrogen cyanide is not present there.

An easier clean-up method, i.e., a conversion of the blue patches into colorless compounds, is not possible by any common chemical means.

Commentary

It goes without saying that fumigations involving highly toxic substances must be performed only by expert contractors with the appropriate training and licenses. During the treatment the premises in question are kept under guard so that no unauthorized persons can enter them. Despite the toxicity of the substances involved, no accidents have been reported to date. Cases of damage to the facilities themselves have also been very rare. One spectacular case of such damage was reported for the first time in 1974, by Grosser and Roßmann.

But despite being highly uncommon, this report of damage also shows how difficult it is for an architect to use chemicals in construction. Plasters and paints must also be considered from a chemical perspective because, as clearly demonstrated by the present case, it is the combination of various factors which ultimately does the damage. It is suggested that in similar cases of fumigation, an appropriate construction-chemical investigation be conducted first to determine whether discolorations such as were the case here might result. The alkalinity and the iron content of the brickwork or plaster are factors requiring particular attention.

For Further Reading

Grosser, D. , and E. Roßmann: Blausäuregas als bekämpfendes Holzschutzmittel für Kunstobjekte. Holz als Roh- und Werkstoff, *v. 32 (1974), pp. 108-114.*

The preceding account was published on pages 120f. of volume 4 of the series *Bauschäden Sammlung. Sachverhalt – Ursache – Sanierung,* edited by Günter Zimmermann, published in 1981 by Forum-Verlag, Stuttgart, and rediscovered by Walter Lüftl, to whom we owe thanks. A more recent review about damages caused by HCN fumigations, including further cases as here described, was published in 1995.[1]

This striking example ought to suffice to refute any objections to the effect that, for chemical reasons, no long-term stable cyanide compounds could have formed in the walls of those Birkenau crematoria that are termed gas chambers, and that there must be a different explanation for the large quantities of cyanide that are to be found in the camp's delousing facilities, evidenced by the patchy-blue discoloration of the plaster there.[2]

The fact that the expert literature is unaware of more such damages caused by HCN might have mainly three simple reasons:

1. The first fumigation of a building or room normally takes place only after it has been used for quite a long period, *i.e.*, years, since new buildings are not vermin-infested. Therefore the plaster of the fumigated walls is carbonized, *i.e.*, no longer alkaline and thus not liable to accumulate high amounts of cyanides after only one fumigation.
2. Normally, a building is fumigated only now and then, *i.e.*, hardly ever more than once a decade or even longer periods of time.
3. Furthermore, a room to be fumigated normally is at least fairly dry as it is required by the legal regulations and operational instructions. But humidity is required for the accumulation of cyanide and its chemical conversion into long-term stable compounds.

Before we compare the case described in the previous article with the circumstances in Auschwitz and Birkenau, we must point out that, despite affirmations to the contrary, accidents have indeed happened in the course of HCN fumigations of buildings. As in any commercial activity, accidents do occasionally happen here as well.[3] The sweeping claim that highly alkaline plaster is the only kind to combine with hydrogen cyanide is also untrue. While a high degree of alkalinity does facilitate the rapid absorption of large quantities of HCN, slightly alkaline or even neutral plasters can also accumulate considerable quantities over time, as the HCN delousing chambers in Majdanek show (cf. the contribution of Carlo Mattogno in this volume). It is interesting to compare the case described here with the alleged gas chambers in crematoria II and III (in each case, mortuary 1) of Birkenau, on the one hand, with the delousing facilities of Buildings 5a and 5b on the other. These have already been described in detail in the chapter by Germar Rudolf (this volume):[4]

The iron content of the plasters in Birkenau was determined by Germar Rudolf as documented in his report.[4]

The alkalinity of the plasters in the mortuaries of the crematoria will have been similar to that in the church described previously, since in both cases the plasters were cement-based, which are clearly alkaline in the long term. The plaster in the delousing facilities is a lime-based mortar and therefore was probably strongly alkaline only in the beginning – which may have sufficed to form reasonable amounts of iron blue if the fumigations started right away after the plastering had been finished.

Despite the fact that the temperature is generally low in churches, and that as a result plasters there usually have a high moisture content, the plaster in the church in question was likely only moderately

[1] E. Emmerling, in M. Petzet (ed.), *Holzschädlingsbekämpfung durch Begasung*, Arbeitshefte des Bayerischen Landesamtes für Denkmalpflege, Bd. 75, Lipp-Verlag, Munich 1995, p. 43-56.

[2] *E.g.*, J. Markiewicz, W. Gubala, J. Labedz, *Z Zagadnien Nauk Sadowych*, Z. XXX (1994), pp. 17-27; J. Bailer, in B. Bailer-Galanda, W. Benz, W. Neugebauer (eds.), *Wahrheit und Auschwitzlüge*, Deuticke, Vienna 1995, pp. 111-118; B. Clair "*Revisionistische Gutachten*", *Vierteljahreshefte für freie Geschichtsforschung* (*VffG*) 1(2) (1997), pp. 102f; for critiques of these see G. Rudolf's contribution about the 'gas chambers' of Auschwitz.

[3] For example, one case is described by S. Moeschlin in *Klinik und Therapie der Vergiftung*, Thieme, Stuttgart 1986, pp. 300f.

[4] For a more detailed account, cf. Germar Rudolf, *The Rudolf Report*, Theses & Dissertations Press, Chicago, IL, March 2003, pp. 279-283 (online: vho.org/GB/Books/trr).

PROPERTY \ LOCATION	CHURCH CLEAN-UP AND RESTORATION	CREMATORIUM II/III (MORTUARY 1)	DELOUSING FACILITIES OF BUILDINGS 5A/B
Iron content	>1% by vol.	1-2% by vol.	0.5-5% by vol.
Alkalinity	high	high	low to high
Moisture	moderate	high	moderate to low
Time elapsed between plastering and fumigation	several weeks	between several weeks and 3 months	(several weeks???)
No. of fumigations	1	allegedly ≥400	probably ≈300
Cyanide present	clearly apparent	negative or traces not reproducible	clearly apparent (0.1-1% by vol.)

damp due to its hydrophobic (water-expellent or repellent) consistency. The walls of the [underground] unheated mortuaries 1 of crematoria II and III of Birkenau, on the other hand, would have been very moist, especially if one assumes mass gassings to have been a fact (condensation of body moisture on the cool walls). On the other hand, the delousing facilities of Buildings 5a/b, which were located above the ground and were equipped with heating systems, will have had dry and warm walls, except perhaps the external walls on cold (wintery) days.

Since crematoria II and III were built in the winter of 1942-43 and were allegedly put into operation as mass gassing facilities right away, in spring 1943, a time period of between a few weeks and up to three months would have elapsed between the time of completion of the plasterwork and the time of the first fumigation – just as much as, or a bit more than, in case of the church. The time between the completion of the delousing facilities and the first fumigation is unknown, but it was likely no more than a few days, since the disastrous hygienic situation in Birkenau must have urged the SS to operate these facilities as soon as they were finished.

Therefore, the only significant differences between the Birkenau mortuaries and the fumigated church was the higher moisture content of the mortuaries' walls and the possibly longer time gap between completion and start of operation in case of the mortuaries. Both factors are likely to compensate each other. Thus, one would have to expect a similar tendency to form long-term stable cyanide compounds in both cases. But we cannot find any significant cyanide residues in the mortuaries now testified to have been homicidal 'gas chambers'!

If one attempts to maintain a theory of the mass gassings in those mortuaries, despite the actual state of affairs, which is clearly contrary to what one would have to expect under the exterminationist hypothesis, then one is indeed forced to go against eyewitness claims and to minimize the number of gassings, to greatly reduce the quantities of poison allegedly used, and to decrease the application time to a technically absolutely impossible level – while disregarding entirely the lack of any means for introducing the poison gas substance into the rooms, and also disregarding entirely the paradox posed by the alleged gas chambers of Majdanek and Stutthof, where huge amounts of iron blue did from, due to alleged homicidal gassings, as we are told. In actual fact, these facilities in Majdanek and Stutthof were never anything else than simple, straight-forward hydrogen cyanide delousing chambers (compare the chapter by Carlo Mattogno, this volume).