REPORT ON THE FIRST FUMIGATION OF A CHURCH IN EUROPE USING SULFURYL FLUORIDE

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Abstract—Sulfuryl fluoride is a well-known fumigant in the USA. The procedure of its first use in Europe for controlling wood boring insects in a structure is described.

INTRODUCTION

Many famous German churches are infested by wood boring insects mainly *Anobium punctatum* De Geer and *Ptilinus pectinicornis*. These insects pose a potential threat to the wooden interior artifacts such as organs, altars, etc.

Fumigation with methyl bromide is still the most common procedure to kill these pests (Binker, 1992). But the accusation that it may cause cancer and affect the ozone layer, may cause it to be undesirable for its further use in churches in Germany.

The better alternative fumigant seems to be sulfuryl fluoride (Vikane*) (Derrick *et al.*, 1990). As studies conducted in the USA indicate, sulfuryl fluoride does not show any carcinogenic effect and has no direct ozone depletion potential. Laboratory examinations done at the Getty Conservation Laboratory as well as by B. Hering (member of the German National Museum) showed very little damage of papers, textiles, dyes, pigments and metals exposed to sulfuryl fluoride.

Fig. 1. Total view of the church "Saint Stephen" in Oberpindhart

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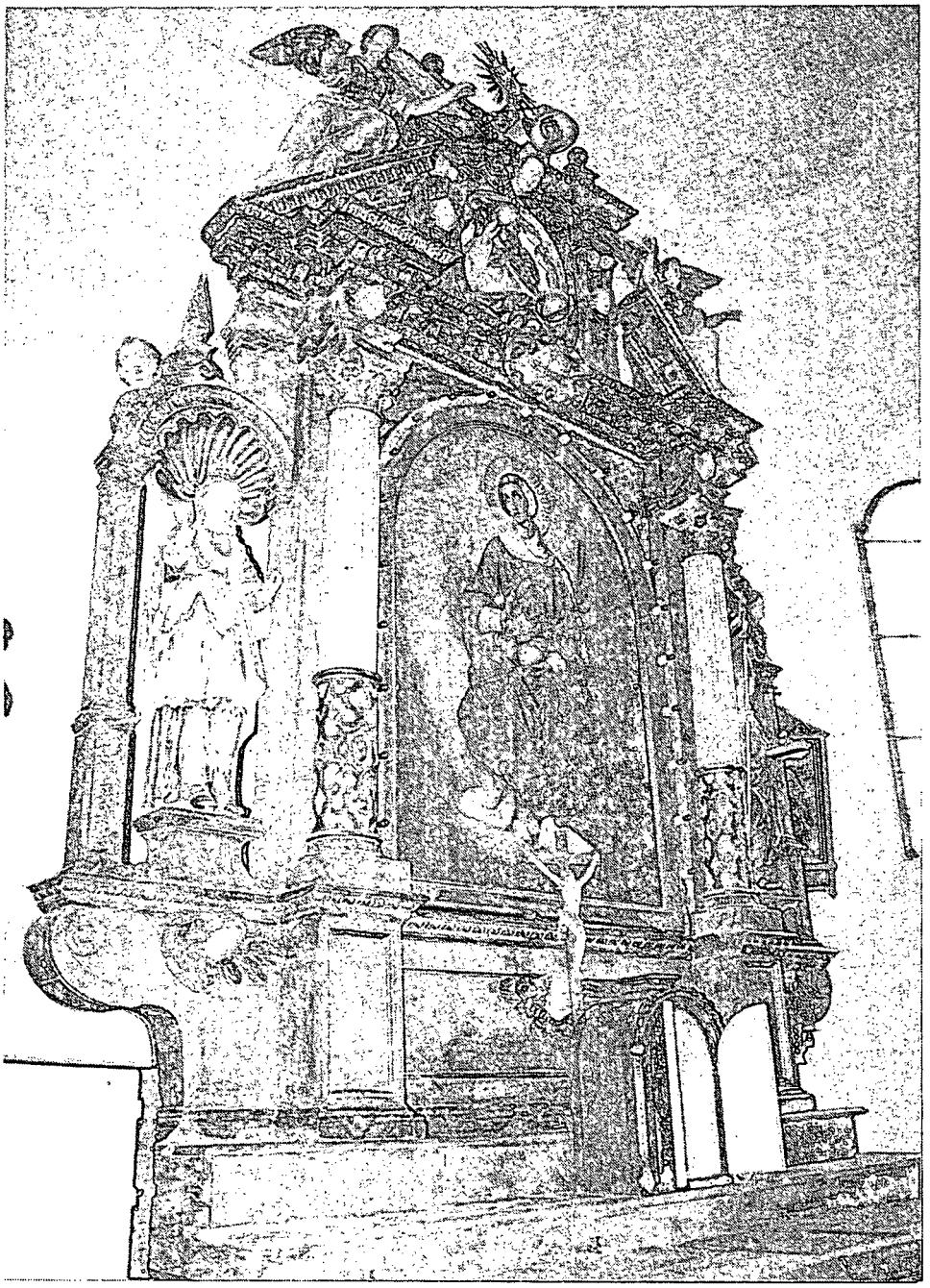

Fig. 2. View of the precious altar

Encouraged by these results, we initiated the first fumigation using sulfuryl fluoride of a structure in Europe. The structure we chose to fumigate is a famous baroque church.

This fumigation was carried out in October 1992 at the church "Saint Stephen" in the little Bavarian village of Oberpindhart. The whole historical and precious interior was infested by Anobiidae beetles so a fumigation of the church (excluding the roof) was necessary.

METHODS AND MATERIALS

The church was sealed by the tape and seal technique. Using this procedure, all windows and doors were covered with poly and all cracks and crevices were sealed with a special adhesive paper.

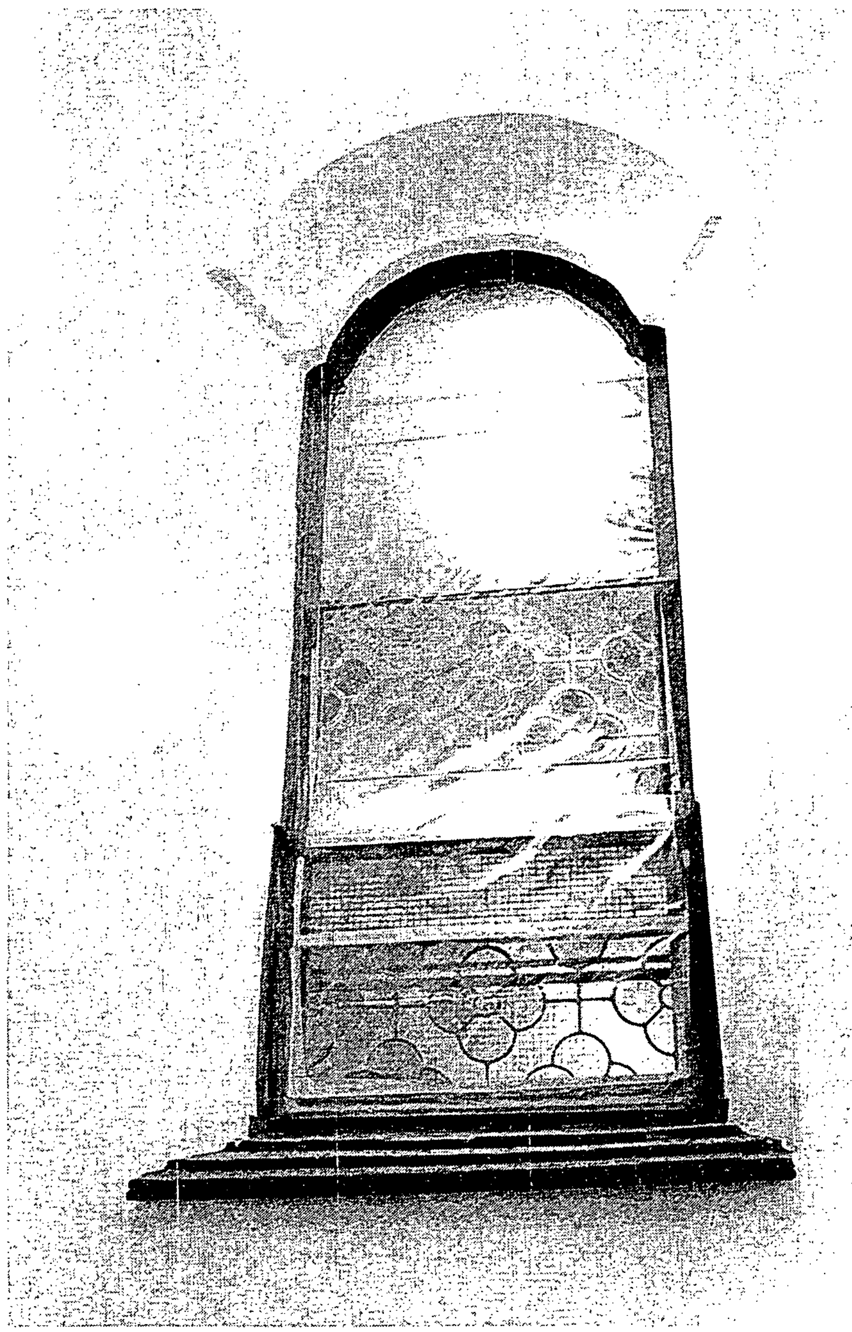

Fig. 3. A sealed window of the church to prevent gas loss

The required gas tightness of the church before fumigation was checked by "low pressure testing". For this a low pressure of approximately 10 Pa was generated in the church by a fan installed outside the church. The partial vacuum was stopped and the half loss time and pressure neutralization was measured. The determined half loss time was 3.6 seconds, indicating the structure was very "gas-tight"; therefore no emission problem for the neighborhood was expected to be created by the fumigation. The concentration of sulfuryl fluoride outside the church was expected to stay below the threshold of 1 ppm.

The initial dosage of sulfuryl fluoride was calculated by means of a special calculator to give 36 g SO_2F_2/m^3 (= 36 oz/1000 ft^3). The volume of the inside of the church (excluding the roof, which was

Fig. 4. Releasing the sulfuryl fluoride from the cylinder

not fumigated) was determined to be 1000 m^3 (ca. 35500 ft^3). The temperatures inside the church ranged from 6°C–9.5°C (42.8°F–49.1°F). These low temperatures are indicative of very difficult conditions for killing insects, because of their reduced rates of respiration. Thus, to determine the effectiveness of the fumigation, wooden blocks and metal cages with Anobiidae larvae were posted at various positions in the church.

The sulfuryl fluoride was released from a cylinder outside the structure through an application hose with a filter to remove impurities from the sulfuryl fluoride.

The fumigant was directed toward efficient fans, which ensured rapid and uniform distribution. To avoid damage caused by a "fog-out" of the gas, it was also important not to exceed the shooting

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rate of 1 kg SO_2F_2/min (= 2.2 lb/min). After the gas shooting was finished, the church was checked for leaks with an Interscan Gas Analyzer, a monitoring device capable of measuring sulfuryl fluoride concentrations between 1 and 50 ppm. No serious leaks were detected as a result of the careful sealing. Additionally, each day the gas concentration outside the church near the adjacent dwelling houses was measured frequently, while the actual concentration within the fumigation site was monitored with a Fumiscope, an instrument capable of measuring sulfuryl fluoride concentrations in oz/1000 ft^3.

Evaluation of the Fumiscope measurements indicated a half loss time for sulfuryl fluoride of 67 h. After 162.5 hours of exposure, 8 g/m^3 (8 oz/1000 ft^3) remained within the church for aeration. The building was aerated using fans to enhance ventilation. The sulfuryl fluoride concentration within the church was decreased to 1 ppm within 4 hours and at that time the church was ready for re-entry to remove all the sealing materials and equipment.

RESULTS

No test insects survived the treatment, which was checked by the BAM, which is the Federal Institute for Testing of Materials. Furthermore, no interior surfaces were damaged. Due to the chemical inertness of sulfuryl fluoride , there was no tarnishing of any golden coatings, coloured glass or altering of the valuable and historical artifacts and ceiling paintings.

A secondary benefit was the survival of the bats in the untreated church loft.

DISCUSSION

Sulfuryl fluoride proved to be an effective structural fumigant. No visible damage was ascertainable. These results make sulfuryl fluoride look promising for use as an artifact fumigant. Since possible reactions may not produce visible changes, more examinations need to be done in future.

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