WILL THERE BE BLOOD…

An Investigation of the Materials used on Painted Québécois Wooden Works before 1950

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The purpose of this study was to investigate and document the use of blood as a paint medium on early wooden works. Blood, specifically oxblood, as a paint medium has been reported in literature. Its application in Canada has yet to be scientifically established. Twelve Québécois wooden works were examined for the presence of blood.

Fig.1 Small table examined for its oxblood colour finish, Saint-Charles-sur-Richelieu

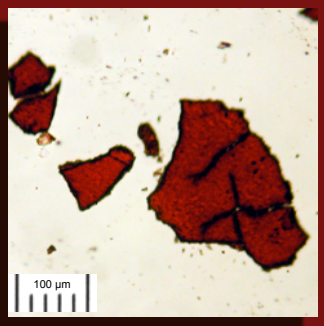

Fig.2 Dried blood observed under transmitted light

Research summary

Similar to traditional film-forming substance animal and fish glue, egg white, egg yolk, and casein, blood is a proteinaceous (or albuminous) material that has strong adhesive and cohesive properties.

A review of the literature has revealed a significant amount of information that can be related to the subject matter. This review confirms the use of blood as an adhesive, and supports the hypothesis of blood use as a binding and coloring agent in paint on wood. Nevertheless, searching the literature revealed no scientifically documented occurrences of blood as a paint medium in Canada. Consequently, paint layer on twelve Québécois wooden works were analyzed for blood content.

First, polarized light microscopy was used to examined paint layer cross-sections. Reactive FITC (fluoroscein isothiocyanate) was used to highlight protein layer(s). Unfortunately, the stain did not target proteins in control samples and was not considered useful for this study. Instead, Fourier transform infrared (FTIR) spectroscopy was used to detect protein in samples. Samples that tested positive for protein were then investigated to detect the presence of blood, or heme ($C_{23}H_{32}N_4O_4Fe$), as a binder using a benzidine test. In the end, none of the samples examined recorded positive for the presence of blood.

Experimentation

1. Visual examination

Thick cross-sections and permanent slides of samples were examined using a Nikon S-kT microscope. Particular attention was given to stratigraphy, thickness and different optical attributes of layers and particles (i.e., colour, pigmentation, transparency, surface details, texture, shape, homogeneity). As well, cross-polarized illumination was used to determine isotropy or anisotropy of red colorant. Where the red material is anisotropic, it is not blood.

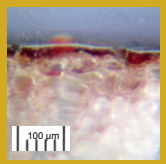

Fig. 3 Mixture of oxblood, casein and lime over pine wood

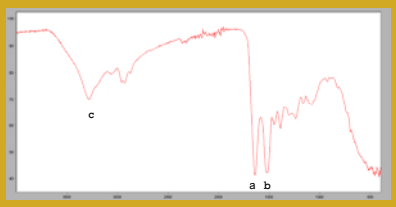

Fig.4 FTIR spectra of oxblood

2. FTIR

The proteineous nature of oxblood was identified in the FTIR spectra by the absorption bands (doublet) that occur close to 1645 and 1525 cm^{-1}, respectively amide I and amide II bands (identified by **a** and **b** in fig.4). In addition, the presence of protein could also be confirmed by a broad N-H stretching band near 3300 cm^{-1} (identified by **c** in fig.4). However, spectral features do not differentiate blood from other proteinaceous materials. Therefore, a second, more specific, method of analysis was required to ascertain the presence or absence of blood.

3. Test for blood using benzidine

In order to identify the presence of blood, a benzidine test was performed on samples that showed protein bands in the FTIR spectra. Benzidine (*p*-Diaminodiphenyl, $NH_2(C_6H_4)_2NH_2$), a toxic and carcinogenic material, changes colour to a vivid bluish-green (fig.5) when in contact with 2[OH]. 2[OH] is a product of the enzymatic reaction that occurs between the heme groups ($C_{23}H_{32}N_4O_4Fe$) in blood and hydrogen peroxide (H_2O_2), which is added to the testing solution (fig.6).

Fig.5. Positive result to benzidine test

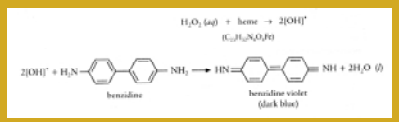

Fig.6 Benzidine test reaction with blood

Results and conclusion

First, observed under cross-polarized illumination, every sample presented an isotropic red material. Next, of the twelve samples examined for protein with the Fourier Transform Infrared (FTIR) spectroscopy, seven of them presented possible evidence of proteinaceous film-forming substance. Finally, of these seven samples submitted to the benzidine solution, none have tested positive to the presence of heme, the iron-containing compound of hemoglobin. No visible colors (bluish-green) could be observed around the sample in the minute following the application of the solution, which clearly indicated the absence of blood. This research did not identified any instance of blood use as a binder on wood in Canada. Nonetheless, its quality as a film-forming material and documentation supporting its use on wood suggest that it would have been used on wooden works. Further testing is recommended.

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