

**Gold or Black? – the secret behind a Chinese wedding document  
(Study and Treatment of a Chinese wedding document)**

**Author details:**

Wing-fai Lai

Postal address: G95, Hong Kong Heritage Museum, 1 Man Lam Road, Shatin, Hong Kong

Email: [wflai@lcsd.gov.hk](mailto:wflai@lcsd.gov.hk)

Fax: (852)- 21211029

Man-wai Tang

Postal address: G95, Hong Kong Heritage Museum, 1 Man Lam Road, Shatin, Hong Kong

Email: [cmwtang@lcsd.gov.hk](mailto:cmwtang@lcsd.gov.hk)

Fax: (852)- 21211029

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## **Gold or Black? – the secret behind a Chinese wedding document (Study and Treatment of a Chinese wedding document)**

Wing-fai Lai & Man-wai Tang

### **Abstract**

This poster illustrates the treatment of a Chinese wedding document commonly used by the Chinese in Hong Kong until the mid 20th Century. The 1950's red document, with 4 big black Chinese characters on its cover page (representing 'getting together through marriage'), recorded information on selected auspicious days for holding various pre-wedding rituals until the wedding day.

Like other functional items, the object exhibits various signs of general wear and tear, but the paper damages/losses around the Chinese characters on the cover page were surprisingly serious when compared with the written text inside. The whole document appeared to be written in black ink at a preliminary glance, but microscopic examination revealed that the black ink of certain characters on the cover page was surrounded by some light green particles; further analysis by SEM/EDS showed that these had a high copper content with traces of chloride, whereas the text was written in black carbon ink.

The secret of "Gold or black" is revealed. Some of the Chinese characters on the cover page were written in a copper-containing ink compound which would appear "gold" when first written on the red document. This matches perfectly well with the practice that Chinese like to adopt "Gold" and "Red" for festive occasions. Copper corrosion explains the seriousness of paper deterioration on the cover page of the document.

Problems caused by the copper ions and follow up conservation treatments are also presented.

## **Introduction**

This article describes the technical examination and conservation of a wedding document titled “#1” (meaning auspicious date for wedding) which dated to 1950's. The document belonged to the Tang clan, one of the "Five Great Clans" in the New Territories of Hong Kong (Wong 1998). The Tang clan can be traced back to the twelfth century. They came from Southern China and were the first resident settled in Hong Kong. This red document, with four big Chinese characters “#2” (getting together forever through marriage) on its cover, was popularly used by the Chinese in Hong Kong until the mid twentieth century for recording the birthdays of the couples and the selected auspicious dates for holding the various ceremonies as part of the wedding process. Selecting auspicious dates for the wedding ceremony is very important in the Chinese culture. The auspicious days were chosen after the analysis performed by a fortune teller based on the couples' birthdays and according to the fortune-telling literatures. The said wedding document would be sent to the bride's family from the groom's family together with the engagement tokens. Both families would then follow the dates listed to hold the pre-wedding and wedding rituals such as installation of the bridal bed, presenting the betrothal gifts, preparing for the wedding costumes and holding the wedding ceremony.

## **Description**

The wedding document was made of machine-made laid paper of dimensions approximately 30 x 54 cm. The thickness of the paper, measured with Mitutoyo Dial Thickness Gauge, ranged from 0.16 - 0.17 mm. The document was light yellow on the verso and dyed to a deep dark red on the recto. It was folded into four parts vertically in a zig-zag manner with the cover page on the right hand side. There were four big Chinese characters “#2” written on the cover page with decorated borders and figures. The characters in the main text were smaller in size, presented in a table format recording the selected auspicious days of the wedding rituals. All the characters were hand-written with Chinese brush and were “black” in colour, as observed in the present stage.

## **Condition**

The wedding document was very brittle, extremely fragile and seriously discolored. Some places on the cover were heavily damaged. The edges along the big characters “#2”, the decoration borders and figures, appeared to be burnt. Even with extreme careful handling, the paper would crack easily and small fragments would get detached easily. There were some tiny light green particles deposited on the dark grey ink as observed under microscope with raking light. However, the characters in the main text were shiny black color when observed under microscope. There were long tears with losses along the top edge and the fold lines of the document. Dents, creases and signs of wear and tear were apparent. Previous restoration by sellotape was found on the tears on both sides. There were some dark brown accretions deposited on the recto. Many spots of stains scattered on the recto. The pH values of the paper were tested with pH paper on ten random spots; the pH ranged between 4.5 – 5.0.

## **Research on Problems of Paper Deterioration**

In order to analyze the material nature of the ink of the document, samples were taken from a few areas: the light green particles, the dark grey ink of the big characters and the shiny black ink from the main text to investigate the causes of the deterioration on the paper. Microscopic examination of the ink revealed that both ink and green particles were lying on the surface of the paper substrate. The green particles were loosely attached on the surface of the dark grey ink which could be easily removed by scalpels. Analysis from the Scanning Electron Microscope (FEI Quanta 200) and Energy Dispersive Spectrometer (Edax) indicated that the green particles contained approximately 70% copper, 8% zinc and 10% chlorine while the adjacent dark grey ink contained 48% copper, 4% zinc and 0.32% chlorine. The green particles were probably the copper chlorides, the corrosion products of copper.

So, it was suspected that the Chinese characters and decorative borders on the cover page were written in a copper-containing ink which was “gold” in colour when it was written initially. The shiny black ink was contained 84% carbon and 14% oxygen and identified to be traditional black carbon ink which was very commonly used for Chinese writing.

It is well known that copper-containing ink or pigment causes severe deterioration on the paper substrates (Eriko and Masahiro 2002). Even trace concentrations of copper ions would accelerate the aging and induce foxing on paper. Recent researches showed that copper ions would induce the generation of peroxide and hydrogen radicals in the presence of oxygen and water vapour. These products will cause oxidation of cellulose. Copper ions catalyze the oxidation on the anhydroglucose ring (in paper fibres) by Lewis mechanism. In the presence of copper ions, even only a short exposure to light could cause photochemical processes leading to radical formation, which is the initiating step for the decomposition of cellulose. It can be deduced that copper ions formed from the corroded ink has degraded the paper and made the paper to crack into fragments. Another possible reason for the serious paper deterioration may be the solvent or binder of the copper containing ink. The SEM/EDS results indicated the grey ink contained 30% higher carbon and oxygen content than the green particles (no other elements found in grey ink). The solvent of the ink was probably organic and had high acidic content which caused acid burns on the paper substrate.

Scientific research has shown that paper samples containing copper acetate could greatly be stabilized after deacidification treatment with magnesium bicarbonate (Carlson 1997). Deacidification treatments do appear to reduce the degradation of paper by oxidation. Reports show that deacidification of paper retards not only oxygen-independent degradation (acid hydrolysis), but also oxygen-dependent degradation (oxidation). So, adding a small amount of magnesium bicarbonate is effective in improving the chemical stability of paper with copper ions damage and decreases the rate of acid hydrolysis on paper substrate.

## Treatment

Because the object was in a very poor and unstable condition, conservation treatment was considered to be necessary to prevent further deterioration. The objective of the treatment was to clean the surface dirt, remove the aged sellotape, reduce the acidity and improve the physical and chemical stability. The overall structure was stabilized by infilling the losses, repairing the tears and strengthening the embrittled paper by lining with Japanese paper and wheat starch paste.

Before carrying out the treatment, the solubility of both black inks and the red dye were spot tested with both neutral distilled water and a slightly alkaline solution-magnesium bicarbonate at pH 7.5 (Carlson 1997). The black ink was insoluble in water but the red dye was quite fugitive.

As the weakness and delicacy of wedding document was weak and delicate had made handling difficult, a temporary backing support was given to the document to facilitate handling. Bondina<sup>®</sup>, a thin and smooth polyester sheet was chosen because of its strength and smoothness. Although it was very brittle and fragile along the big characters, it was possible to remove the surface dirt with a dry cleaning sponge carefully. Precaution had been taken to avoid further damaging the embrittled areas.

Pressure sensitive adhesive, a low molecular weight acyclic polymer, has all along been a major conservation concern on paper-based objects. Sellotapes, for example, will deteriorate and harm the paper substrate which it is stuck to after a long while. The adhesive on carrier will go through the paper fibres, turns them brown and leave unpleasant stains. As regards, the aged sellotape on the wedding document was removed by a heated spatula set at 70° C. The heat conducted from the heated spatula melted the adhesive and helped to release it from the paper. The adhesive residues and stains were removed by swabbing with mineral spirit.

To reinforce the weak and torn areas, losses were infilled with toned bast fibre paper and wheat starch paste. Tears were repaired with toned Spider tissue<sup>®</sup> (8.5gsm). Losses were repaired and dried under Bondina<sup>®</sup> and blotters. The document was stabilized by deacidification treatment with

magnesium bicarbonate at pH 7.5 by spraying on the verso since the red dye was to fugitive undergo immersion deacidification treatment. Then, the document was relaxed by an ultrasonic humidifier in a closed chamber and dried between blotters under pressure.

## **Conclusion**

After some technical analysis on the element, it was deduced that ink was a copper-containing ink which was probably appeared “gold” when it was first written. This dovetails with the practices of Chinese who favours to use gold and red as a sign of celebration and happiness. Copper-containing ink causes severe deterioration on the paper substrates since the free peroxides and hydrogen radicals induced by copper ions cause oxidation of cellulose. Copper corrosion explains for the seriousness of paper damages on the cover page. After the conservation treatment, the document was stable for handling and display in the museum.

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## **Author Biographies**

Wing-Fai Lai graduated with a BSc degree in Chemistry from the Hong Kong University of Science and Technology in 1994. He is currently working as a conservation scientist and photograph conservator in the Central Conservation Section of the Leisure and Cultural Services Department in Hong Kong

Man-Wai Tang graduated with a BSc degree in Applied Chemistry from the Hong Kong Baptist University in 1993 and obtained a MA in Paper Conservation from Camberwell College of Art in 2004. Since 1998, she has been working as a paper conservator in Central Conservation Section of the Leisure and Cultural Services Department in Hong Kong.