

The Stationers' Foundation

Amy Crampton

The Stationers' Foundation had very kindly and generously funded my MA term of the Conservation of Books and Library Materials programme at West Dean College. The MA term is the final 10 weeks of the programme; during this term it is expected that students write their final thesis which includes the research and experiments of their chosen topic.

I had chosen to research blue fountain pen ink from the Second World War period. This was inspired by past volunteering experience at The Rifles Museum in Winchester, Hampshire. The Rifles Museum had a collection of just over 300 boxes which were filled with journals, letters, postcards, certificates, log books and all manner of paper documents that were dated from the Second World War period. My job was to catalogue the contents of each box to make the contents available on a database. This enabled me to have a close inspection of each individual document out of the boxes; I had found that blue fountain pen ink was common among personal documents and the fading of the ink varied greatly. On some documents the blue ink would appear vivid as if applied the day before and on other documents the blue ink would be faint enough to appear as if it were a spider's cobweb resting on the page.

By eye, I could see that the paper for all the documents was wood pulp paper and showing varied acidic degradation. This can be spotted by yellowing of the paper and/or featuring blotches of yellow which scatters across the surface. When I was finishing cataloguing the contents of the 300 boxes, I could conclude that I had not found a pattern of the fading rate of the blue ink and the acid activity within the wood pulp paper. As the entire collection was from various sources, it was useless to tell if day light or industrial light was the cause of the fading rate of the ink.

During the summer holidays, I researched wood pulp paper for the MA; this research included paper manufacture during the Second World War and the various ways which wood pulp paper degrades by acidic activity. Then, when the time had come to start writing the MA proposal (in October), I was sending emails to all the ink manufactures I could find which were producing blue fountain pen ink during the Second World War. In the emails, I had asked for blue fountain pen ink formulas between 1930 to 1940 and other various details. I had many replies, all pleasant and kind, but unfortunately, they could not provide a great amount of information. I was also emailing the Imperial War Museum and had contacted Tina Kelly who works there as a paper conservator; Kelly frequently works with Second World War documents, so she was able to confirm that blue was a popular ink colour and that wood pulp paper was the most common to manufacture. It was really positive to be in contact with Kelly because she was keenly interested in the MA topic as the conservators and curators of the Imperial War Museum have been frequently discussing their concerns of fading writing ink. Kelly had sent me a few documents about the care of the Imperial War Museum collections and documents specifically relating to light conditions. Kelly had also invited me to the archives to have a look at collections of personal documents for 'case studies' for my thesis.

For my MA I focused my research on fountain pen writing ink from the 1930's to the 1940's, dyes (in the writing ink), wood pulp paper and light deterioration. I decided to focus on light deterioration because light is necessary to exhibit documents. I had found two Parker Pen Company patents for blue fountain pen writing ink, dated 1933 and 1949. I decided that I would make these formulae and light expose them for 20 days to examine their fading rate. West Dean College is equipped with a light bank which produces 12, 000 lux per hour; exposing the writing ink for 20 days is equivalent to 320 years of being exhibited using the Imperial War Museums maximum light exposure of 18, 000 lux per year as a guide. The National Trust advise 150, 000 lux per year for documents featuring ink media; the 20 days are then equivalent to 38 years of exhibiting.

I had collected nine books, dating from 1935 to 1949, to act as the support paper; I collected nine to enable an elimination process as these papers had to be spot tested for lignin and alum. Lignin is derived from wood; therefore, it could confirm if the paper is made from wood pulp. An alum content would confirm if the paper was made with alum-rosin sizing. Sizing is a process which occurs during pulping, it's purpose is to prevent writing ink from penetrating the paper. Alum-rosin was the most popularly used sizing during the Second World War. The aim is to have a support paper as close to the 'real thing' as possible, therefore it was important to conduct these spot tests. Results had shown that there was one paper which had lignin *and* alum present; this was the paper dated 1944 and so this was the paper chosen to move on to the next experiments.



Figure 1: The nine books which I had collected from second-hand book shops. The margins were cut into 3cmx3cm samples for all experiments.



Figure 2: The samples of paper after lignin and alum testing. The big spots are to test for lignin and the small spots are to test for alum. Only one book, printed in 1944, contain lignin and all books contained alum.

I made the writing inks using the Parker Pen Company formulae. The chemicals and dyes were bought from various sources. Once mixed, I applied the inks on to the 1944 paper. I then pH tested the samples to have a recording of the pH before light exposure to see if the light exposure would cause any pH changes in relation to any fading. I had also applied the ink on to filter paper because this paper has a neutral pH; this is to see if the ink has a different fading rate on a non-acidic paper support. Therefore, the filter paper acted as the ‘control.’

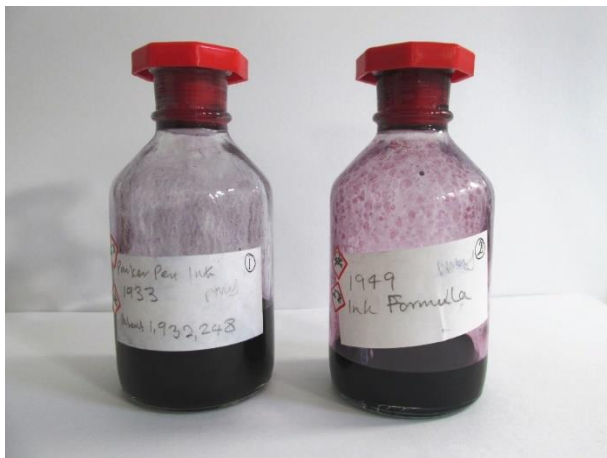


Figure 3: The 1933 ink and the 1949 ink which had been made in the laboratory in the book's conservation studio.

I then made five samples of each of the inks on the 1944 paper and on the filter paper. I then colour measured these to have a colour measure before light exposure. These samples were light exposed for 20 days and for each day the colour of the inks was measured.



Figure 4: The Konica Minolta Colour Spectrophotometer, this is an analytical tool used to measure colour. The Spectrophotometer flashes a light on to the sample and with the information it receives it makes a unit measurement which signifies the location of the sample's colour on the CIE L*a*b* sphere. The CIE L*a*b* colour sphere holds all the colours and their varied hues in a round ball; it is used to measure the difference between two colours.



Figure 5: The samples are in the light bank tray. I had made an extra tray using white card to protect the samples. On the back of the samples are notes of which ink is applied on top and the number of the sample, this is to be consistent as much as possible.

The results had shown that the 1933 ink had faded the least; this ink had a highly alkaline formula, so these results could suggest that a highly alkaline ink would have a 'slower' fading rate compared to a lower alkaline ink. The filter paper also reflected these results. The 1933 ink had reached the 'Just Noticeable Fade'¹ point in 6 days, which is equivalent to 12 to 96 years in regard to the National Trusts advice and the Imperial War Museums policy. This is much 'slower' compared to the 1949 ink which reached the 'Just Noticeable Fade' point in one day! This is equivalent to 2 to 16 years in regard to the National Trusts advice and the Imperial War Museums policy.

¹ A 'Just Noticeable Fade' point is the International Standards Organisation's way of describing when fading is noticeable for the viewer. They define the 'Just Noticeable Fade' point at 1.8 delta. The delta is the unit used to describe a colour measurement using the CIE L*a*b* colour sphere.

The experiments had also shown some surprising results, which was the filter paper had resulted to the most fading for the inks. My tutor had a theory that this may be due to the filter paper being a lighter colour compared to the 1944 paper; when the ink fades the lighter colour of the filter paper is revealed. To test this theory, it would be interesting to do further experiments with a neutral pH wood pulp paper; this may determine whether a light colour or the neutral pH effects the fading rate. However, overall, both inks show that most of the damage is done during 2 days of light exposure, which is equivalent to 4 to 32 years of the National Trusts advice and the Imperial War Museums policy. After the 2 days the fading rate had slower pace. The results described above could have relevance to Second World War documents featuring blue writing ink which have not been displayed before. This is a good possibility because my Rifles voluntary experience had shown that there are many donated documents stored in boxes and with no immediate plans to go on display. When the Second World War reaches its Centenary, there may be many exhibitions leading up to it. The results from my experiments show that potentially in the first 2 years the ink could fade to the 'Just Noticeable Fade' point. It has been worthwhile for me to spend the time conducting these experiments and writing the thesis because for my future career I wish to conserve documents such as journals, letters and log books.