When the University of Hong Kong was founded in 1911, at the close of China’s dynastic rule, a library was established in the main campus building to house what was, at first, a rather modest collection of Western and Chinese books. Significant purchases and donations over the following decades enabled the collections to grow. Many rare and unique editions of Chinese books were acquired. In 1932, Mr. Fung Ping Shan donated the funding to construct a purpose-built library for the Chinese collection. Today, the Library’s collection of rare Chinese books (published in or before 1795) is one of the largest in Hong Kong with more than 800 titles in 14,000 volumes including 4 Song dynasty editions, 18 Yuan dynasty editions, as well as block prints from the Ming dynasty and manuscripts from the Qing.

The Chinese collection was relocated to the Main Library in the 1960s when it outgrew the Fung Ping Shan building. The Chinese books were administered independently, though the two collections shared the same building. Well-intentioned staff did their best to care for the collection by performing minor repairs and making upcycled enclosures out of discarded slipcases and book covers. Other custom enclosures were fabricated by local binders. In the 1990s, a Rare Book Room was built to house the treasures of the Chinese collection. While this was the first time the collection benefited from a 24/7 climate-controlled environment with fire suppression and security systems, it also marked a shift in the amount of individual attention provided to the collection, as the staffing was now centralized in the Main Library.

The rare Chinese books remained largely untouched during the transitional years, until only recently when a preservation division and conservation lab was established for the library. As part of this initiative, the preservation staff first decided to perform a detailed survey of the collection. Over 11,000 volumes were examined and documented. This process revealed numerous books with damage, some at imminent risk of further loss. It also provided insight into the collection and of the preservation of Chinese books throughout history, as well as onto a former Hong Kong that is quickly succumbing to urban renewal.

It has been widely acknowledged that paper was invented in China around 100 BCE. However, paper did not replace silk (and bamboo and wood) as the primary substrate for books until centuries later. The modern book conservation movement in the West is generally dated to the Florence floods in 1966, but preventive preservation measures had been practiced in China for many centuries prior to this well-publicized catastrophe. Among the various procedures used in China, papers were dyed to protect them from insects and make them more moisture resistant. T.H. Tsien’s translations of historical records inform us that during the Tang dynasty the Imperial Library employed ten people who were responsible for the preservation of the books.

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treatment of paper for documents. Tsien quotes a decree from the year 675 that states, “Since the issuing of decrees and orders is a permanent institution and since white paper has generally been damaged by insects, hereafter let the Grand Secretariat be instructed to order that yellow paper be used by the various government office and all the districts and prefectures.” Many extant manuscripts and printed texts used this dyed yellow paper, of particular note is the earliest dated printed book in the world, the Diamond Sutra (868 A.D.).

Classification systems were developed in the Sui dynasty (581–617) to allow better record keeping and access, as well as to prevent loss and theft. Scholars urged each other to keep food, candles and lamps away from storage rooms, and after consulting a book, to immediately return it to the designated storage location. Books were arranged by topic and kept in separate chambers. Other collections were arranged by quality, as well as topic, and marked accordingly. During the Tang dynasty (618–907), Liu Gong Chuo kept multiple copies of the same title. The best quality books were deposited in storage, medium quality editions were for daily use, and the lowest quality editions were set aside for use by students. Construction of storage rooms also took into account protection of the books. Stone shelving reduced the risk of fire. In front of the Tianyige Library, which was built in 1561 and survives today as the earliest private library still in existence in China, a pond was dug to serve as a ready source of water in case of fire. Placement of windows allowed for airflow. Some books were aired outside, but only in the dry season and then allowed to reacclimatize before being placed back into storage. Like books in Western collections, the threats are largely the same. But geographic differences magnify some of these threats.

Located at the south of China near Guangzhou, the mercury rarely falls below 50 degrees Fahrenheit in Hong Kong. There is no record of freezing temperatures in the urban areas. Consequently, this subtropical part of the world, with high humidity and frequent rainfall, is under continuous threat from insects and mold growth. This presents a year-round challenge for those caring for historical and archival collections. A seven-year study by the National Archives of China, documenting the distribution and types of insects posing threats to library collections in China, notes that Guangdong Province, located across from Hong Kong’s northern border, is especially vulnerable, with 21 different insect types threatening archives and museums. (Illustrations 1a-c) In 1911,
Ye De Hui (translation by Achilles Fang) remarked:

*The ancients used to sun their books on the seventh day of the seventh lunar month, but this practice is not best. For the seventh month in South China happens to be a month of intense heat. There are two drawbacks to the sunning of books under the scorching sun: first, your books will become desiccated; second, showers may take you by surprise. Then again, if they are exposed to the sun in the morning and taken in at evening, it will take all night for them to cool. Were you to put them forthwith into the cabinets, the heat absorbed would stay for days. Therefore it is better to sun them in the eighth and ninth lunar months, when the autumn sky looms high and the air is refreshing, just when the crops are being harvested; furthermore, the west wind blows seasonably and kills worms. The difference in climate between North China and South China must be considered.*

(illustration 2)

The condition survey of the Fung Ping Shan rare books at HKU tells us that 41% of the volumes have previous insect damage, 62% have an insect preventing treatment as part of the binding, and mold damage was discovered in 11% of the collection, including active mold on several key titles. The insect prevention measures employed on these books is the inclusion of bound-in endsheets that have been treated with an orange-red colored solution with insecticidal properties, a typical Southern China practice dating from the Ming and Qing Dynasties. There are many early examples of paper dyed for the purpose of preservation; particularly well-preserved examples have been excavated in Dunhuang. New techniques were developed as the need arose. The bright orange paper in the HKU collection is known as *wan nian hong* paper. Historically, this particular type of dyed paper is not the first, nor the most recent attempt at treating paper with the purpose of eradicating insects. There is evidence and analysis of several major categories of paper that involve the topical application of an insecticidal solution to the paper’s surface. All of these special papers involve a solution or surface treatment applied to the prepared sheet of paper, rather than mixed with the pulp in the papermaking vat. Following are six categories that provide a brief introduction to the major types of surface treatments for protecting paper from insect damage. Although there is some overlap, the categories are listed in roughly chronological order, from the earliest documented
instance during the Han dynasty to the present.

1. YELLOW

According to the late Professor Tsien Tsuen-hsuin, (Written on Bamboo and Silk, 1962):

Earliest colored paper was probably the ho-t’i mentioned in the Han Dynastic history as a small piece of thin paper for wrapping. According to Meng K’ang of the third century A.D., it was a kind of “silk fabric dyed red for writing, as paper is dyed yellow today.” If this is correct, red was used as early as the first century B.C., and yellow must have been in vogue in the third century A.D. Hsün Hsu, the official curator of the imperial Chin library, said in his preface to one of the bamboo documents discovered in the Wei tomb that they were copied on separate sheets of paper and treated with a yellowish insecticidal substance. (73 Mu-t’ien tzu chuan, Hsun Hsu’s preface 3b.)

The dying of paper, which was called ran huang (染潢) was fully discussed in the Ch’i-min yao-shu, a work on agriculture and handicraft written by Chia Ssu-hsieh of the fifth century A.D.

A liquid obtained from soaking the inner bark of the Amur cork tree (Phellodendrum amurense), known as huang bo 黃(檗)柏 in Chinese, was strained and boiled to produce a fragrant dye, then applied to an unsized sheet of paper. The bitter preparation is toxic to some insects. A more detailed description of the process was described by Jia Sixie in the 5th century, which was also translated by Tsien Tsuen-hsuin. This process was commonly practiced from as early as the Wei-Jin period (220–420) and continued into the Song dynasty when the style of the book changed from roll or accordion format to side-sewn and folded leaves. Tens of thousands of manuscripts that date from the Tang dynasty were unearthed from the Mogao Caves of Dunhuang at the start of the 20th century and are largely undamaged by insects. A significant selection of the findings had been treated with huang bo dye, as in the case of the Diamond Sutra, which was coated with a solution made from Phellodendron amurense, which contains berberine, and has both insecticidal and water-repellant properties. The yellow dye was applied over the entire paper, either before or after the writing was done. However, it has been shown that dye applied after the documents were inscribed is considerably more effective.

2. WAX BURNISH

Paper was dyed yellow and burnished with wax during the Tang dynasty (618–907) in order to further prevent insect damage and to resist moisture. The burnished paper was partially translucent. Some modern scholars believe that the reason for treating papers was not necessarily to protect them from harm, but rather a matter of aesthetic preference, and in the case of waxed paper, as a tool for making copies. However, from the countless descriptions in ancient histories, the theory of dyeing paper to prevent insect damage appears sound.

3. PEPPER

Pepper was used in the Southern Song dynasty (1127–1279) to prevent insect damage to paper. There are no clear recipes for making this extract, but it is believed that Sichuan peppercorns, which are not related to peppercorns or chili peppers, but rather belong
to the citrus or rue family, were used. Sichuan pepper, *Zanthoxylum bungeanum*, features prominently in Sichuan cuisine. Consuming them has a numbing effect on the mouth and the sensation has been described as “spearmint and electricity, juniper and novocaine.” The pepper solution applied to paper has a noticeable lingering fragrance. Ye Dehui believed this practice not only could kill insects, but would provide long-range prevention. He noted that 600 years after a Song dynasty book was printed, the pepper solution continues to be effective today and the books remain undamaged by insects. Experimentation with Sichuan peppercorns continues in China.

4. BLUE

Some Buddhist manuscripts (in hand scroll or concertina format) are elaborate and striking works inscribed with silver or gold on dark blue indigo-dyed paper. The effect is lustrous with the paper often glazed or burnished with a mixture of ingredients that may include yak, goat or sheep brains. There is little documentation about the production and use of blue indigo paper in ancient China, but it was costly to produce and a luxury product usually reserved for significant religious texts. Some hand scrolls used yellow-dyed or plain paper for the main text, but incorporated the indigo paper as the lead section or front piece of the scroll. Indigo has natural insect repellent properties that are recognized in many cultures. This practice may have helped to prevent insect damage, in addition to aesthetic concerns. During the Ming 1368–1644 and Qing (1644–1911) dynasties, indigo-dyed paper for book covers and cloth for bookcases became common practice.

5. ORANGE–RED

Bright orange endsheet papers are dominant in the Fung Ping Shan Collection. The Chinese name is *wan nian hong* paper (萬年紅紙), and is made using red lead or litharge *qian-dan* (鉛丹). Literally translated, *wan nian hong* paper means 10,000-year red paper, but the papers in the HKU collection are more of a bright orange color than red, as the name implies. Most of these books date to the Ming and Qing dynasties, a period when substantial numbers of Chinese books, many originating from the south of China, were acquired by libraries and private collectors all over the world. It is common to find this brightly colored paper today in Chinese books collected in the USA and Europe. (illustration 3a-b)

Primary fibers for paper production prior to the Ming dynasty were mulberry or hemp. Although bamboo was used in book and papermaking from earliest times, it gained in popularity during this period, especially in the southern more tropical regions of China. Bamboo paper has been shown to be more susceptible to insects than paper made from other fibers, and consequently the orange-colored insecticide paper is found mainly in southern China, where bamboo paper production has been more widespread. It is notable that the prepared orange paper is only effective against one type of insect that is also common in this area, the *Ctenolepisma villosa fabricius*, which is related to silverfish and firebrats and thrives in warm regions. The orange paper does not prevent, but kills the insects after contact and/or ingestion. On page 76 of Volume 5 of Joseph Needham’s *Science & Civilisation in China*, there is a description of the traditional process...
of preparing red lead for use on paper. These papers have been the subjects of research by various institutions in China and the presence of red lead has been verified. Tests have also been carried out to prove the effectiveness of insecticidal properties of the prepared papers. Application of the insecticide solution to the paper is not always even and does not always extend to the ends of the paper. It is not uncommon to find an endsheet that is only partially covered by the orange color. There are examples where the uncolored area has been damaged by insects, but the orange-colored areas remain undamaged. Interestingly, some orange papers that appear to have the same treatment are not effective, and some tests have determined that certain orange papers do not contain red lead. It appears that some unscrupulous manufacturers of the red insecticide paper used other less expensive red pigments to produce fraudulent insecticide papers. (Illustration 4a-c)

Chinese thread bound books are printed or written on one side of a sheet of paper that is folded at the foredge and stab sewn along the long cut edge. The insecticide solution is applied to only one side of the paper and is most often folded and sewn in with the text block. Five different methods of incorporating insecticide papers are noted here:

1. As endsheet, folded with the color to the outside, sewn in at front and back of the textblock;
2. As endsheet, folded with the color to the inside, sewn in at front and back of the textblock;
3. Inserted inside a regular folded endsheet (either folded or a single layer of red paper) sewn with the textblock;
4. Inserted inside every folded page of the volume (either folded or a single layer of red paper) sewn with the text block;
5. Used to line the book enclosure.

The red insecticide paper is limited in its effectiveness, as most often it is only used as endsheets, leaving the center of the textblock vulnerable to attack. In addition, the preparation of the solution involves handling toxic elements that are harmful to humans as well as insects.

6. CONTEMPORARY INSECTICIDE PAPERS

A range of preservation concerns at the Shanghai Library were addressed in the 1990s when a new building was designed and constructed. In 1997, a donation of 45,000 volumes infested with silverfish was not contained and quickly spread to the main collections. Library staff handled the infestation by sealing off the area and controlling the environment, but they also had been experimenting with a new version of in-house-made insecticide papers. The chemical used was pyrethrin-based, and like the historical insecticide papers, the solution was applied to the surface of a thin piece of paper. Ultimately the problem was controlled and has not recurred. More recently, preservation staff at the Shanghai Library have developed version 2.0 of the insecticide papers. The light yellow-colored papers solve some of the problems associated with the original recipe. According to Chen Jianhua, Deputy Director of the Shanghai Library Historical Documents Preservation Center, the new generation of pyrethroid-treated paper is more effective against silverfish, as well as beetles that had previously shown resistance to the insecticide paper. At the same time, the new version is less toxic to
humans. It is effective for around five years and fulfills the requirement that the method be safe, effective and economical.

Insecticide papers have not been the only method of pest management in contemporary and ancient China. Certain species of insect deterring woods have been used for book boxes and book boards. Medicinal plants have been placed on or near books, and soon after their development modern chemicals were embraced and applied to collections. Today, some of the traditional methods endure including experimentation with insecticide papers and the use of traditional woods and herbs alongside modern Integrated Pest Management systems. In some places, the use of toxic chemicals still persists.

Today we find that nearly all of the Fung Ping Shan Rare Book Collection is in need of new or replacement enclosures. Previously, there were at least four active binderies located not far from the university. Based on the labels affixed to the board shear and book presses that I inherited at Hong Kong University in 2010, it is clear that there was once a demand for binding equipment, which was actually produced in Hong Kong.

All the binderies previously working with the library have since gone out of business. There are no longer any local manufacturers of binding equipment, though a few suppliers/importers of general binding materials remain. Today the local streets where print shops and binderies thrived are filled with cafes and boutique shops selling high-priced handbags, cosmetics and watches. There are no local manufacturers or suppliers specializing in archival materials.

The traditional practice of airing books is simply not practical, both from the staffing perspective and because the appropriate weather conditions are more difficult to pin down with changes in the local climate. Now we do our best to control the indoor environment with air conditioning and dehumidification, along with an Integrated Pest Management plan. Preventing the reintroduction of pests and the recurrence of mold growth are top priorities. The survey also revealed that only 5% of the volumes are adequately housed. The housing situation for the remaining 95% can be broken down as follows: 1% of the items have no enclosure, 61% of the items are housed in enclosures that are either poorly fitted or have broken clasps or flaps, and 33% are made of poor quality materials with clear acid migration onto the books and deteriorated plastics and adhesives.

To fabricate thousands of enclosures will be a long-term project, especially when considering the absence of any local binders or suppliers of archival materials.

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