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History and conservation of Kunyu Quantu (A Map of the Whole World) by Ferdinand Verbiest, 1674

A copy of Ferdinand Verbiest’s rare and intriguing wood block print, Map of the Whole World (Fig. 1), produced in China and dated to 1674, was purchased by surgeon and collector William Hunter (1718-83) sometime between 1765 and 1779. Hunter’s collection was bequeathed to the University of Glasgow in 1783 where the Hunterian Museum opened in 1807. The importance of the map was only recognised ten years ago and until May of 2007 it had never been displayed and was infrequently accessed. The bicentennial of the founding of the Hunterian Museum prompted the conservation of the map so it could be displayed. The University was also able to secure funding for a research studentship to study the map.

Fig 1. Ferdinand Verbiest (Belgium, 1623-1688), Kunyu Quantu (A Map of the Whole World). Woodblock print on paper lined with linen. Approx. 168 x 307 cm. Both Hemispheres after treatment. Collection The Hunterian Museum, Glasgow. (Photograph © Mr Harvey Wood.)

History and provenance

Ferdinand Verbiest’s Map of the Whole World was one of a series of early maps produced by Jesuit missionaries in China. Italian Matteo Ricci was the first Jesuit to arrive in China, and in 1584 was the first to produce a map of the world. It is possible that Ricci regarded mapmaking, together with other aspects of Western science and technology, as a way of drawing the attention of the literati class, who governed China, to the Catholic Church. Ricci’s map, which depicted a single hemisphere, was the first in China to use a projection of parallel latitudes and curving longitudes, showing the entire world as a sphere and consisting of five continents divided into climate zones. The map was printed in several editions, the last in 1608. Its detailed information on peoples and continents was translated into Chinese with the help of Chinese Jesuit converts. This was the model that Father Verbiest followed in his map of 1674.

In 1601, Ricci was granted residence in Beijing, the Chinese capital. The Jesuits maintained this position at the heart of China for nearly two centuries. They were able to do this through their mastery of scientific knowledge, particularly their abilities in mathematics and astronomy. In 1644, one of Ricci’s successors, a German, Adam Schall von Bell, was appointed Director of the Bureau of Astronomy at the Chinese Court. He was the first Jesuit to join the ranks of the Chinese bureaucracy. In 1669, Flemish
Jesuit Ferdinand Verbiest (1623-88) (Fig. 2) was appointed Director of the Imperial Observatory. Like earlier Jesuits, Verbiest was familiar with astronomy and cartography and was able to respond to the Chinese Emperor Kangxi's interest in European science. The Manchu had overrun China in 1644 and established the Qing dynasty. The second Qing emperor, Kangxi (1662-1722) was concerned with consolidating power in China and so required reliable maps of the empire and the world beyond. In 1674, Verbiest published his *Map of the Whole World* in response to the Emperor's requirements.

From the beginning, maps have served various purposes, such as providing information for tax gathering, water conservation, river transport and defense against human enemies and natural calamities. Although the Chinese always valued precise knowledge of their empire's geography, there were no professional cartographers in China until the late nineteenth century. Before this time map makers tended to be broadly gauged scholars and artists rather than more narrowly focused technicians. They were expected to make maps in the same way they created striking landscapes or spectacular calligraphic works. In the West, the primary concerns with map production were science-based, whereas China's intellectual echelon also concerned themselves with astronomy, geography, philosophy, art, literature and religion. Western influence came extremely late, especially when considering that the first map found in China dates from 2100 BC. In Verbiest's map, the amalgamation of cartographic styles is evident. Western cartographers concerned themselves with perspective and scale while Chinese map makers did not think this was important. It was not unusual for mountains to be drawn in elevation while rivers would appear in plan. Geographical perspective and actual dimensions varied greatly depending on the purpose of the map. To compensate for the absence of an accurate scale, the maps were heavily annotated.

The map's Chinese title, *Kanyu Quanmu*, is printed in four large characters at the top and is read right to left. The date of the map, 1674, and Verbiest's title as Head of the Astronomical Board appear at the bottom right and left.

Surviving copies of Verbiest's *Map of the Whole World* are very rare. This copy can be traced directly to the Jesuits at Beijing. It is the earliest example in a Western collection of the map with such a complete provenance.

The map consists of two hemispheres showing the five continents as they were known at the time: Asia, Europe, Africa, America and Magellanica, which was the uncharted southern part of the globe. Each hemisphere is over 1.5 meters square. The six large cartouches containing Chinese text, along with multiple smaller cartouches within the map design, describe natural phenomena and detailed information on mountains, rivers, peoples and relevant facts particular to individual regions and countries.

The animals that appear in the map, both real and mythological, were associated with different parts of the world and were derived largely from Konrad Gessner's *Historia Animalium.* This publication is a series of five volumes on creatures of the world, illustrated with woodcuts and published between 1551 and 1586. Gessner (1516-65) was a respected physician, philologist and bibliographer whose research took him into many spheres of human activity. He was born in Zurich, and studied medicine, science and the classics at Basle, Paris and Montpellier. By the time of his death in 1565, Gessner had produced and published an abundant amount of work, establishing himself as the father of zoology. Gessner's sources for the images used in the *Historia Animalium* were a mixture of originally commissioned work and those
borrowed from other books and manuscripts, an example of the latter being the inclusion of Albrecht Dürer’s famous woodcut of a rhinoceros, first published in 1515.

In 1731, Theophilus (Gottlieb) Siegfried Bayer (1694-1738), Professor of Greek and Roman Antiquities at the St. Petersburg Academy of Sciences, (and after 1735, Professor of Oriental Antiquities) began corresponding with the Jesuit missionaries in Beijing.3 Bayer was one of the earliest Europeans to make a study of the Chinese language. It was his study of Chinese that led to his correspondence with the Jesuits which lasted until his death in 1738.4 From this correspondence (held in Glasgow University Library), we know that a copy of Verbiest’s Map of the Whole World was sent to Bayer in 1732 from Beijing by Father Dominique Parrenin (1665-1741). After receiving the map, Bayer wrote to Father Parrenin in 1734 to thank him and, in a subsequent letter of 1736, to explain that he had translated the texts on it. Bayer wrote about Verbiest’s map in an article published posthumously in 1740.5 After Bayer’s death in 1738, his collection of books, manuscripts and letters were acquired by Heinrich Walter Gerdes (1690-1742), a Lutheran Pastor in London and Fellow of the Royal Society. Sometime between 1765 and 1779, Dr William Hunter purchased the entire collection from Gerdes’ widow.

From its description in the original list of the Bayer Collection, it is clear that the map came to Bayer and then to Hunter in the form of eight unmounted vertical scrolls.6 These scrolls were intended to be mounted and hung together to form a complete map. The vertical hanging scroll was the traditional format for Chinese paintings and other graphic material, and would have allowed the map to be rolled up with ease when not in use. Some time after the map came to Europe, it was mounted on canvas in the Western manner, as it is seen today.

Materials and techniques of production
A close examination of Verbiest’s map made possible during the conservation process allowed some interesting hypotheses to be drawn about the possible history of its mounting and the printing process employed.

A useful source of information found on the development of the use of paper and printing in China is in the series Science & Civilisation in China, edited by Needham. The following quote is from Volume Five, Part One: Paper & Printing by Tsien Tseu-Hsui.

There is a long history of pre-printing techniques in China, including the use of seals, for stamping on clays, and later on silk and paper, of stencils to duplicate designs on textiles and paper, and of the inked impressions taken from stone inscriptions. All these processes gradually led to more efficient methods of mechanical multiplication of copies and around 700AD, printing began in China. Moveable type was introduced by the middle of the 11th century and multicoloured printing sometime in or before the 12th century.7

There is very little documentary evidence to indicate the date woodblock printing was introduced to China, or describing the technical processes involved. While there are no surviving examples of woodblock printing before the eighth century, Tsien Tseu-Hsui suggests that literary evidence, (e.g. words that describe the woods used for blocks; their cutting, or engraving, printing or publishing), indicates that it may have started earlier. He goes on to describe the woodblock printing process:

After the blocks have been cut, they are usually soaked in water for about a month but, if they are needed for immediate use, they can be boiled instead. They are then left to dry in a shaded place before being planed on both sides. Vegetable oil may be spread over the block surface, which is then polished with the stems of polishing grass. The size of the block depends on that of the sheet to be printed; normally it is rectangular, averaging twelve inches wide, eight inches high, and half an inch thick. Both sides are usually carved to enable the printing of two pages, or one leaf, on each side.

In the preparation for engraving and printing, the manuscript is transcribed on thin sheets of paper by a professional calligrapher. ...The paper is waxed lightly and smoothed with a
stone burnisher to make the surface easier to write on with a brush. The transcript is placed, written side down, on a block over which a thin layer of rice paste has been evenly spread. The back of the paper is then rubbed with a flat palm-fibre brush so that a clear impression of the inked area is transferred to the block. When the paper is dried, its upper layer is rubbed away with finger tips and brush to expose a fine mirror image of the characters or designs which have been applied to the block, looking as if they have been inscribed directly on it. The block is then ready for carving. The carving is carried out with a variety of sharp-edged tools of different shapes, leaving the characters with a relief of about one-eighth of an inch.\textsuperscript{8}

The text provides insight into what was done to correct mistakes if they were found:

Four proof-readings are normally required in the engraving process. When a mistake is discovered or a line chipped off, a block can be repaired; a small error being excised with one edge of the chisel by making a notch into which a wedge shaped piece of wood is hammered, but if an area is involved, a suitable piece of wood is inlaid. In either case, the new surface is smoothed and carved as if it were the original.\textsuperscript{9}

The 1674 Verbiest map includes such a correction in the top left corner of the Africa/Asia hemisphere (Fig. 3). The edges of the inlaid section have printed darker than those surrounding it, indicating that the piece of wood inserted was probably slightly higher than the rest of the block.

Tsien describes the inking and printing of the blocks:

After the carving is complete, the surface is cleaned of any remaining wood refuse or paper tissue and washed. The printer takes a round inking brush, made of horsehair, dips it into water-based ink, and applies it to the raised surface of the block. A sheet of paper is immediately laid over it and a long, narrow rubbing pad is brushed lightly over the surface of the paper. A positive image of the characters or illustrations is thus transferred to the paper, which is peeled off the block and laid aside to dry. Fifteen thousand prints can be taken from an original block, and another 10,000 after slight touching up. Blocks can be stored and used again and again when additional copies are needed.\textsuperscript{10}

It is impossible to know how many impressions of the map were made. The image is generally sharp and very well defined, but in some areas it has printed slightly blind. These pale areas vary between extant examples of the map, indicating irregularity in the inking or printing process. The size and nature of the map suggest that the number of impressions may have been limited and it could be speculated that they were printed as required, rather than in one large edition.

A second edition of the map was printed from new blocks in 1860, and re-printed in 1936.\textsuperscript{11} The 1860 edition shows significant differences from the 1674 version. The block arrangements and the shape of the text cartouches are completely different. The cutting of the blocks is relatively crude and much of the fine detail that is found in the 1674 edition is lost. It is thought that the blocks for the second edition were carved because the original blocks had been destroyed, possibly burnt in one of the fires that destroyed the Northern Cathedral in Beijing.

The surface of the map was carefully examined to identify the block joins and the paper seams. It was
found that each hemisphere was printed using seventeen blocks arranged in three vertical strips (Fig. 4). Generally the blocks were slightly off square and varied in size, but they were cut so that they tessellated together very accurately. This is crucial with an image of this complexity, since gaps between the blocks or uneven edges would severely disrupt the 'reading' of the map. Gaps do appear between the blocks in the final printed image, but vary in existing copies of the map. This suggests that they are due to errors in registration while printing rather than with the blocks themselves.

The paper sheets are also arranged in three vertical strips, usually made of two pieces joined two-thirds of the way up. The right hand strip of the Africa/Asia hemisphere is made of five pieces, one a small strip insert. The paper joins overlap by approximately five to eight millimetres.

The arrangement of the blocks and paper sheets suggests that the map was printed in two groups of three vertical strips. The image is printed over the horizontal overlaps joining the paper sheets but not over the vertical ones, where the block edges accurately match the sheet edges (Fig. 5). The vertical joins between the printed strips of paper are less accurate. For example, there is a significant overlap at the top of the Africa/Asia hemisphere between the central and right hand sections. Part of the printed image has been obscured and tenting or bulging has occurred at the centre of the map, as the overlap is uneven over the length of the join.
The two central cartouches span both sections of the map, and suggest that the margins should have been trimmed enabling the text to be read continuously when the hemispheres were hung together. The top margin would also probably have been trimmed, where ink from the edge of the blocks is visible in both sections.

It may be concluded that the map was originally printed on six vertical pre-joined sections of paper, which were intended to be trimmed and scroll mounted. According to records at The Hunterian, their copy of the map was acquired in rolls. After entering the collection, the sections must have been joined and were probably lined with linen at the same time. A copy of Verbiest's map in Uppsala, Sweden, is mounted in the same way as the Hunterian copy, suggesting that this may have been a common practice in map collections in the West. However, unlike the Hunterian copy, the edges of the Uppsala map have been trimmed.

Another copy, previously unknown to us, of Verbiest's *Map of the Whole World* in the Library of Congress was scroll mounted but the date of the mounting is not known. It is possible that the Hunterian copy was once lined with traditional scroll mounting materials, and had its scroll mounting removed before being joined and re-mounted with the linen. However, the object shows no evidence of this and if this had been the case, the margins would probably have been trimmed. It might also have been very difficult to remove a lining without inflicting serious damage to the map's short fibred, light-weight Chinese paper and there was no evidence of adhesive residues, skinning or losses that one might typically find in this case. The scrolls, if unmounted, could not have been frequently handled without sustaining damage. It is assumed that the linen lining was applied soon after the map came to the Hunterian.

**Conservation and display**

The map is 333 years old and shows some signs of aging. Having been stored folded for many decades, it did not lie flat. The paper was fractured, worn and flaking away from the fabric support along many of the fold lines (Fig. 6). These areas were extremely vulnerable to further damage and loss on handling of the map. Distortions and undulations were present, the result of the paper having been stretched and imperfectly aligned when adhered to the linen backing. The lining material was strong, provided a good physical support, and was well bonded to the thin soft paper. The paper was slightly discoloured overall but the printed image was in excellent condition.

The map had been stored in the museum collection with no outer wrapping for much of its life. There was light, dusty surface dirt throughout, and heavier, more extensive deposits of sooty soiling over areas of both the paper and the fabric backing. The paper showed signs of degradation where it had been exposed to light and atmospheric pollutants. There were pronounced water stains which appeared as lighter, cleaned areas with strong tide lines. These had been formed by water falling onto the map while it was folded and these areas of damage indicated how water-soluble the discoloration in the paper was.

The aim of the treatment was to:
- Reduce the sooty soiling on the linen and the paper;
- Re-attach the delaminating fragments of paper along the fold lines;
- Reduce the tide lines;
- Press out the fold lines; and
- Devise a means of hanging the map for display while preserving its three-dimensional character.

There was no intention to remove the map from its backing. Although the linen is undoubtedly not original, it has been in place for about two centuries.
It is strong and stable and supports the paper on which the map is printed. The current lining and presentation are very much part of the map’s history.

Soiling reduction on both the paper and the linen surfaces was carried out using latex sponges. In many areas the paper was strong enough to be cleaned quite effectively with the sponges, but particular care had to be taken along the abraded and damaged folds. Soiling was substantially reduced by the treatment, but areas that had been water damaged and areas on the edges where the dirt was most engrained, did not clean so well.

The lifting fragments of paper were re-attached using wheat starch paste applied with a fine brush. Although much of the flaking and delamination was located along the fold lines, other lifted areas were found that must have been caused by uneven application of paste during the lining process.

Reduction of the water stains was accomplished on the suction table with a fine brush. Filtered deionised water, with the pH adjusted to 8.5 with calcium hydroxide, was applied to small sections of the tide lines. The wetted area was immediately blotted with a small piece of blotting paper and dried with a hair drier. This technique prevented side migration of the water and the stain, allowing immediate tone comparison with adjacent areas and preventing the risk of over-washing. The paper was extremely absorbent and, had it been possible to do an overall washing treatment, the discolouration could have been greatly reduced. However, the fragility of the paper and the presence of the linen backing made this option impossible.

In conjunction with the curator, Sally-Anne Coupar, and Nick Pearce, Professor of Chinese Art at the Art History Department of the University of Glasgow, the conservators devised a means for hanging the map. The undulations in the map prevented it being held flat with a conventional style mount and frame. The hanging method had to carry the considerable weight of the two large, linen lined sections of the map and allow the two sections to hang next to each other so that the half-oval cartouches joined up as closely as possible. In order to achieve this, a system was designed whereby the two panels would be hung from a bar.

Six loops of linen were applied to the top of each section. The loops were made from unbleached linen (375a Turnbull & Wilson – Ulster Weaving Company), cut with pinking shears and hemmed with a sewing machine. They were attached to the linen verso of the map using the heat set adhesive Beva 371. The uneven edges of the sections required the loops to be of slightly varying heights.

Removing creases and undulations in the map proved more problematic than had originally been thought. Once the linen hanging loops were attached the two sections of the map were hung up for several weeks to allow the planar distortions to reduce.
There were essentially three different causes of the creasing and distortion: those caused by the folding, diagonal creasing due to subsequent rolling of the map, and those created by the lining. It was not possible to reduce the distortions that had been introduced when the lining was applied to the paper, so it is by no means completely flat (Fig. 7). The attachment of a second set of linen loops to the lower edge of the two parts of the map, so a pole could be suspended from the lower edge and provide a small amount of tension helped reduce the distortion.

A custom display case was made for the map. The size of the case and the required quality of the glass made it an expensive item, costing £7,100. The case is three metres 30 by two metres, and uses opti-white laminated UV filtering glass. The air exchange rate is less than 0.1 cycles per day (Fig. 8).

After the map treatment was complete, and the display case commissioned, a discovery was made in the stores of the Hunterian Museum – two further sections of the map were found. The sections had been lined together in exactly the same way as the main part of the map. The sections contain four text cartouches each, which refer to eclipses and other natural phenomena. The two sections were originally designed to be placed on either side of the two hemispheres of the world. Due to the discovery of these panels, the archive evidence of the provenance describing the map as consisting of 'eighth [eight] sheets each', finally made sense. The side panels were discovered too late to be incorporated into the designs for the new museum, but plans are in place to have these two sections conserved and they will be displayed in an adjacent case.

The newly refurbished Hunterian Museum of the University of Glasgow was opened to the public on 23rd May 2007. Verbiest’s Map of the Whole World, one of the great treasures of the collection, has proved to be a popular exhibit, and it is satisfying to know that after so many years in storage it is finally accessible and appreciated.
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Suppliers

Beva 371:
Conservation Resources (UK) Ltd, Oxford
Email: ConservArts@aol.com; Web: www.conservationresources.com

Linen:
Whaley's (Bradford) Ltd
Email: info@whaleyssltd.co.uk

Endnotes

4. Correspondence between T.S. Bayer and Dominique Parrenin in 1732, 1734 and 1736 (Ms. Hunter B/A2, B12, B14), held in Glasgow University Library Special Collections.
5. Bayer, T.S. 1742. 'De Ferdinandi Verbiestii S.J. scriptis, praecipue vero de eius globo terrestri sinico' (The works of Ferdinand Verbiest S.J., especially his Chinese world map), Miscellanea Berolmensis, VI: 180-92.
8. Tsien, 196-197.
10. Tsien, 200-201.