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Proceedings
of the thirteenth international seminar held at
the University of Copenhagen 13th–15th April 2011

Edited by
M.J. Driscoll

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The vignette on the cover is taken from the allegorical representation of Professor Arnas Magnæus/Árni Magnússon's scholarly activities that adorns the oldest series of publications of the Arnamagnæan Commission 1773–1809.

Storing library collections: A workflow for packing and tracking items in the library of the St. Catherine Monastery, Sinai

by Caroline Bendix & Independent conservator and advisor on libraries conservation to the National Trust

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Introduction

St. Catherine's Monastery stands at a height of about 1,500 m above sea level in the mountains of the Sinai desert in Egypt and is a six-hour drive from Cairo. The Monastery was built in the sixth century, but the present library floor was added to the south wall of the Monastery by the early 1950s. A recent survey found that the suite of rooms comprising the New and Old Libraries was potentially unstable and needed to be rebuilt, resulting in the need to pack the collection in crates and store it elsewhere in the Monastery.

The library collection comprises 3,381 manuscripts, thousands of early and modern printed books, a large number of papyrus fragments – the New Finds, a cache of manuscript and papyrus fragments discovered in an old store room in 1975 and an archive. The collection was housed in the New Library, the Old Library, which has two levels (the main floor and the Gallery), the New Finds room and the archive (Figs. 21 & 22). Other than the manuscripts, there were no exact totals for each part of the collection, and although the manuscripts and 1,000 rare books were catalogued, no comprehensive lists existed for the rest of the collection.

The importance of the collection and the requirement for access to the manuscripts and New Finds during the building works were the defining factors of the pack and track methodology. Materials easy to seal and

Fig. 21. Plan of main library floor. *From left to right: modern library room, printed books shelving, reading room and archive room.*

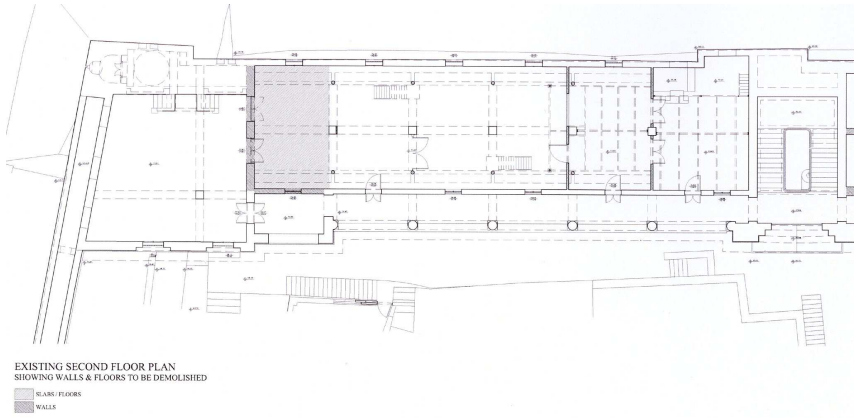
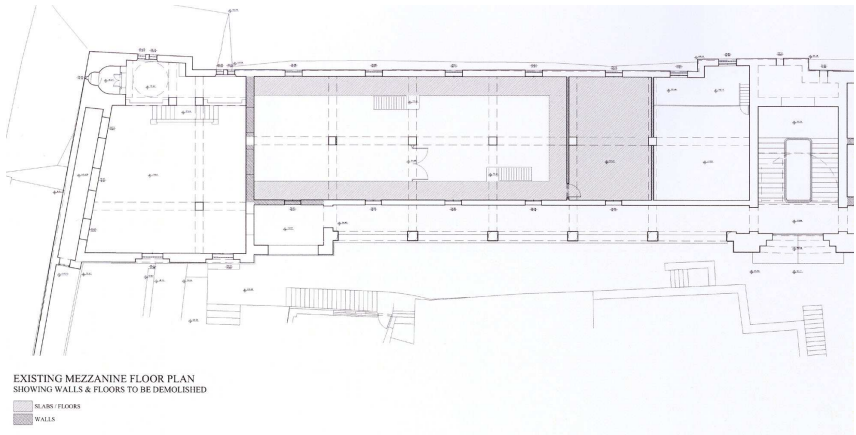


Fig. 22. Plan of mezzanine library floor, *Mezzanine floor shaded. From left to right: manuscript shelving, new finds room.*



reseal were chosen, and barcode equipment and software was used to eliminate tracking errors.

Condition of the collection and building

The condition of the collection ranges from good to very fragile. The earlier manuscripts are vulnerable to handling; some have clasps and metal furniture, others have no binding at all; some have strong structures, whilst others have broken sewing. The nature of the collection meant that individual wrapping of each item was essential in most instances, except for the modern material in the New Library, and the New Finds, many of which were already protected by phase-boxes.

A vital part of the preparatory work was to assess the floor loadings in each area. In the Old Library in particular, much of the weight of the books, especially those in the Gallery, was borne by the walls, not the floor, as the shelving was tied into the walls. During packing, these books would have to be removed from the shelving and stored in boxes placed on the floor thus significantly increasing the weight to be borne by the floor. The strength of the old and poorly constructed building was therefore a major concern during planning.

Planning

An essential part of the planning was to ascertain the weight of the collection, as no decisions about storage areas or the sequence of the move could be taken without this knowledge. David Mitchell of the British Library provided advice based on modern books, but factors such as much lower relative humidity levels, the weight of the crates, packaging materials and any racking on which they would be stored had to be taken into consideration as well. Father Justin, the Librarian, weighed a few shelves of manuscripts as a sample and the results showed that much variation was possible within the collection. However, according to the calculations of the structural engineer the overall weight of the collection could safely be borne by the floor.

The time available to pack the whole collection was six weeks, split into two trips of three weeks each – the rebuilding of the Library was intended to begin as soon as the collection was packed and moved into

storage. To optimise the use of the limited time available it was essential that materials and equipment required for the project were delivered before the conservators arrived to begin packing. The location of the Monastery meant that sourcing materials and equipment in the immediate locality was impossible and, once materials had been sourced, delivery times could not be guaranteed. Egyptian suppliers were initially difficult to find and eventually, although crates and most of the packing materials were sourced locally, some materials, such as acid-free tissue and pony-hair cleaning brushes, had to be purchased in the UK and transported to the Monastery.

A difficult calculation was that of the number of crates required. Measuring collections by linear metres does not provide enough information to quantify crates unless all books are a standard size or are being moved upright or on their spines, which was inappropriate for this project. The only accurate total for numbers of items was for the manuscripts but a detailed count of the archives had already been made, and Father Justin had provided estimates for the rest of the collection. The total number of crates was calculated based on the estimated number of items and the volume of space taken up by them, with an extra 20 % both as a contingency and to incorporate the packing materials; this high contingency proved to be justified because approximately 5 % of the crates were damaged while being transported to St. Catherine's.

It was decided that the old Trapeza and Icon Store be used as storage areas for the collection. These areas would require the crates to be loaded onto a hoist and brought down the outside of the building but, with hardly any rainfall in Sinai, this posed no risks for the collection.

Security

The security of the collection was of paramount importance. Despite the fact that it was to be stored within the Monastery walls, the lack of comprehensive lists meant that a system had to be devised by which individual items and the crates in which they were stored could be tracked. This way we would be able to find any 'missing' items during packing, and Father Justin would be able to retrieve items requested by readers during building work. The crates had to be sealed in such a way that access to their contents and subsequent resealing could be carried out.

Barcode tracking system

Barcode technology is widely used for data inputting with confirmed reliability in many industry applications, including libraries. The main reasons for using barcodes is the increase in speed and accuracy when inputting data. These were critical in our case since time was limited and easy retrieval of the packed books was essential for Father Justin. The shelfmark of every item in the library was encoded on a barcode. Barcodes were prepared in advance and printed on two slips of paper, one to be placed inside the item and the other to be stuck to the protective packaging around it.

There were two principles followed in our barcode tracking system:

- Barcodes were tracked as they were moved: Contrary to many tracking applications where the destination of an item is known, as is its route, in our case the route of an item from the shelf to the crate, then to storage and (when the building works are complete) back to the shelf could not be determined in advance. Decisions on packing crates were taken on the spot and a book originally placed in a crate often moved to another for optimal packing. Instead of risking a predetermined path for items, we decided to monitor the barcode only when it reached a new location. There was a risk of missing a location during the path, but given the level of control over the process this was minimal.

- Barcodes were arranged hierarchically in a parent-child relationship: A library item could be placed in a crate making the item's barcode a child of the crate's parent barcode. The same applied to crates which were placed in different rooms. This principle can be extended to any number of items and containers within containers, but also allows information to be stored in a single list of barcodes which require only a parent barcode to indicate their location.

Open source software was used to implement the tracking system, for accessibility of the collected data. The thousands of barcodes necessary for tracking were produced in advance using barcode4j, a programme which can output barcodes in bulk as JPEGs for a given list of shelfmarks (e.g. Fig. 23). The JPEG files were then inserted directly into a text file in ODF format, ready for printing. Inserting these thousands of barcode

Fig. 23. Example barcode, *Barcode for printed book Greek number 10.*

images would have been an impossible task if done manually. However, the open specification of ODF allowed direct alterations of the file programmatically, automating the whole process.

A database was used to store the list of tracked locations for each barcode. We opted for a server-client arrangement because there were multiple clients connecting, querying and updating the database at any given time. Records were kept in chronological order and the path for each item could be extracted by querying the database. We used the open source industry standard MySQL for storing our database records, which has good support and is reliable. A web-form for barcode inputting was built with php – a popular open source programming language – and the whole system ran on a GNU/Linux operating system. The clients were equipped with barcode readers and a standard web-browser to access the web-form. Hourly backups were collected and sent to a remote server, so a database failure would cost only an hour's worth of records in the worst-case scenario.

Standard laptop equipment was used for running the software and specialist handheld equipment was used for barcode scanning. Barcode scanners were used constantly, so they had to be compact, reliable, fast and robust, as the project's progress relied on them. We chose the 'Motorola MC55' handheld computer which fulfilled all requirements (Fig. 24).

Pre-packing

During the planning stages, all extraneous material was removed from the Old Library, so that there was as much space as possible for setting up the work area. Father Daniel made a bubble-wrap dispenser and sourced a hoist to be used to bring the manuscripts down from the Gallery. An advance team went out to St Catherine's to prepare the workspace before the rest of the team arrived. Tables were covered with board, melinex or foam board, to provide a smooth surface, and placed in line down the

Fig. 24. Motorola MC55, *Handheld computer with numeric keypad (barcode scanner on top).*

north side of the room. Foam book supports were used to create packing stations of different heights to reduce the risk of back strain.

It was originally planned that the printed books be packed first and the crates moved out of the Library to the Synodiko, a room on the same floor, after which free-standing bookshelves in the centre of the Library would be removed to create space for packing the manuscripts and storing them in their crates within the Library, the most secure area available. However, the crates had not arrived in time for the beginning of the packing and were unlikely to do so before the conservators left, so the packing sequence had to be changed, from putting packed material into crates to having to return it to the shelves temporarily and until the crates arrived. The packing was done in a production line for faster workflow.

Packing: Stage one

The first of two three-week stages of the project comprised packing the printed books and archives. Books were moved from the shelves to the end of the production line, where the barcode slips were added inside the upper cover, so as not to be lost during cleaning. The barcode sequence was preserved to facilitate unpacking the crates at the end of the building works and to reduce handling. All books were treated as if they had a western format to make it easier to know which was the spine and which the fore-edge when it came to putting wrapped material into crates.

Each book was placed on the table sequentially. At the next stage, the books were kept in piles with the top one cleaned first and placed on the table, the second placed on top and so on. The same procedure was followed at each workstation, so that when the packaged books were placed back on the shelves, they were all in their original sequence which could be checked instantly.

Books were then cleaned externally, measured and assessed for protection and/or support in the future. This included making a judgment as to whether bookshoes or phase-boxes would be needed, and this data was entered into the database.

Each book was then wrapped in a double layer of acid-free tissue or, if it had clasps, with extra tissue and bubble-wrap. If a book was warped or distorted, it was marked with a 'W', so that when packed into crates it could be placed on the top of the contents to avoid potential damage to the structure. Barcodes were attached to the outside of the wrapping with masking tape and placed on the upper board side; the acid-free tissue and bubble-wrap were likewise secured.

Occasionally items were packed together under one barcode, e.g. identical books without shelfmarks and, conversely, there were also occasions when several individually-barcoded books were wrapped in the same bundle, e.g. very slim pamphlets; when this happened all relevant bar codes were stuck onto the outside of the wrapping.

The shelves were cleaned and the wrapped books returned to them. At that point gaps in the shelfmark sequence were easily identified and a barcode slip showing the missing item was placed in the relevant pile, in case the book was located in a later shelf. Because of the extra space taken up by the packaging materials, books were stored flat on their return to the shelves; warped books were always placed on the top of a pile. After the conservators left, Father Justin mapped the whereabouts of all the books and then turned over the top book in each pile, so that the upper board was downwards, to ensure that the masking tape remained in place in the dry atmosphere.

During the first stage about 14,000 printed books, a large part of the archives and 237 manuscripts were wrapped and returned to their shelves. Between the first and second stages Father Justin and helpers crated the New Library books, which did not require any special handling, and the archives, which were typically stored in boxes anyway.

Packing: Stage two

In the second stage, many of the same conservators returned to finish wrapping the manuscripts and to put all the material into crates. Because the storage rooms were not ready in time, the workflow was organised to enable free-standing bookshelves to be emptied and removed from the Library to provide extra space in which the crated material could be stored. In order to maximise space still further, crates, instead of tables, were used as packing surfaces. The conservators were split into two teams, one crating the printed books and the other wrapping and crating the manuscripts.

High-density polyethylene crates, the preferred option, were not available in Egypt and would have been prohibitively expensive to ship from the UK. Plastic, lidded crates were sourced locally and were fit for purpose, although they would not have been used had it been necessary to transport the collection beyond the Monastery walls. Each crate was lined with bubble-wrap, with bubble-wrapped foam at the bottom to reduce the risk of jolting during handling. Extra space was taken up by bubble-wrap and the crates were sealed, using polypropylene strapping and metal seals. Each crate was weighed to keep track of the amount of loading on the Old Library floor. The crates were then stacked in piles of four and, once all the shelving was removed, arranged into a basic sequence and mapped.

The crates were subsequently moved to storage where they will remain until building work is complete.

Conclusion

The project was difficult to organise because of the nature of the collection and the geographical location of St. Catherine's Monastery. Given the difficulties in sourcing and supply of materials, its geographical position and the need to finish on time because of the building works, the high contingency of 20 % proved essential to avoid delays due to lack of materials. Despite the several changes of plan, both before and during the packing, the willingness of Father Justin and his helpers, as well as the skill, adaptability and hard work of the conservators, meant that the project was completed on time and on budget. The tracking system was a significant asset in the whole process. It allowed monitoring of the

progress of packing in absolute numbers and better time management. It ensured the safety of the collection and allowed easy searching for packed items. The choice of open-source software was successful since the potential for open configuration offered flexibility at a minimal cost. Significant time was saved by using an automated tracking system instead of traditional solutions. Finally the resulting database, apart from a finding aid, stands as a useful record of the progress of the project on a day by day basis.

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List of suppliers

Egyptian agent: Mr. Vayonitis; email: mahaadly@yahoo.com Supplied smaller-sized crates, bubble-wrap, crate strapping and associated equipment

Largest crate: Office Express Providers Ltd., Akragantos11, T.K.10442, Athens; email: sales@exofpr.gr

Foam: Habitat Egypt, Furniture & Contract Furnishings, C.R. 302995, First Industrial Area, Block 13010, Obour City, Cairo; tel: 002 02 46100180

Acid-free tissue: Conservation By Design Limited, Timecare Works, 5 Singer Way, Woburn Road Industrial Estate, Kempston, Bedford MK42 7AW; tel: 00 44 (0)1234 853 555; fax: 00 44 (0)1234 852 334; web: www.conservation-by-design.co.uk

Nilfisk GD2000 vacuum cleaner: Basco Engineering and Trading, 20 Asmaa Fahmy St., Ard El Golf, Heliopolis, Cairo; tel: 002 02 90 6997