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**Collection Moves at Leicestershire Museums’ Natural Life Collections:  
Practical Hints and the Importance of Volunteers**

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**Abstract**

The move of the Botany and Geology Collections between Leicestershire County Council and Leicester City Council in 2010 is described and some of the problems and opportunities that arose are illustrated. Following the move, the two parts of the Leicestershire Museum Service Herbarium (Herb. LSR) have been reunited, and it now contains over 120,000 botanical specimens. Substantial environmental improvements have been made to the Natural Life Collections that have had positive effects both on curation and volunteering.

**Background**

In 1997, Leicester City Council was created as a unitary authority from Leicestershire County Council following Local Government Reorganisation. The museum collections that were held by the previous single council were divided by agreement between the two new councils. The Botany Collection was largely split taxonomically, and the Geology Collection by locality (Table 1) between the two new councils. Library books and journals were similarly divided.

	<b>Leicester City Council Museum Service</b>	<b>Leicestershire County Council Museum Service</b>
<b>Botany</b>	‘Higher plants’ (ferns, conifers and flowering plants; c. 50,000 specimens); a carpological (seed) collection; a wood collection; wax and wood plant models; plant collecting and herbarium apparatus; prints, illustrations and photographs; record sheets and cards; historical correspondence; history sheets.	‘Lower plants’ (algae, fungi, lichens, bryophytes and slime moulds; c. 50,000 specimens); a representative selection of ‘higher plants’ from the UK; relevant correspondence and history sheets.
<b>Geology</b>	British and world rocks, Leicestershire minerals and selected British and world minerals, meteorites falling on Leicestershire and world wide, trace fossils, invertebrate and plant fossils of Leicestershire, Mesozoic vertebrate fossils of the Midlands (including types), vertebrate fossils of British and World provenance.	Leicestershire lithology collection, petrology reference collection, core samples, fossil handling collection, comparative and educational collection of common minerals, the Frank Ince collection of local rocks and minerals.

**Table 1.** Location of the Botany and Geology Collections in 1997.

In 2009, some key staff retired, but financial constraints precluded the appointment of a specialist botany curator by Leicester City Council and a specialist geology curator by Leicestershire County Council. So, a Strategic Collections Review was made by both councils which recommended that the Botany and Geology Collections should be re-united. The Botany Collection was to be held by Leicestershire County Council’s Museum Service (LCCM) and curated by a specialist botany curator, and the Geology Collection by Leicester City Council Museum Service (LCMS) and curated by a specialist geology curator. A project began in

earliest in March 2010 to move the two collections, with a December 2010 deadline and was a joint venture between the two councils. This paper describes the facilities (buildings/stores/post-move arrangement of collections etc.) of Leicestershire County Council's Museum Service alone, focussing on the Botany Collection.

### **Internal Collection Moves**

The LCCM Geology Collection was housed on the ground floor of Leicestershire County Council's Collections Resources Centre (CRC), and the LCCM Botany Collection was housed on the mezzanine floor of the same building next to the Working Life Collection. As it would have been impractical to split the Botany Collection between the two floors, it was decided to move the Working Life Collection from the mezzanine to the ground floor, to the space vacated when the Geology Collection moved out. The space created by the move of the Working Life Collection would allow the Natural Life Collection (Botany and Zoology Collections) to be reorganised, as the existing siting and configuration of entomological and botanical cabinets allowed pockets of stagnant air to develop in the Natural Life Collection area which made it difficult to maintain an optimal temperature of 20°C and humidity of 40% (Bridson & Forman 1999a).

### **Strategy adopted**

Moving each collection in series (i.e. completing each move before starting the next one) was considered very risky, as there were several crucial time-dependent stages that, if delayed, would impact on the completion date. For example, a long time gap between the LCCM Geology Collection's departure and the LCMS Botany Collection's arrival would be needed to move the Working Life Collection, but, the working life move could not over-run and delay the botany move, as it was being done by a commercial company. So, it was decided to move the three collections, or prepare them for moving, in phases over several months, rather than move them all at once. This approach needed more management and more planning, but had fewer risks, lower costs and there was more time to move objects, which was more acceptable to both volunteers and staff. The *PRINCE2* method (OGC, 2009), a process-based approach to project management that provides an easily tailored and scaleable method for all types of project, was used to manage the move. Application of *PRINCE2* methods enabled dependencies and critical points and dates to be identified, risks to be identified and mitigating actions planned, tasks to be defined and allocated to staff and volunteers, and monitoring to take place to ensure timely completion. A risk assessment for each task identified was done in advance using UK Government guidelines (HSE, 2012). Considerable assistance was provided by Leicestershire County Council's Museum Service's volunteers.

### **Communication plan**

A 'Collections Move Newsletter' was emailed to all staff likely to be affected every three months, to inform staff of the dates of moves, restrictions to access, changes to the building layout, noisy days, and details of work completed. This was particularly important for off-site staff who used the store's facilities occasionally, and may not have been able to obtain access. Staff members commented that it was useful to know when disruptions were likely, as they could plan their own work around them well in advance, and could raise access or use issues, enabling the early resolution of potential conflicts.

### **The LCCM Geology Collection**

Before the collection could be moved out, some preliminary tasks were necessary that needed the expert advice of Grace Deeks (Conservation Manager, Leicestershire County Council). The quantity of materials involved in these one-off tasks was small, but potentially hazardous, so there was little benefit to volunteers or to the Museum Service in training them, so they did not assist with these tasks.

1. Unstable specimens of pyrites were packed into polyethylene boxes (Stewart Ltd., Croydon) with loose dry silica gel to stabilise them.
2. Records showed that three radioactive specimens were present within the main collection. They had been tested for emissions by an external contractor in 2006, and the emission rates had been found to be low (1.0, 1.5 and 50.0  $\mu\text{Sv/hr}$ ). As radioactive materials present risks for staff, volunteers and contractors (Freedman, 2012), and labelling of the main collection had not been completed, it was essential to locate these specimens. They were found to be adequately labelled on the outside of containers, but inadequately packed in plastic vials or boxes. So, they were each placed within a sealable plastic bag to minimise release of particulates, placed within a box filled with acid-free tissue to minimise movement during transport, then placed in a large plastic container (Stewart Ltd., Croydon) filled with granular expanded polystyrene packing material and labelled as a radioactive hazard. In this way, exposure to radioactivity was reduced by maximising the distance from the source to the user.

3. Specimens of toxic minerals (containing mainly arsenic, antimony, nickel and lead compounds), some weighing several kilos, were packed into sealed boxes with much granular expanded polystyrene packing material and acid-free tissue, as appropriate, by staff wearing lab coats, disposable gloves and masks to reduce inhalation or ingestion risk, and marked clearly on the outside as toxic (Freedman, 2012).

The collection of 114 borehole core samples and their associated documentation were accepted for curation by the British Geological Survey (BGS, Keyworth, Nottinghamshire) on the basis that they would reserve the right to return or dispose of any samples that were not localised, or that were inferior to material already held in the BGS's core collection. Cores were stored in cardboard or wooden boxes and were moved by staff from the BGS.

Volunteers from all the different collections teams and staff from the Leicester City Museum Service were trained to pack and stabilise rocks and minerals by Mark Evans (Senior Curator, Natural Sciences, LCMS). The minerals, fossil learning, petrology reference and Leicestershire lithology collections were stored loose in cardboard boxes, which were packed to reduce movement and possible damage during transport using bubble wrap and acid free tissue as appropriate for each box of samples. Before being wrapped in acid-free tissue or bubble-wrap (depending on the size, shape and composition of the specimen), data from the specimen itself, or on an accompanying card, was entered into a *Microsoft Excel* spreadsheet which was used to produce the catalogue to accompany the exit forms. By the end of May 2010, the cores had been transferred to the British Geological Survey store and, during the next three months, volunteers and staff from both LCCM and LCMS packed and catalogued 10,815 items and 107 boxes comprising:

- 1,749 igneous and volcanic rocks
- 1,163 sedimentary and metamorphic rocks
- 2,396 minerals
- 279 fossils
- 370 numbered items and 56 boxes of unnumbered items in the Frank Ince collection
- 4,818 specimens of local rocks (Leicestershire lithology collection)
- 51 boxes of teaching materials
- 40 miscellaneous items (ranging from large 3-dimensional maps to mammoth tusks)

Although this work was repetitive, and volunteers could easily have declined to do it, communicating the Service's vision and encouraging volunteers to see the future, helped to maintain their enthusiasm even when, as they sometimes remarked, there was "...another box of grey rocks to pack". Because of budget constraints, the stabilised specimens and boxes were transferred to the LCMS Store using in-house transport. The van driver was briefed about the nature of the radioactive contents and was reassured that they posed no risk. No special route was planned in view of the low risk to the public. The non-radioactive materials were securely packed in shallow layers on the floor of the van so as to not exceed the vehicle's maximum laden weight. As the cores and boxes were packed and moved, they released space on shelving and roller racking, allowing the transfer of the Working Life Collection from the mezzanine floor. The mineral collection was stored in 28 custom-built metal racks and cabinets that had been supplied by *Polstore Storage Systems* (Guildford, Surrey). These needed their specialist expertise for dismantling, removal and re-erection at the LCMS Collections Store, Leicester. This was a substantial cost (about 25% of the total budget) and the task was completed during early August, 2010. A small collection of Geology books was catalogued by LCCM volunteers and transferred to LCMS using in-house transport.

#### **The LCMS Botany Collection**

An assessment of the collection showed that the wax models and some cones were extremely fragile, so were carefully packed to reduce movement, with acid-free tissues and transported separately. The remainder of the materials was housed in cabinets or was loose in cardboard boxes. The herbarium cabinets had metal drawers rather than shelves, in which herbarium folders, sealed in plastic bags, were stored.

Some of the herbarium sheets had been stamped to show that the plant materials had been treated with mercuric chloride, which produces vapour that is toxic by inhalation (Oyarzun *et al.*, 2007). As these sheets were loose inside folders, removal would have released the gas, or possibly generated an aerosol that might pose a health risk. As a computer catalogue of the herbarium specimens had already been made, only the number of separate sheets in each folder was counted and entered onto an electronic spreadsheet that was

used to produce the catalogue to accompany the exit forms. The material was sorted and marked either for freezing (biological materials) or direct transfer to the store (pamphlets, card indexes and other paper- or card-based materials, illustrations, photographs), before incorporation into the store collection. The unfrozen items were sealed into plastic bags stored in boxes on racks in the main collection, and were removed for cleaning and pest-checking over the next year, but none was found to be infested by pests such as book-lice or silverfish.

Volunteers and staff from both Museum Services helped to pack each drawer with bubble-wrap wedges to minimise transverse motion during transport. They also helped to pack 188 boxes of loose materials, seeds and cones, models, prints, card indexes and computer records for safe transport by encasing items or padding boxes with bubble wrap. Each box, or group of small boxes, was placed in a large polyethylene bag and sealed. This work was completed over a two-week period in July, 2010. History files were part separated into botany and zoology, but most had to be separated by inspection and photocopied when botanical and zoological specimens were present together. They were housed in two fire-proof safes, also transferred to Leicestershire Museum Service. A critical step in the Botany collection move was quickly identified: botany cabinets were housed in the basement of New Walk Museum Leicester and needed to be moved to ground floor level. The Museum has a lift serving these two floors, and stairs for use when it is out of service. Replacement of the wide Victorian staircase in the 1970s with narrower, modern stairs only just gave sufficient space to enable a cabinet to be carried safely around the turns of the staircase. If the lift was out of service on the day, the cabinets would have to be carried, which would require more removers, increase the cost, delay the start of freezing and reduce freezing time available. The fire safes also depended on the lift, so would have to be moved at a later date, further increasing costs.

#### **Controlled drugs**

The collection contained six herbarium specimens of *Cannabis sativa*, but plant material of the genus *Cannabis* is a Class B controlled drug (HMO, 1971,2001). The herbarium specimens could only be moved, if Leicester City Council upgraded its licence to supply the material and if Leicestershire County Council obtained a licence to possess it. In 2010, the Home Office introduced charges for a new licence of £3,133, and an annual renewal charge of £326. The cost of the licence could not be justified for six specimens, so it was decided that they should remain with the LCMS.

#### **Decontamination of the botanical material**

The material to be transferred was very dirty and had not been condition-checked for at least a decade, so decontamination was a priority. The most successful method of decontaminating herbarium material from temperate climates is by freezing to at least -18 °C for 2 days to kill all stages of the life cycle of the major pest, the biscuit, or drug-store, beetle, *Stegobium paniceum* (Bridson & Forman, 1999; Eisenman, 2005). If the presence of different or additional pests is suspected, then other techniques are required. Repeating the freezing cycle, after it has been left at room or ambient temperature for a few days, to allow eggs to hatch has been much used in the past (Bridson & Forman, 1999b), but a literature review by Florian (1997) showed that a longer freezing period was as effective, and possibly less damaging to the material, so she recommended freezing it at -20°C -30°C for 3 days (see also, IPMG 2008). Longer freezing was advocated by several authors and institutions e.g., Strang (1997) recommended freezing below -20°C for 7 days as a minimum, Calabrese (2005) recommended -20°C to -29°C for 2-5 days, the Royal Botanic Garden Melbourne, Australia (2012) recommend -23°C for 7 days. The Natural History Museum, London (2012) recommends a cycle of 1 week freezing to -30°C for 3 days, then slowly raising the temperature to ambient, a technique that was used in the recent move of the Botany Collection (Brown, 2010).

In view of the literature researched, a freeze-thaw cycle was ruled out, and freezing for a longer period was selected, although freezing to -30°C was ruled out on grounds of the cost of the freezer. Given the quantity of material to be frozen (51 cabinets and 160 boxes of loose material), one or more large industrial freezers with an air circulation fan would be needed. However, only a single-phase 240 V power supply and domestic plug sockets were available at the CRC: the absence of a 3-phase supply and 16 A bayonet connectors, commonly used in industry, precluded the use of certain types of commercially available freezer. Taking all these factors into account, it was decided to freeze for 10 days at -25°C with 2 days chill-time and 2 days thaw time (although it was discovered that ambient still had not quite been reached after 2 days thawing). The method chosen was informed by reference to literature and helpful advice, but determined by the power supply and the type of power connectors available at the CRC, the volume of material to be frozen and the cost of freezer hire. The cabinets and boxes were frozen in two industrial freezers that were erected in situ on the store car park by *Elliott Kitchens* (Gaddesby, Leicestershire) (fig. 1). The freezers arrived two days

early, both to ensure correct operation, and to determine freezing and defrosting times by test-freezing a few items. During commissioning, it was found that some 30 m extension leads were needed which had to be custom-made on site, further justifying the test period.



**Fig. 1.** Freezers on the Collections Resources Centre car park. Image © Leicestershire County Council.

As moving the bagged herbarium folders from their cabinets and freezing them separately would require preparation time and shelving in the cold room, the cabinets of biological materials were frozen unpacked to simplify procedures and minimise hire costs. To provide air circulation, cabinets were placed on wooden pallets obtained from a local bakery, and their doors were removed before freezing. The loose boxes of objects were sealed in plastic bags before freezing, and stacked in the freezers. The freezers had to have sufficient space both to allow cold air to penetrate the cabinets and boxes, and to allow staff movement when packing and unpacking the freezers. It was important to consider the location of the freezers on the store car park to avoid restricting access, yet provide sufficient space for loading and unloading from the removal lorry, and to ensure that they were waterproof, as they would be sited outside unprotected.

#### **Insurance cover**

The removal company's insurance covered the items during the move, but the Council's insurance did not cover the material whilst in the freezers, as they were sited on the car park in front of the store, with only site perimeter fencing, night flood lighting and the supplied lockable door handles for security. It was not possible to purchase additional cover, so, the freezers were sited so that their doors faced each other to reduce visibility from the road and possible damage or theft. This was unsuitable and undesirable, but there was no viable alternative.

#### **The LCMS Botany Library**

Further division of the library books was needed to enable LCMS to retain books on gardening for one of their museums, and natural history books dealing with general topics e.g., ecology, genetics and insect pests. Staff from LCMS produced a catalogue of 1,665 books and journals in the library which were packed into crates one week before removal day. Although some library shelves were offered free from Leicester City Council as a result of the closure of the Central Lending Library, they were very large and bulky and could not be dismantled for removal. Some new shelves were purchased to complement the existing shelving. Re-organising the store permitted longer runs of shelves, and it was possible to create three more bays of shelving by reconfiguring the existing metal shelving (fig. 2).

The books, journals and other materials not retained by LCMS were packed into crates delivered by Pickfords Removers 7 days before the move to LCCM, which had to be returned within 14 days. The library shelving had to be purchased and in place before the crates were returned: another critical step. At the

same time, the opportunity to re-organise the library to improve access was taken: books and journals were separated and are now stored in different parts of the store, and books were organised on shelves according to the Dewey decimal system by a volunteer. Rare volumes were stored in a fire-proof safe. Duplicate volumes were offered to local universities and museums, and then nationally via the NatSCA mailing list. Parts and runs were taken by National Museums, Liverpool and Bracken Hall Museum, Bradford.



**Fig. 2.** Library shelves before the move showing poor access (left) and after showing improved access (right). Image © Leicestershire County Council.

**Moving the Botany Collection and Library**

Selecting the removal day (23 September 2010) needed co-ordination and agreement between the City and County Council Museum Services’ staff and the removal company, Pickfords, as mid-September was a holiday period. Another critical step was identified: the internal collection move had to be completed before the Botany Collection arrived, although there was a contingency period of two weeks while the material was being frozen. Material that was not being frozen was placed *in situ*, while the cabinets and boxes were loaded into the freezers, and the move was completed in about 7 hours. After a 48-hour defrosting period, the cabinets were moved to marked positions in the store (fig. 3) and the exteriors cleaned by volunteers.



**Fig. 3.** Botany cabinets in position in the store. Image © Leicestershire County Council.

**Protected species**

The collection contained specimens of eleven taxa, the possession of which is regulated by The Conservation (Natural Habitats, &c.) Regulations (2010), Schedule 5, European Protected Species of Plant (DEFRA, 2010). These were: *Gentianella anglica* (Pugsley) E.F. Warb., *Apium repens* (Jacq.) Lag., *Apium nodiflo-*

*rum x repens*, *Liparis loeselii* (L.) Rich., *Najas flexilis* (Willd.) Rostk. & Schmidt, *Rumex rupestris* Le Gall, *Spiranthes aestivalis* (Poir.) Rich., *Saxifraga hirculus* L., *Trichomanes speciosum* Willd., *Cypripedium calceolus* L. and *Luronium natans* (L.) Raf. As none of the species in Annex 5 were present in the existing LCCM Botany Collection, a licence to possess these specimens was obtained from the Government's regulatory authority, Natural England after transfer to LCCM. The wood collection was inspected and it was found to contain no specimens regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), an international agreement between governments that came into force in 1975 (UNEP-WCMC, 2005).

#### Data transfers

All relevant computer files were transferred between the councils. Object records are maintained using the *MIMSY XG* computer application (Selago Design Inc., Ottawa). As no new specimens had been added to Herb. LSR since disaggregation, merging data records was (mercifully) not needed.



**Fig. 4.** Hills cabinets stacked three high. Image © Leicestershire County Council.

#### Re-organising the Natural Life Collection

While the botany material was freezing, opportunity was taken to re-organise the Natural Life collections area to make use of the space released by the move of the Working Life Collection. Because of space shortage, Hills cabinets had been stored three and four high (fig. 4), which reduced access, was an safety issue and made the work areas dark. The remainder of the Natural Life collection was stored on racks in such a way as to maximise space, but which reduced air flow, allowing pockets of hot and cold air to accumulate. The fluctuations in both temperature and humidity were a serious concern, both to the health of the collections, and to the long-term stability of the Hills cabinets. The cramped conditions also made it difficult to show visitors around the store (fig. 5) and did not show the collections favourably. The collections were re-organised so that Hills cabinets were only two high, and the materials on racking were moved to new, lower racks in another part of the store. To accommodate the new material in boxes in the Botany Collections, eight double herbarium cabinets (*CD Sheet Metal*, Kent) were put into position before the Botany Collection move, and which were used to store material held in a variety of cardboard and wooden boxes.

#### Project summary

Some valuable lessons were learnt, which may guide other curators who have to plan similar complex collection moves. During the geology collection move, it was found that, as some orders were high value, authorisation was needed by senior management, which created a bottle-neck, so orders need to be placed as early as possible. Volunteers' experience of *Excel* varied greatly and they mistyped some item numbers, although their errors reduced with experience. It was found best to pair inexperienced with experienced volunteers to create an opportunity for knowledge exchange, and to monitor them closely initially. During the botany collection move, it was found that some items in the collection came to light after removal plans had been made, so a contingency plan was required. Compliance with the relevant legislative requirement, writing risk assessments for all tasks and the provision of insurance cover needed time, so need to be considered early in the project.





**Fig. 5.** Cramped conditions during a 'Behind the Scenes' visit.  
Image © Leicestershire County Council.

There were four main outcomes of the project which had positive benefits for the Museum Service.

1. *Early completion.* The adoption of the *PRINCE2* method allowed the project to be finished nearly ten weeks before the dead-line, releasing staff time. Volunteers were crucial to the success of this project. Without their hard work and dedication, the project would not have been completed either on time or within budget the budget of £15,000.
2. *Environmental improvements.* The store has better lighting, more space and better access: more work-spaces have been created following the re-organisation. Now that the stacked cabinets and shelving no longer impede free air circulation nor create stagnant air pockets, the humidity and temperature fluctuations recorded over the years have been reduced and the collections and cabinets are much less at risk from environmental damage (fig. 6).
3. *Increased interest in volunteering.* Store tours following the moves produced a very positive response from the public, several of whom expressed an interest in volunteering. Some members of local natural history societies have also indicated that they wish to volunteer solely as a result of the improvements to the collections and the working environment.
4. *Conservation improvements.* Seven months after freezing, there was no recorded evidence of pest damage or infestation in the collections. A new regime of regular freezing is now in place to ensure that the collection's pest-free state is maintained.



**Fig. 6.** The Natural Life Collections after the move showing environmental improvements.  
Image © Leicestershire County Council.

## Conclusions

- Plan: use *PRINCE2*, or a similar method, to break the task down into manageable components.
- Identify the critical step(s); they may not be where you expect them to be!
- Changes to the plan are inevitable; *PRINCE2* provides a method to evaluate their effects on the project timeframe and costs.
- Communicate changes and critical dates; think how changes to the store will affect other Curators, their volunteers, buildings and collections access.
- Consider what your options are, if insurance is unobtainable. Are you prepared to take the risk involved?
- Look for opportunities to...improve storage, create space and improve access.
- Use staff experience. Don't be afraid to ask!
- Volunteers were keen to help. Just communicate your vision.

## Acknowledgements

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