Sustainable Preventive Conservation at the Natural History Museum, London

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Abstract

In the 1970's human remains of more than 1400 individuals were excavated from a former Romano British cemetery (approx 135 AD to 350 AD) close to the current village of Poundbury in Dorset. The collection which is now held in its entirety at the Natural History Museum represents one of the most heavily used study collections in the Palaeontology Department. The collection is almost continually in use by visiting researchers. The poor storage of the collection coupled with its heavy use has led to its current condition; eventually this could lead to its inaccessibility. In line with the preventive conservation strategy led by the Palaeontology Conservation Unit a project has been set up which aims to evaluate the current storage conditions, to re house the material in recycled conservation grade boxes, provide all elements with bespoke supports, prevent abrasion and reduce the necessity to handle the collection through better labelling. A team of specially trained volunteers has been developed to support the project.

Introduction

The Poundbury series of human remains forms part of the British Isles Human Comparative Collection. It has been identified by collection managers and researchers as a very high priority for the Palaeontology Department's documentation project. In support of this project, specialist conservation re-storage work is being carried out to bring this collection up to the Best Practice standard according to the Collection Management protocols.

The remains were excavated close to the village of Poundbury, Dorset between 1966 and 1976. It consists of the remains of over of 1425 skeletons of people who lived nearly two thousand years ago and who represent a period of well over two centuries (approx. 135 AD to 350 AD) of the human biological and cultural history of the British Isles.

The continual use of this collection together with its inadequate storage has led to its current condition, which in some cases has resulted in breakages, abrasion and the so-called "Wheatabix" effect. This term describes bone material that has become so badly abraded that it appears like crushed "Wheatabix" see figure 1. The ongoing deterioration can be halted by new and appropriate storage and up-to-date labelling methods.

Fig.1 : Poor access and damage on bones ("Wheetabix" effect)

The key tasks of the project

- Review current storage and user requirements:
- Undertake a brief survey of the collection to gain an understanding of the its scale, the variety of the material, its condition and the number of bones per box (completed).
- Development of new storage concept:
- Re-plan the storage of the collection within its current location and minimal increase to current footprint. Enable easy access to the material and reduce the need for handling. Plan and produce templates for each new type of storage unit. Design, build and purchase bespoke storage boxes (completed).
- Implementation:
- Re-box as much as possible of the Poundbury collection in conservation grade materials. Training of volunteers to fit out boxes with supports (ongoing).
- Analyse the collection environment.

Survey

A short survey of current boxing, storage units and damage identified the following issues:

- Bones are deteriorating because of overfull boxes, lack of support and heavy use. (Deterioration observed: loose teeth, abrasion, fresh breakages especially of fragile bones such as shoulders)
- Poor accessibility: average 100 bones are kept loose in boxes (see Fig 1)
- Storage containers are deteriorating (missing lids, mould, corroding staples, broken bags leading to loss of bone association)
- Labelling is insufficient and occasionally confusing
- Use of non-conservation-grade packing materials such as newspaper, medicine and confectionery boxes consisting of acidic paper (Fig. 2)
- The current footprint of the collection allows little space for expansion, which is inevitable given the overfull boxes
- Several hazards were noticed in the anthropology storage area (heavy trays without stoppers, wedged-in boxes, unstable ladders, lifting heavy boxes at awkward angels)

Fig. 2: Damaged and unsuitable storage containers, confusing labelling

Choice and design of storage containers

The new storage containers were designed by the staff in the Palaeontology Conservation Unit. The design was given to a specialist conservation supplier "Conservation by Design". It was based on the survey of the material and assessment of compactor units. The aim was to allow safe handling, yet maximum use of the available space, avoiding expansion of the collection as far as possible. It was decided to create a four-box system. The number of different box types was kept small to allow bulk orders and reduce costs for dye cutters. The four chosen sizes can be combined efficiently. As space was identified as a main restriction, especially for the postcranial material, an insert tray was designed to increase the internal space within the container.

Fig.3: Volunteers and students at work (from left to right: Josephine, Marielle, Priya and Andrew)

Internal support

A series of tests were carried out to determine the optimum way of mounting the bones of priority group I. It was decided to use two layers of plastazote foam. The shape of the bone was cut out of the top layer. This ensured that the bones are padded and held securely in their place to avoid abrasion. Boxes for crania were fitted out with plugged-in foam wedges for additional support. The use of adhesives has been avoided, as these are often weak points in storage systems. The slot for each bone has a rather characteristic shape and it is hoped that this will help users to return the material correctly. A note on the label advises users to remove only one bone at a time.

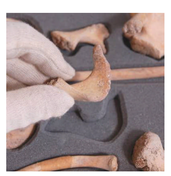
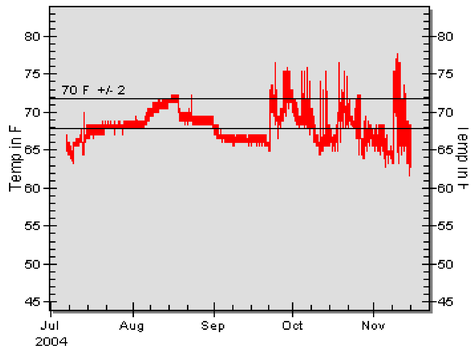


Fig 4: New containers and foam inserts.

The recycled board created for these low cost Archive Boxes is a high density, hard pressed material making the boxes stronger, longer lasting and more resistant to fire and flood than any other equivalent box available. The boxes are made from 100% Recycled Premier Grade Archival Paper & Board Waste. They are 100% Chemically Purified, Woodfree Fibre. They have a PH of 7 -7.5 and are acid, lignin and O.B.A. free.

The Collection Environment

The Poundbury collection is housed in the Anthropology store in the Palaeontology Building of London's Natural History Museum. This building was welcomed as a major advance when opened in 1977 but the conditions provided for specimens were soon in doubt. A study of the design parameters, records of environmental and specimen condition, and anecdotal accounts identify the general malaise of the building. Experimental pressurised testing of the building envelope confirmed that the suspected 'leakiness' of the structure, compounded by an inherently inadequate HVAC system and other factors, such as inappropriate solar gain, all added to the building's failure. An understanding of these elements fed the design process for a major refurbishment programme, completed in 2005, that spanned 3 years at a cost of £7.5 million (c. $14.5 million).



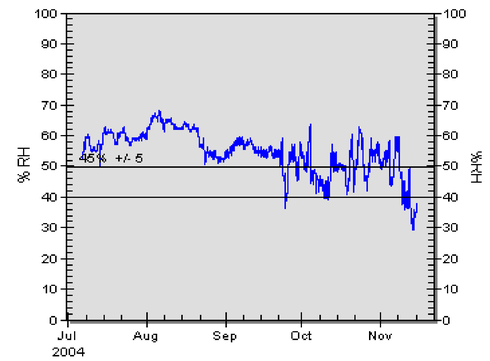


Fig 5: Relative Humidity in the Anthropology Store July to December 2004 – Pre refurbishment

Anthropology Main Storage Area

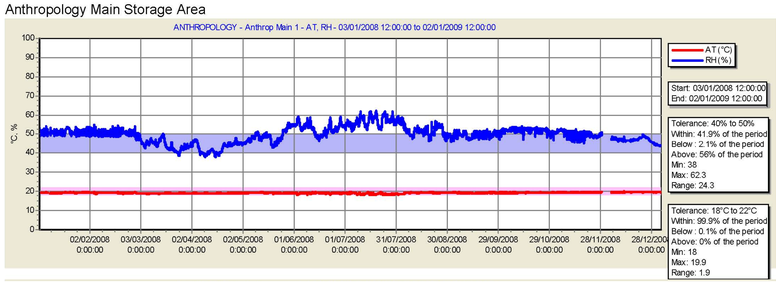


Fig 6: Relative Humidity and Temperature in the Anthropology Store 2008

The Palaeontology Building Refurbishment Project

For more than two years a large team drawn from a variety of disciplines worked on a feasibility study for the building's refurbishment. The main impetus for the refurbishment was not only the new fire regulations requiring the building to be sealed at its perimeters but also the need to remove asbestos that had been used in its construction and were posing a potential threat to the health of the employees. Mechanical, electrical and structural engineers, quantity surveyors, architects, project managers, HVAC consultants, health and safety advisors, lighting experts, and the Museum's Estates managers met regularly, sometimes monthly, as a project design team to explore and consider a range of building problems and solutions. Fortunately conservation and curation staff were part of this team from the outset and their knowledge and views were considered an essential element and feasibility decisions.

Investigation and examination

The behaviour of the building, and resulting energy costs, were affected by the extent to which the heating, ventilation and air conditioning (HVAC) plant was compensating for leakage in the building envelope i.e. that it was not sealed at its perimeter. The original infiltration heat loss was calculated to have been 50%, a level which prevented the original size of air conditioning plant achieving the desired environment. The UK's Building Research Establishment (BRE) was engaged to carry out building air tightness test ("Probe" process recommended by CIBSE8). Test results indicated an hourly leakage rate of

2.2 Air Changes per hour. Compared to the BRE criteria, the infiltration rate of the Palaeontology Building at 2.2 air changes per hour was better than average but well over the intended target of 0.5 Air Changes and the ideal rate of 0.33. Improvements in the Collection Environment

Improvements in the Collection Environment

Since the introduction of a combined cooling heat and power plant (CCHP) on the NHM site replacing the old Boiler House improvements have been measured in the Palaeontology collection environment. Whilst the 2002/04 refurbishment of the department did not meet the costs of replacing completely the old heating ventilation and air conditioning (HVAC) system in the department it did improve certain aspects; these included new more efficient air handling units and pumps, lighting, fire alarm and sealing of the building envelope . Further to this In July 2007 the department was connected to the museum wide chilled water system from the CCHP. The chilled water is required by the HVAC to provide cooling and humidity control. Although the previous system also used chilled water it was not as efficient and it was proving costly to maintain. The chilled water produced by the CCHP uses the absorption refrigeration system (ARS) which is a more environmentally friendly process than producing chilled water from electricity. Not only does the system produce less carbon dioxide emissions it has fewer maintenance requirements. The new chilled water system is closely monitored and has improved back up and support.

The CCHP produces electricity for the museum site as well as heat which is used to heat buildings and to provide the chilled water via ARS. The CHP is 84 % energy efficient as opposed to a coal fired power station which is only 35% efficient.

Together CHP and ARS are known as the tri generation scheme as they provide electricity, heat and cooling. Overall the tri generation scheme saves 2000 tonnes of carbon per annum.

Sustainability

The museum has embraced sustainability and endeavours to use its concepts in all of its projects. The use of recycled board for the collection containers goes someway towards that aim. The quality of the board is far superior to that offered by many other suppliers and therefore there is no compromise on quality and no risk to the collection.

The heating, cooling and electricity provided for us by the CCHP is giving us a better collection environment than we had prior to it introduction. The work carried out during the refurbishment of the building such as sealing the building envelope has gone some way toward providing a more stable environment for the collections. The second phase of our refurbishment scheme will go ahead as soon as funds are secured this will provide environmental control by more effectively zoning the building and in particular separating the collections air conditioning systems from those of the staff.

References

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