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Mastodon and on and on…A moving story

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Abstract

This is the latest chapter in the history of the mastodon *(Mammut americanum* (Kerr, 1792)) specimen on display at the Natural History Museum (NHM) in London (UK), and continues from the story told by Lindsay (1991). The specimen was selected to be one of the new exhibits for the Wonder Bays of the refurbished Hintze Hall, at the heart of the Waterhouse building. Residing, until recently, on open display in a different exhibition space, the mastodon required stabilisation and careful dismantling before transportation and re-assembly in its new site.

Keywords: Butvar B98, Fossil, Conservation, Specimen move

Specimen History

The mastodon bones *(Mammut americanum* (Kerr, 1792); NHMUK PV OR 15913) were excavated in 1840 in Missouri, USA. Albert Koch, a self-confessed 'fossil showman', purchased the bones and created a large skeleton, considered at the time to be a biblical aquatic Leviathan. Koch toured it throughout North America and Europe. The specimen was purchased by the NHM in 1844, and was rearticulated by Richard Owen to be more anatomically accurate. The specimen spent several decades in the museum's Fossil Mammals gallery until it was moved to the Mammal Hall in the late 1980s. Its fascinating early history and first gallery move are fully documented by Lindsay (1991). As part of this move, it was stabilised through consolidation with polyvinyl acetate emulsion in water by spraying and drip filling. Broken porous areas were stabilised with Alvar 1570 (polyvinyl acetal) in organic solvents. Cracks were filled with a mixture of alvar, jute flock and kaolin (AJK dough) (Lindsay, 1991), whilst the fragmentary skull and maxilla were replaced with a cast constructed of expanded polyester resin.

The specimen was chosen for exhibition in the new Wonder Bays in the Hintze Hall, opened in 2017. This required another move, and the specimen was stabilised before being dismantled, transported, and reassembled in its new position.

Stabilisation and dismantling

After an initial condition report was completed, the specimen underwent a series of treatments prior to any dismantling. The specimen had accumulated a thick layer of particulate contaminants, and was cleaned with soft goat hair brushes and low-pressure vacuum before condition assessments and photography could be carried out. Further cleaning was executed using cosmetic sponge (Figure 1) and lint-free tissue dampened with Industrial Methylated Spirit (IMS). Cleaning revealed cracks in the vertebrae, ribs, and leg elements caused by lateral movement and fluctuating relative humidity. Two large diagonal cracks followed the presumed path of the armature that had been inserted into the pelvis, causing potential separation of the upper section, which was

held up by the armature, and the lower sections, which were now resting on the tops of the femora and had caused compaction. Cracks were also found within the old gap fill that held the foot bones together, and delamination was significant on the ribs and tusks. Areas of structural weakness were stabilised using Butvar® B98 consolidant (5% in ethanol), Butvar® B98 adhesive (20% in ethanol) and Butvar® B98 gap-fill (20% in ethanol mixed with glass microballoons (fumed silica), pre-tinted with earth pigments). As a filling material, Butvar® B98 was found to have a longer working time than Paraloid B72 and microballoon mixtures, and exhibited no problems with bubbles and expansion during curing.

Butvar® B98 is a terpolymer of vinyl butyral, vinyl alcohol, and vinyl acetate monomers. It has been used for many years at the NHM, where strength and stability are required at elevated temperatures, as are often encountered within the galleries. It is also recommended for consolidation of porous fossil material by the American Museum of Natural History (Goldberg and Davidson, 2014). Butvar® B98 is considered reasonably stable (Spirydowicz et al., 2001) and has been found to be reversible with no negative effect on the majority of stable isotopes in bones (France et al., 2015), making it a good choice for scientific specimens. There is, however, some concern about cross-linking over time and a resulting decrease in solubility, meaning it may require stronger solvents to remove (Feller and Curran 1975; Ellis and Heginbotham, 2004). This does not pose a problem with the mastodon, since more polar solvents would not cause damage and, on balance, the issue is of less concern than the risk of physical damage resulting from collapse. Butvar® B98 can also be used as a reversible barrier with irreversible resins (Anderson and Podmaniczky, 1990), so was used on the mastodon as a coating where in-painting with acrylics was necessary for aesthetic reasons.

Figure 2. The leg armature extends into four sections of tree trunk, which are braced with a network of curved metal bands. Image: L.Allington-Jones, © The Natural History Museum.

Figure 1. The vertical line on the pelvis delineates the division between the dusted area (facing left) and the area which has been further cleaned with cosmetic sponge (facing right). The blue whale model keeps a watchful eye in the background. Image: L.Allington-Jones, © The Natural History Museum.

The toes of the mastodon had to be carefully excavated from a cement-like base decoration before the remainder of the plinth was deconstructed. This polymer mix was softened with water to reduce vibrations as dental tools and, at greater distance, a hammer and chisel were used. Beneath the plinth, the support system was exposed as a network of iron bands intertwining four sections of tree trunk, within which the leg supports were embedded (Figure 2). The skull cast had been installed to encase the armature which supports the tusks, so it had to be removed. The two halves of the polyester skull were separated using a rotary tool along the flash line and the plaster of Paris gap-fill around the tusks was carefully chipped away. Once the top of the skull had been removed, the Victorian armature supporting the lower jaw and tusks was revealed (Figure 3). This was labelled and photographed to ensure that it could be replicated during re-installation.

Figure 3. The Victorian armature inside the skull cast, which links the tusks to the torso. Image: L.Allington-Jones, © The Natural History Museum.

Elements which were easy to remove, such as the scapulae, were detached, but each leg and the rib cage would have suffered damage if disarticulated so these were treated as intact units. Wooden frames were constructed to support the torso and each individual leg during transportation between the two galleries (Figure 4). The pelvis was secured with Relic Wrap™ (polytetrafluoroethylene film) and padded ratchet straps to prevent movement of cracks during component release and transportation. The dismantling was carefully planned and helped hugely by the sketches published by Lindsay (1991). Risk assessments were created for the dismantling and removal of elements, taking into consideration the specimens surrounding the mastodon as well as the general public, since the main gallery remained open for the majority of the project. The whale skeleton, suspended directly above the mastodon, caused particular inconvenience because it did not allow for enough clearance for the torso to be hoisted upwards off the legs. Instead, the weight of the torso needed to be suspended in situ using block and tackle attached to the cross beam of the scaffolding whilst the legs were unbolted and canted out from beneath using crate skates.

Figure 4. One of the rear legs, ready for transportation, is cushioned by a Tyvek® pillow filled with Plastazote® off-cuts. Image: L.Allington-Jones, © The Natural History Museum.

The de-installation was nerve-wracking, with the (unfounded) worry that the Victorian armature was under pressure and could spring outwards when the bolts were released. Many spotters were needed when hoisting down the tusks (using a mobile hoist and straps) to ensure that the surrounding specimens were not damaged. In fact, only two issues of concern occurred. The first was that the torso tried to rock backwards when the weight of the tusks was removed. The torso was therefore winched forwards using ratchet straps attached to the scaffolding, to prevent stress on the remaining joints (or even a slow backwards collapse) whilst the legs were removed.

The second was that compression cracks opened up in the femoral heads when the weight of the pelvis was relieved. The move to Hintze Hall itself was achieved using padded pallets and crate skates. It required a wooden platform to be built across the other plinths in the Mammal Hall, plus the removal of one giraffe and three rhinoceroses.

Installation

Due to spatial constraints caused by the new plinth in the Hintze Hall Wonder Bay, the legs were hoisted using a chain pulley system attached to scaffolding (Figure 5). Once the legs were roughly in place, the original metal bands were reattached around the tree trunk sections and then the torso was lowered on top using chain pulleys. Bespoke metal spacers were manufactured and fitted to the joint between the pelvis and femora to prevent further compression damage. The two halves of the skull were joined using Milliput® (2-part epoxy putty) over twists of acid-free tissue (Figure 6), with a barrier of acid-free tissue surrounding the tusk sockets. Putty was chosen in preference to polyester resin and fibreglass patches due to health and safety considerations. The putty was over-painted with acrylic paints.

Conclusion

Several lessons were learnt from, or exemplified by, this project. Apart from being unsightly, and increasing the risk of pest infestations, fire, and chemical reactions, particulate contaminants can hide deterioration and structural problems in display specimens like the mastodon. Conservation plans must be flexible, and treatments must evolve during a project to accommodate issues revealed by cleaning that may not have been apparent in initial assessments. The project also shows the value of old records, and the need to investigate the history of a specimen. Risk assessments proved invaluable for creating a holistic perspective and promoting consideration of the surrounding environment.

The mastodon now stands suitably framed by the terracotta archway, in the newly refurbished Hintze Hall, where it will hopefully stay for many decades to come (Figure 7).

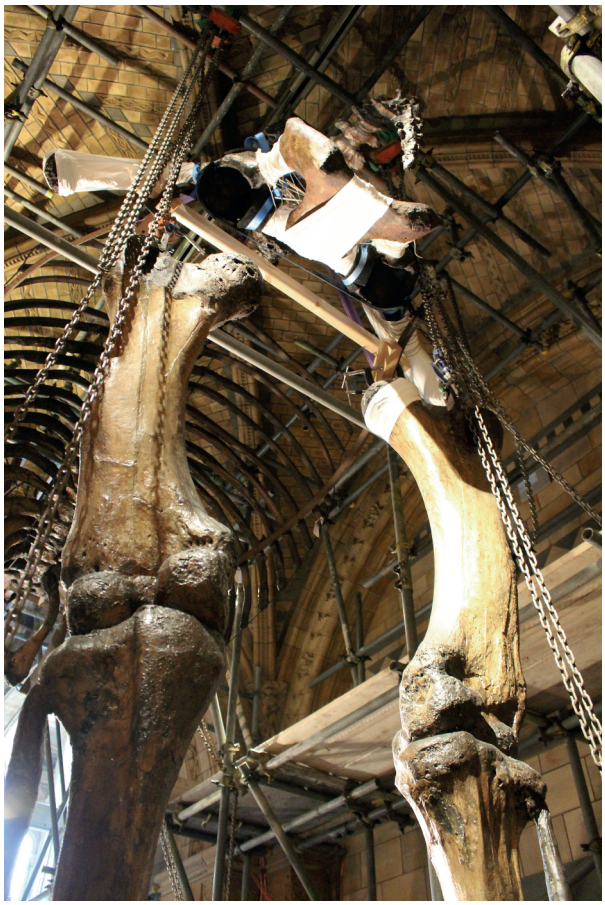

Figure 5. At this stage the rear legs have been hoisted into position, but the wrapped pelvis is yet to be lowered down to meet them. Image: L.Allington-Jones, © The Natural History Museum.

Figure 6. The unpainted putty which secures the two halves of the skull cast can be seen here as an orange band. Image: L.Allington-Jones, © The Natural History Museum.

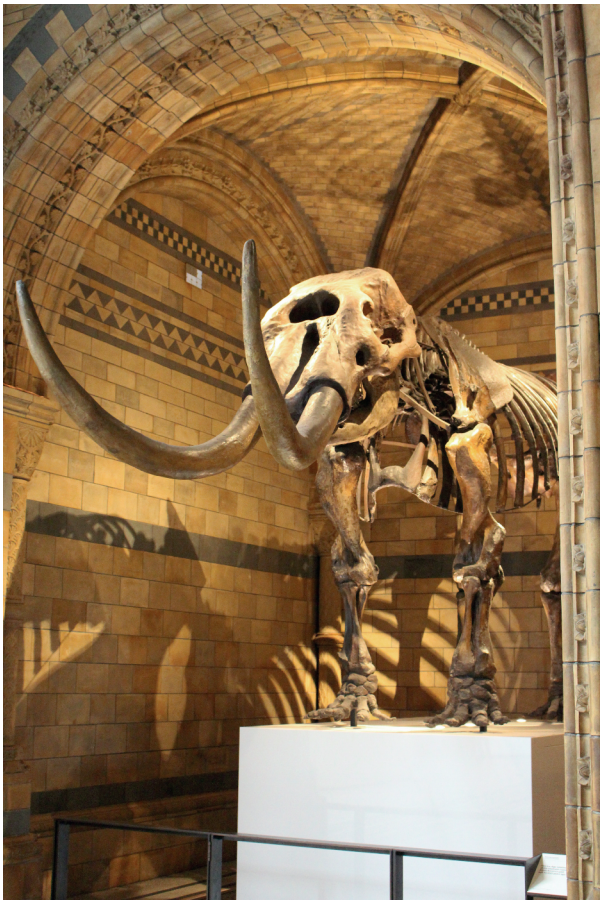

Figure 7. The Mastodon installed in Wonder Bay 1. Image: L.Allington-Jones, © The Natural History Museum.

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