2016 Posters Associated with the Preparators' Session

THINKING INSIDE THE BOX: CONSTRUCTION OF INEXPENSIVE, LIGHTWEIGHT STORAGE CONTAINERS FOR MEDIUM-SIZED FOSSIL SPECIMENS

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Vertebrate fossil collections of the University of Michigan Museum of Paleontology are being moved from their campus home to a new off-site research and storage facility that utilizes mobile compact storage cabinets. Transfer of these collections necessitates construction of cradles and other storage devices for numerous fragile specimens, both for safe transport and long-term housing in the new facility. Methods for constructing large-scale cradles and encapsulating microvertebrates are established, but there are no consensus storage solutions for medium-sized specimens.

We developed a versatile, inexpensive protocol for building padded archival specimen boxes that can accommodate objects of varying shapes and dimensions—from sirenian skulls to long-spined Edaphosaurus vertebrae—providing distributed weight support and security for transport of objects between facilities and their long-term storage in mobile, compacted cabinets. Materials utilized include sheets of Coroplast™ twin layered, corrugated polypropylene, remnants and ¼" thick sheets of Ethafoam™, Tyvek® spunbonded polyethylene fabric, Paraloid™ B-72 acrylic resin and acetone in adhesive tubes, and polyester batting. Tools required are standard in collections facilities (e.g., scissors, hot glue gun, clamps, box cutter). Corrugated polypropylene sheets are cut to provide a base slightly larger than the dimensions of the specimen with attached cutouts to make vertical walls and flaps. Assembled, walls and flaps extend above the specimen, and are scored and sliced so that they overlap in corners. These are held together with hot glue and clamped until firm. Ethafoam™ cut to the shape of the specimen is used as an internal support base. This is topped with batting and covered with Tyvek® to reduce friction. The internal base and Tyvek® are glued to the bottom of the box with B-72. A scaffold of form-fitting cradle supports are then added around the specimen for stability. These are constructed of small Ethafoam™ blocks with support "pillows" of batting-filled Tyvek® attached using a groove-and-tuck technique.

The materials and methods to make these box cradles are readily accessible and produce a rugged, inexpensive mode of long-term protection for vertebrate fossils.

PILING, SLOTTING, AND SURROUNDING: SHIPPING FOSSILS FROM CHINA TO ITALY

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Shipping fossils has always been a serious challenge since every fossil is one and only and it requires maximum safety while traveling. Especially in the case of overseas transportation, languages and customs could be a barrier for handling specimens. To avoid unnecessary damage and misunderstanding, the fossils should be packed in secure and straightforward methods. In the summer of 2015, the Land and Resources Bureau of Xingyi City shipped twenty-six specimens to the University of Milan with a help of Peking University. Xingyi, a city in Guizhou Province in China, had held paleontologists' attention over the last decade due to its rich and well-preserved Triassic marine fauna

represented by numerous vertebrate and invertebrate fossils such as the sauropterygian *Keichousaurus*. The University of Milan had conducted fieldwork and research in Monte San Giorgio, a UNESCO World Heritage Site, where they also recorded Triassic marine fauna, and planned to hold a special exhibition indicating similarities between these two fossil faunas and connection between Italy and China during Triassic Period. In order to ship the fossils, we required packing methods specialized for limestone and mudstone slab specimens in different sizes.

Here we described three packing methods: “Piling”, “Slotting”, and “Surrounding”. The slabs were securely placed in shipment boxes without any spaces that could potentially cause movement and friction during transportation. Since the fragility level of each specimen varied depending on the thickness of its slab, we categorized the specimens into three groups: thin-layer (less than 1 mm), medium-layer (1–10 mm) and thick-layer (more than 10 mm). “Piling” was a stack of 40 mm-thick polyethylene foam (Ethafoam) layers with cavity-mounted lightweight/thin-layered specimens. “Slotting” was to place the medium-thick slabs vertically, like vinyl records in a music store, into slots surrounded by the polyethylene foam. “Surrounding” was to enclose the thick layered specimens by the walls of the polyethylene foam and fill gaps with the blocks and pieces of the foam. Even though pre-shipment conservation on the fossils was essential for safe transportation, these glue-free space-saving packing methods made it possible to give a very simple orientation for handling and take in and out individual specimens easily.

THE USE OF RECYCLED MATERIALS IN THE MOLDING AND CASTING PROCESS

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As part of the molding and casting process, excess materials are removed from around the specimen and typically discarded. The two main materials that are trimmed away are the molding material: tin-cured RTV silicone rubber #GI-1000 from Silicone INC, and the casting material: Isophthalic Polyester #90 from Fibre Glast. These materials were tested for feasibility of the incorporation of cured material into a fresh batch, and suitability of the heterogeneous mixture in molds and casts.

In the test of feasibility, a batch of each material was mixed, divided into two containers, and cured material mixed into one container. Results were evaluated qualitatively against the control container.

In the test for suitability, a batch of each material was mixed, cured material added, then applied. The silicone rubber was vacuumed to remove excess air bubbles and poured over a specimen to form a block mold. The polyester resin was poured into a two-part mold and clamped together.

The new silicone rubber combined well with cured silicone rubber. This result was expected, and it passed the test of feasibility. When applied, the silicone rubber forms an exact mold of the original. The small chunks of cured silicone are suspended in the body of the mold and do not appear to alter the fidelity of the mold. The silicone rubber passed the test of suitability.

The new polyester combined well with cured polyester. It passed the test of feasibility. When applied to a mold, the cast contained a number of large air pockets on the up surface, but there was no evidence of chunks affecting the fidelity of the cast. I think the heterogeneity of the polyester trapped air that settled out as the cast rested on the bench. Subsequent tests showed that the polyester mixture worked well in layup molds. The polyester conditionally passed the test of suitability as it is appropriate in some casting procedures.

The incorporation of cured materials is both feasible and suitable for the molding and casting process. Not all specimens will respond the same and exercise care to determine cases where this will work.

TRANSPARENT MATRIX: BRINGING X-RAY GOGGLES TO THE PREP LAB

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There is probably not a single palaeontologist or fossil preparator who has not pondered the benefits of having a pair of proverbial X-ray goggles in the lab. We developed an early prototype of a visualization workflow that delivers just that: “live” 3D X-ray vision into a fossiliferous block of matrix.

Our experimental setup consists of a 3D workstation coupled with a 3D augmented reality device, which projects CT-data (acquired earlier) in real-time over the matrix block or plaster jacket-enclosed fossil. A usable 3D augmented reality experience however, is not easily achieved; most challenging is the seamless, real-time registration and mapping of the virtual image over the real-world objects. Particularly when applied in a paleo lab setting where preparation work requires sub-millimeter precision, perfect registration of the virtual image is essential. Thanks to recent developments in consumer electronics, many components required to achieve this have become available off the shelf at an affordable price point. Also, fueled by developments in the gaming industry, hardware allowing for high-speed 3D-rendering of complex data sets has become more readily available.

We expect, as technology matures, the “live X-ray vision” our setup provides could be of help in planning the approach of preparing more complex fossils, and can be helpful, too, during the preparation process itself. Providing haptic feedback through the airscribe, or image-analysis-driven shutoff of the airscribes upon approaching the fossil are among the next steps we consider.

The same setup used in a Virtual Reality setting rather than in Augmented Reality mode can help in more rapidly segmenting CT data sets; in this case the virtual matrix surrounding the virtual fossil can be removed using a toolbox of virtual scissors, brushes, and airscribes.

LONG-TERM PRESERVATION CHALLENGES IN THE CARNEGIE QUARRY, DINOSAUR NATIONAL MONUMENT, UTAH, USA

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Dinosaur National Monument was created in 1915 to preserve the Carnegie Quarry, a laterally extensive sandstone layer in the Morrison Formation containing thousands of dinosaur bones. This layer has a 70° dip. Approximately 2/3 of the bones were removed in the early 20th century. The remaining bones were left in place and in 1958 a visitor center was built over the quarry. This building was demolished and replaced in 2009–11.

Although the building protects the quarry from the elements, there are many other problems threatening the site. The most persistent problem, and potentially the most catastrophic, is the extensive natural system of cracks. For the most part, the depth and rate of expansion of these cracks is unknown. They are particularly challenging at the western end of the quarry where the upper layer of the sandstone has been left in place. Here, bedding planes maybe a weak point allowing the upper layer to slough off, doing incalculable damage and destroying the most complete skeleton in the quarry, a partially articulated *Camarasaurus* specimen with a complete skull. Throughout the quarry, cracks cut across bones and matrix. Some bones have been damaged and lost and many other bones are threatened.

Conservation issues also threaten the bones. Between 1950 and 1994 various adhesives, fillers, and coatings were used to stabilize and protect the bones. However most of the substances used were not archival and many are not clearly documented. Some examples include asbestos fiber filling and red shellac. These substances have an unknown effect on the bone. Other bones were never stabilized and thus are prone to cracking and chipping.

Finally, various health and safety issues make access potentially hazardous. Rodent feces and dust accumulate on the quarry face. The feces can carry Hantavirus and the dust captures naturally occurring radon progeny. Both are dangerous to inhale. The asbestos filler is also a potential threat. Because the quarry is at a 70° dip, the bones can only be accessed by climbing and 20% of the bones cannot be safely accessed without a crane and bucket.

Moving forward first steps include at a minimum: (1) measuring, mapping, and monitoring depth and rate of expansion of crack systems; (2) an assessment of the structural stability of the quarry sandstone; (3) testing and documentation of historic adhesives; and (4) a plan for cyclic cleaning and conservation of the bones and rock. These problems are typical of those faced by in situ fossil vertebrate exhibits around the world, and are an emerging area of study within the discipline of fossil conservation.

TETRAPOD WORLD: EARLY EVOLUTION AND DIVERSIFICATION (TW:EED) PROJECT FIELDWORK: CONSOLIDATION OF DAMP SPECIMENS FOR TRANSPORTATION USING PRIMAL WS 24 AND FABRIC BANDAGES AS FIELD JACKETS

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The TW:eed Project is funded by the UK Natural Environment research Council (NERC). It is a major collaborative study of fossils and environments from the earliest Carboniferous (360–345 million years ago) when tetrapods were beginning to move from water onto land. Recently a number of sites found in Northumberland and the Borders Region of Scotland have generated not just tetrapods, but also fish, plants and arthropods. One such site was in the bed of the Whiteadder River.

Last summer part of the River was barricaded off and pumped out to allow access to the fossiliferous beds. Sedimentary logs, photographs, and a 3D laser scan of the dig site were done during all stages. Slabs from the most significant beds were collected, wrapped, and transported back to the lab to be examined and prepared.

Problems arose as soon as the material was extracted from the wet siltstone. The matrix dried out very quickly and immediately needed consolidation to prevent the fossils from crumbling. Primal WS 24 (an acrylic copolymer colloidal diluted at 10 to 15 parts water to one part liquid) was used as a consolidant. Fragile pieces were consolidated using different concentrations and reinforced with out-of-date medical bandages saturated with Primal WS 24 as jackets to protect the slabs during transportation to the lab. The fabric bandages were faster and simpler to use on the large number of small specimens than conventional plaster jackets, and had less impact on the environment. Acid-free paper, plastazote foam, and bubble wrap were used to give extra protection and padding to the material for transportation.

Once in the lab, after the specimen was dried, the bandages were easily removed. Acetone was used to remove the Primal WS 24, which is not re-soluble in water. Paraloid B72 at 10/90 w/w in acetone was used to consolidate the material after removal of the bandages.

There are still nearly 1000 specimens to prepare.

A FALL DINOSAUR EXCAVATION: INSIGHTS ON COLD WEATHER JACKETING **KNAUSS, Georgia, SWCA** Environmental Consultants, Sheridan, WY, United States of America; JOHNSON, Shawna L., SWCA Environmental Consultants, Sheridan, WY, United States of America

SWCA was contracted to monitor fall construction of two well pads in remote grasslands along the eastern edge of the Powder River Basin to fulfill Bureau of Land Management requirements for mitigation of paleontological resources. Lance Formation bedrock was immediately exposed at both locations, and fossils were uncovered. Due to their close proximity to the surface, many of the bones are fragile, having been exposed to freeze-thaw actions, rooting, and burrowing. This complicated each evaluation, and, when applicable, subsequent collection. Further complicating collection were widely ranging temperatures (5–70 degrees Fahrenheit [F]) and wind gusts exceeding 55 miles per hour. As additional fossils emerged, including ceratopsid, ornithomimid, and hadrosaur elements, SWCA explored methods that allowed timely well pad construction and fossil preservation and collection despite conditions. Total excavation depth at each location was minimal, not exceeding 3 and 10 feet, respectively. Due to the project's remote location, various supplies were not readily available. SWCA used pre-soaked plaster bandages for smaller bones and applied burlap and Plaster of Paris to larger elements. Low temperatures necessitated understanding the chemical reactions associated with Plaster of Paris to ensure jacket integrity. Crews learned to carefully consider a number of variables, including water temperature, plaster mix (e.g., ratio of water weight to plaster weight), soak time, stir time, jacket surface temperature before each application, and additives to ensure quick setting before freezing. Stirring time, for example, is not critical at optimal environmental temperatures, but in cold weather, extending stirring time aids in plaster setting. However, water temperatures impact stir time: Both cold (35–40° F) water and hot (100–105° F) water create ideal plaster consistency after six minutes in cold weather, but plaster stirred into room-temperature water (65–70° F) under the same conditions will set at that point. Formal measuring of plaster, unnecessary in warmer weather, becomes critical to consistency in colder weather, which slows the material's absorption of water. To improve plastering conditions, SWCA set up a canvas tent and used propane heaters to warm the tent; these efforts improved crew comfort but created other issues. The heaters required proper ventilation and the use of CO_2 monitors, and maintaining the heat was difficult. In addition, extreme winds threatened tent integrity during the most critical points of the excavations.