ULTRALIGHT POLYESTER RESIN CASTS FOR MUSEUM EXHIBITS IN SOUTHWEST CHINA

SATO, Tetsuya, Peking University, Beijing, China; XU, Feng-lun, Xingyi National Geopark Museum, Xingyi, China; HU, Bin, Xingyi National Geopark Museum, Xingyi, China; JIANG, Da-yong, Peking University, Beijing, China

Fossil casts are important in paleontology for research and education. Casts are commonly used in museum exhibits especially when the necessary materials do not exist in that particular collection. However for a low-budget local museum, shipping costs are high due to the weight inherent in many large, high quality casts. Moreover handling by inexperienced persons endangers fossil casts during transportation and mounting. Here we present a method to produce lightweight but highly durable, exhibit-quality casts.

The Xingyi National Geopark Museum (XNGM), located in Xingyi City, southwest China's Guizhou Province, recently opened an exhibit that featured local Middle Triassic marine fauna in the context of material from the Early Triassic Chaohu fauna, the Middle Triassic Panxian fauna, and the Late Triassic Guanling biota. In the spring of 2016, Peking University (PKU) donated two dozen exhibit-quality casts from these faunas to promote on-going fieldwork in Guizhou with support from local governments, and therefore, these casts were shipped over 1200 miles from Beijing to Xingyi. The casts comprised two layers when the original fossils were in slabs. The first layer was made of polyester resin, fumed silica, and 1/2-inch chopped glass fibers with the ratio of 15:3:1 by weight in that order. No-brand polyester resin from a local vendor was used for cost and accessibility. The mixture had the viscosity of peanut butter (~250,000 cps) and was applied on RTV silicone molds with China bristle brushes in several sizes. The second layer was 1-1.5 inches of light-density open-cell spray polyurethane foam (ocSPF), which provided thickness and worked as a cushion. Although the ocSPF's longevity is relatively short (up to 20 years) due to ultra-violet light and routine surface damage, this lifespan is acceptable considering the timespan until the exhibit's renewal. The casts reduced approximately 75% of the weight compared to regular polyurethane resin casts previously made in PKU. At present, these lightweight casts are on display in the newly established XNGM exhibit.

CT SCAN DATA COLLECTION THROUGH LOW KV PROTOCOLS PROVIDES ACCURATE DATA ON NON-MAMMALIAN CYNODONT FROM THE SANTA MARIA FORMATION, BRAZIL

HOFFMANN, Carolina A., Faculdade de Biociências - PUCRS, Porto Alegre, Brazil; ANDRADE, Marco B., Faculdade de Biociências - PUCRS, Porto Alegre (RS), Brazil; SOARES, Marina B., Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil; MARQUES, Jayme, Faculdade de Biociências - PUCRS, Porto Alegre, Brazil

X-ray computed tomography (CT-scan) is a useful nondestructive tool in the research of morphology of extinct organisms. Despite its increasing relevance to paleontology, it remains poorly used in developing countries, as available facilities are equipped with medical scanners rather than dedicated, custom-built equipment. Medical scanners operate with low kV values (<200), while fossil specimens usually require higher energy levels (>300kV) to properly access morphology. In order to solve this problem while acquiring data for an endocranial anatomy study on non-mammalian cynodonts, we explored the use of four standard protocols ("default", "soft", "bone" and "axial"; settings: 0,625 slices, 140 kV and 380 mA) in a standard medical

scanner. The specimen used was the skull of the chiniquodontid *Probelesodon kitchingi* (MCP 1600 PV, holotype) from Santa Maria Formation (Triassic, Paraná Basin, Brazil). Fossils from the Santa Maria Formation are often rich in calcite, a mineral that is highly reflective to CT beams, creating artifacts into the dataset. The 'soft' protocol used a less focused beam, leading to a more accurate differentiation of structures when low density variation occurred between the fossil and the sediment. Given the higher sensibility, this protocol led to a better, more accurate dataset, with fewer artifacts (e.g., interference by calcite). The acquired dataset provides sensible morphological information, can be 3D modeled and give full access to internal structures. Preliminary observations on the endocast anatomy revealed that *P. kitchingi* had a poorly developed telencephalic region, as expected for basal non-mammalian cynodonts. Also, it was possible to recognize that *P. kitchingi* had proportionally longer olfactory bulbs than other non-mammalian cynodonts, suggesting accurate chemical sensibility. The use of different scanning protocols proved to be key to data acquisition, allowing the production of a useful dataset, even using low kV values. The use of a soft beam protocol is an alternative to researchers constrained by medical scanners, particularly when calcite is involved.

Grant Information: CNPq (proc. 131612/2016-6) through the PROEX grant scheme to PPGZoo/FABIO/PUCRS; and Paleontological Society International Research Program (PalSIRP) 2016

3D PHOTOGRAMMETRY MODELLING - THREE CASE STUDIES IN VERTEBRATE PALEONTOLOGY

BORKOVIC, Ben, Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada; NAGESAN, Ramon S., University of Calgary, Calgary, AB, Canada; SANCHEZ, Joseph, Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada

Three dimensional (3D) digital photogrammetry is both a scientific and a commercial modelling tool. It has been used for geological and archeological mapping, anatomical visualization, and engineering applications. Recently, 3D digital photogrammetry has become more widely utilized in paleontology, especially in the study of trackways. Here, three applications for 3D digital photogrammetry in paleontology are profiled: 1) reconstruction of a tyrannosaur skull; 2) documenting a fossil locality that may be lost to erosion; 3) using it as an analytical tool for trackways.

A complete, disarticulated *Daspletosaurus torosus* (TMP 2001.36.0001) skull was assembled for the first time ever after being rendered in 3D virtual space. Each skull element was photographed several hundred times from multiple angles and then rendered in Agisoft Photoscan (AP). After rendering, each element was manipulated into its anatomical position using Windows 3D Builder software. Digital reconstruction and 3D printing of the skull replaced molding and casting of the skull elements. 3D digital photogrammetry offered a less invasive and potentially quicker method to producing a replica of the original specimen.

Fossil localities can be lost to erosive forces such as floods or landslides; 3D photogrammetry can be implemented to record a site for future reference. A fossil-rich Paleocene bonebed in southern Alberta was discovered as part of a wider flood mitigation project. To preserve and map the site as it was, 3D photogrammetry was used before quarrying of the site could begin. A total of 822 photographs were taken of the entire site to produce a single, large render in AP. Additionally, 11 smaller models were made for sections with high fossil density within the larger area. These models preserve what the bonebed looked like in the 2016 field season and can be used more readily than mosaic photographs to produce maps of the specimens.

Fossil trackways are often difficult to interpret because changing lighting conditions may result in variable observations of ichnofossils. Using 3D digital photogrammetry, 3D models may be produced of preserved trackways allowing a user to artificially change the lighting on the surface to maximize the observed occurrences of tracks. Three trackway blocks from the St. Mary River Formation were rendered in 3D and in each case manipulation of the models revealed previously undetected tracks.

Each of these projects shows the potential utility of using 3D digital photogrammetry for display, preservation, and research of paleontological resources.

RIVERS AND RECOVERY - MITIGATIVE PALEONTOLOGY AS A RESULT OF FLOODING IN SOUTHERN ALBERTA

SANCHEZ, Joseph, Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada; BORKOVIC, Ben, Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada; SCOTT, Craig, Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada

The flooding of several southern Alberta river systems in 2013 affected hundreds of thousands of Albertans across dozens of communities and caused billions of dollars in damage. A lesser known impact of the floods is that the destructive effect of the water also led to the exposure of many new fossils in the rivers' banks. The discovery of a complete *Leptoceratops* skeleton in the flood-eroded banks of the Oldman River spurred an effort to seek other specimens that might have been exposed by the floodwaters. Over the past three years the Royal Tyrrell Museum of Palaeontology (RTMP), in conjunction with the Government of Alberta, has undertaken a field project to prospect several river systems in southern Alberta in order to find and collect newly exposed fossils and protect them from future flooding events.

At the outset of the project, river flow data were obtained from the Government of Alberta in order to determine which rivers had flooded and merited surveying. Due to the extensiveness of those waterways, intervals that have produced fossils in the past were prioritised. These areas of interest were determined by referencing the RTMP's collections and GIS databases, as well as by interviewing in-house research and technical staff. For those rivers with little to no previously known fossil localities, Alberta Geological Survey maps were used to determine where the largest exposures of potentially fossiliferous bedrock could be found. Finally, all finds reported by the public along rivers were investigated. The river flow data were used to schedule field work around the various rivers' peak volumes to minimize water height and for safety considerations.

Under the context of this project, over 300 km of river bank were prospected in 12 rivers and creeks. In and along these waterways, field work was conducted on foot in waders, by canoe, and by river boat. Specimens were collected by hand, truck, and helicopter, and recorded as latex moulds and digital models. In total, 214 paleontological sites were discovered and documented, resulting in 331 specimens collected and accessioned at the RTMP. Several specimens were determined to have been displaced or damaged directly by the flooding events, and observations of the progressive impact to fossil localities demonstrated the importance of a prompt post-disaster field program.

NO FOSSILS WERE HARMED DURING THE TRAINING OF THIS PREPARATOR: USING 3D MODELS TO TEACH PROPER PREPARATION TECHNIQUES

KERR, Tyler J., University of Wyoming, Laramie, WY, United States of America; PATRICK, Kacy, University of Wyoming, Laramie, WY, United States of America; CLEMENTZ, Mark T., University of Wyoming, Laramie, WY, United States of America; VIETTI, Laura, University of Wyoming, Laramie, WY, United States of America

Individual fossils have unique properties that make assessment of trainee proficiency difficult if specimens differ in quality of preservation, fragility, and relative hardness of matrix or bone. We sought to design a robust new method to teach budding preparators basic fossil preparation techniques without risking damage to fossils, while also adding a level of technical rigor beyond that associated with prior methods (e.g., plastic toys buried in plaster). Here, we propose using 3D models to 1) standardize training, 2) assign meaningful benchmarks and develop gated difficulty levels, and 3) cater to specific fossil projects. Our ultimate goal was to create a standardized teaching module with controlled variables in order to teach the basics of fossil preparation.

Four variables were modified according to increasing complexity: 1) matrix hardness (plaster, ~2:1 sand:plaster), 2) technical difficulty (a theropod claw, a disarticulated tyrannosaurid skeleton), 3) bone color contrast (blue, brown), and 4) fragility (thin- and thick-walled). 3D prints were created using vibrant yellow PLA filament and painted to establish a grading metric according to number and severity of errors (chips and scratches) made to the paint. Errors were assigned value based on severity and subtracted from an initial score of 100. Students (n=12) were provided a brush, dental tools, and 3D models buried in matrix randomly assigned from one of the four variables. A control group (n=3) was given a pair of identical specimens.

As predicted, most students showed an increase in number and size of marks on specimens as complexity increased. This change was quantified as a decrease in grades for matrix hardness (60% to 54%), technicality (83% to 73%), rigidity (98% to 91%), and coloration (63% to 35%). The control group was consistent across specimens (50% to 47%). These data highlight the value of this technique, which standardizes and controls for more variables than traditional methods.

Printing inexpensive 3D models allows us to create teaching modules that gradually increase in difficulty, from beginner (bright colors, soft matrix, pliable, predictably-trending) to expert sets (realistic colors, hard matrix, rigid, unpredictably-trending). Unlike store-bought toys, 3D prints can be customized to include specific taxa or themes. Furthermore, standardizing training materials ensures accurate and consistent assessment of quality of work, restricting difficult projects to those who pass quality benchmarks – all without the risk of damaging fossil material.

COLLECTION AND PREPARATION OF A SUB-ADULT PROSAUROLOPHUS (ORNITHISCHIA: HADROSAURIDAE) FROM THE BEARPAW FORMATION (LATE CAMPANIAN) NEAR LETHBRIDGE, ALBERTA, AN EXAMPLE OF EXPEDITED LARGE-SCALE EXCAVATION IN AN INDUSTRIAL SITE

KILMURY, Aaron A., Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada; BROWN, Caleb M., Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada; CARBONE, Calla, Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada; MITCHELL, Mark, Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada

In September of 2016, a sub-adult hadrosaur was discovered during industrial excavation in an ammolite mine (Korite SM4), 25 km south of Lethbridge, Alberta. The specimen derives from the Muddy Unit 1 of the open marine, Late Cretaceous (late Campanian) Bearpaw Formation. Following site reconnaissance the same day as the initial report, a four person crew from the Royal Tyrrell Museum of Palaeontology, Drumheller, was sent to collect the specimen in an expedited manner, facilitated by the heavy machinery at the mine. Excavation revealed the specimen to be a nearly complete, semiarticulated/ associated, and well-preserved sub-adult hadrosaur, including fossil skin, in a host rock of dark grey shale. Shovels, rock hammers, and an electric jackhammer were used to dig trenches around the specimen, which was collected in two very large blocks (1,860kg and ~1,400kg) encased in fieldjackets constructed of fiberglass reinforced plaster (FGR) and burlap, and reinforced by lengths of 4x4 lumber. Completed jackets were flipped and transported out of the mine using a John Deere 470G excavator operated by mine staff. Despite muddy conditions from torrential rain, the use of mining equipment facilitated the collection process, reducing the time from initial report to jacket removal from three to four weeks (as seen in a non-industrial setting) to 10 days. Preparation of the specimen was accomplished using hand tools, sodium bicarbonate air abrasion, and an ultrasonic water bath for select, well-preserved elements. The posterior half (mid-dorsal and posterior) is partially articulated, while the anterior half is largely disarticulated, but concentrated. The cranial elements uncovered consist of a left nasal (diagnostic to *Prosaurolophus*), right jugal, postorbital, squamosal, splenial, and dentary, left articular and angular, and left and right maxillae. To date the postcranial elements uncovered include the left and right coracoids, scapulae, femora, tibiae and fibulae, right humerus, left sternal plate, a radius, ulna, and several metacarpals and phalanges, several cervical, dorsal, and caudal vertebrae, ribs, and ossified tendons. Much of the posterior of the skeleton remains to be uncovered, but discoveries in the field and lab suggest isolated patches of preserved skin. This occurrence marks the third diagnostic semiarticulated/ associated hadrosaur specimen to be collected from the marine Bearpaw Formation in southern Alberta, all of which are juveniles or sub-adults of the genus *Prosaurolophus*.

Grant Information: Funding: Royal Tyrrell Museum of Palaeontology, Royal Tyrrell Museum Cooperating Society, and the Drumheller & District Chamber of Commerce

CONSULTING PALAEONTOLOGY IN ALBERTA: PROCESS, METHODS AND RESULTS OF HISTORICAL RESOURCE IMPACT ASSESSMENTS FOR INDUSTRY

FRAMPTON, Emily K., Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada; SPIVAK, Daniel N., Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada; BRINKMAN, Donald B., Royal Tyrrell Museum of Palaeontology, Drumheller, AB, Canada

Consulting palaeontology has a 44 year history in Alberta, starting with passage of the *Alberta Heritage Act* in 1973 (now the *Historical Resources Act*). The *Act* states that historic resources (historic structures, archaeological and palaeontological resources) must be protected as part of Alberta's natural and cultural history. Any project that may impact palaeontological resources may require an assessment to be conducted by a consulting palaeontologist on behalf of the proponent. The process to determine this begins with the submission of a Historic Resources Application to Alberta Culture and Tourism (ACT), the regulatory agency for historic resources in Alberta. These applications can include a Statement of Justification (SoJ), a brief desktop report, to assist with the review process. The SoJ includes project details, the potential of the project to impact palaeontological resources, a listing of palaeontologically sensitive lands within the project area and recommendations for mitigation, if necessary. If recommendations are accepted, mitigation requirements are issued by ACT. Palaeontological Research Permits are issued by the Royal Tyrrell Museum of Palaeontology and any collected fossils are curated there. Three consulting projects, a water intake development, a proposed oil sands lease, and a wind farm, are discussed here as examples of successful consulting projects. The water intake was located along the Athabasca River in the Alberta oil sands. Several hundred ammonites, gastropods and bivalves from the early Cretaceous Clearwater Formation were collected during monitoring and two distinct facies identified. Detailed lithological data and intact fossils are rare from this formation as the shale erodes quickly in natural outcrops. The proposed oil sands lease project was an initial assessment of early to late Cretaceous bedrock in the Birch Mountains. The area is remote and could only be accessed by helicopter. It had never been examined for fossils and four weeks of prospecting yielded approximately 1400 kg of ammonites, bivalves, shark and fish fossils. The wind farm project involved monitoring of turbine footing excavations in southern Alberta through bedrock of the late Cretaceous St. Mary River Formation. Several microsites and small bonebeds were identified and collected during monitoring. This formation typically has few natural exposures and fauna collected from this project bridged the paleoenvironmental gap between fauna from two other localities.

A METHOD FOR MAKING FOSSIL VERTEBRATE SUPPORT CRADLES FROM AN EPOXY CLAY COMPOUND

HENRICI, Amy C., Carnegie Museum of Natural History, Pittsburgh, PA, United States of America; CHURCH, Linsly J., Carnegie Museum of Natural History, Pittsburgh, PA, United States of America; WUERTHELE, Norman, Carnegie Museum of Natural History, Pittsburgh, PA, United States of America; LEACOCK, James, Multiform Studios, South Lyon, MI, United States of America; ANDERSON, Gretchen E., Carnegie Museum of Natural History, Pittsburgh, PA, United States of America

In 2013 the Section of Vertebrate Paleontology at Carnegie Museum of Natural History (CMNH) received a grant from the Institute of Museum and Library Sciences (IMLS) to consolidate and improve storage of holotypic specimens. The section currently has 472 holotypes and many were in need of support cradles. Felt cloth-lined cradles made of plaster strengthened with fiberglass initially were made. These cradles provided good support for the specimens, but they tended to be heavy, subject to breakage, and shed fiberglass splinters when handled. An alternative method was sought to avoid these problems.

We modified a technique used by one of us (J. L.) to make support mounts for exhibit specimens displayed in the CMNH Mesozoic gallery, *Dinosaurs in Their Time*. Because the product that he used, a marine epoxy, is no longer available, we experimented with three different products. Only one of these was considered suitable, a two-part, permanent, self-hardening, waterproof epoxy clay compound.

The following steps are used to make a cradle: 1) felt cloth is cut to conform to the side of the specimen being cradled; 2) the two-part epoxy clay compound is mixed and then rolled into a sheet using a rolling pin; 3) the felt cloth is pressed firmly onto the epoxy clay sheet, which

is then trimmed to the outline of the felt cloth; 4) the sheet is left to cure until it stiffens but still can be manipulated; 5) a plastic sheet or aluminum foil is placed on the side of the specimen that will receive the cradle; 6) the epoxy clay sheet with felt is placed on the specimen, with the felt against the specimen. The sheet is usually sufficiently rigid that undercuts are not a problem, though some manipulation may be necessary; 7) the cradle is left to harden, which can take up to 24 hours; and 8) to keep the finished cradle stable, legs can be made from the epoxy clay compound and added to the cradle, or custom-cut pieces of polyethylene foam can be used.
Cradles were made using this technique for medium to large-sized fossil mammal skulls, jaws, and postcranial bones with great success. The cradles are durable, light weight, and add little to the specimen height, which makes for efficient use of storage space. The only disadvantage over plaster cradles is greater cost for the epoxy clay compound, so this method is not cost-effective for very large specimens such as sauropod dinosaur limb bones.

Grant Information: Funding provided by IMLS MA-30-14-0045-14.

COMPARISON OF DIFFERENT STORE BOUGHT AND HOMEMADE CONTACT PAPERS USED TO STABILIZE JACKETED FOSSILS WITH POTENTIAL BIOLOGICAL MATERIAL

YANN, Lindsey T., Oklahoma State University Center for Health Sciences, Tulsa, OK, United States of America

During the 2016 field season, dinosaur skin impressions were found at the Homestead Site (SNOMNH V1694) and were jacketed with two sauropod vertebrae. The site is located in the upper Morrison Formation, likely the Brushy Basin Member, and is part of a Pleistocene or Holocene landslide. All fossils are highly fragmented, but the pieces remain in close proximity. Typical stabilization techniques include organic solvents, but discussions at the 2016 SVP meeting suggested that there may be biological material preserved. Therefore, a new technique was needed to keep the highly-fragmented fossil material aligned without harming potential biological material. It was hypothesized that shelf liner might be an effective contact paper. To test the effectiveness of a two manufactured and three homemade contact papers, I created plaster disks with four different surfaces (smooth plaster, fine sand, coarse sand, and clay from the Homestead Site) plus clay without plaster to test the effectiveness of each contact paper. The plaster disks were created from one batch of plaster and allowed to set in a low humidity lab. Each disk was broken into fragments to represent the sites highly fractured fossils. Each plaster disk was tested against these five treatments: Contact brand shelf liner, masking tape, high-density plastic (HDPE) sheeting with a thin layer of Butvar B-76, HDPE sheeting with a thick layer of Butvar B-76, and Renown Select trifold paper towels with a thick layer of Butvar B-76. The Butvar B-76 was allowed to dry until tacky before being placed against the plaster disks to ensure no acetone was seeping into the plaster. The manufactured shelf liner was successful in holding together the pieces of smooth plaster, but failed with every other comparison. Masking tape was not effective on the finegrained sand, but would be an acceptable method for other surfaces. HDPE sheeting with a thin layer of Butvar B-76 was effective at holding together larger pieces, but the small fragments did not adhere as well and their orientation was not preserved. HDPE sheeting with a thick layer of Butvar B-76 successfully held together all pieces on all treatments, and it was more structurally sound than the previous tests. The most effective option was the trifold paper towel with two layers of Butvar B-76. It stabilized all pieces, and the stiffer texture gave more support when simulating removal from the jacket and transport around the lab. While

the paper towel was the most effective, we are currently using the HDPE sheeting with 2-3 coats of Butvar B-76 so the bone is visible to volunteers.

MOLD AND CAST FIDELITY AND DATA LOSS IN DENTAL MICROWEAR TEXTURE ANALYSIS

FOY, Melissa, New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY, United States of America; BEATTY, Brian L., New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY, United States of America; MIHLBACHLER, Matthew C., New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY, United States of America

Most dental microwear studies examine tooth casts. Tests of the underlying assumptions about the fidelity of molding and casting compounds have not kept pace with the field. Much remains to be known about the how resolution is influenced by data loss associated with studying casts and how this affects dietary discrimination. To measure resolution lost associated with casting wear surfaces, we evaluated ISO 25178 roughness parameters at magnifications 20x, 50x, and 150x from identical locations of real teeth and clear epoxy casts of experimentally fed rat M2s using a Sensofar PLU Neox white light confocal. The rats were fed one of two transgenic dough diets purchased with either quartz sand or diatomaceous earth added. Clear casts were made from standard dental microwear materials and methods using President Jet Regular body molding compound and Epokwick Epoxy Resin. In paired t-tests of 24 ISO roughness parameters, significant differences were found in parameters between teeth and casts. At 150x, significant differences were with among nine parameters including height parameters (Sq, Sp, Sv, Sz, Sa), hybrid parameters (Sdq, Sdr), one volume parameter (Vmc), one material ratio parameter (Smr). No differences were found among other families of parameters (Spatial, Feature). At 50x, 10 parameters were found to significantly differ, including height parameters (Sq, Sp, Sv, Sz, Sa), hybrid parameters (Sdq, Sdr), a volume parameter (Vmc, Vvc), and a material ratio parameter (Smr). At 20x differences were found among fewer height parameters (Sp, Sv, Sz), the same hybrid parameters (Sdq, Sdr), and a different volume parameter (Vmp). 150x and 50x yielded similar results, while fewer significant results were found at 20x suggesting the differences between teeth and casts are less apparent at low magnification. Six roughness parameters were significantly different between the two diet groups (dough-with-sand or dough-with-diatomaceous-earth) among the data generated from real teeth. Examination of casts at the same magnification found significant differences in only three parameters between the feeding groups. These results suggest that casting leads to significant alterations of microwear texture and these differences are more apparent at higher magnifications. Likewise, analyses of real tooth surfaces may lead to greater discrimination of diet-specific dental wear patterns in comparison to casts. Future dental microwear studies need to consider the potential of data loss associated with casting dental wear surfaces.

THREE DIMENSIONAL VIRTUAL RECONSTRUCTION OF A CORYPHODON MAXILLA FROM THE EOCENE OF WYOMING

ANEMONE, Robert, UNC Greensboro, Greebsboro, NC, United States of America; CROWELL, Jordan, UNC Greensboro, Greebsboro, NC, United States of America

Tools for reconstructing fragmentary fossils within a virtual, 3-dimensional environment allow paleontologists and paleoanthropologists to visualize and interpret incomplete, damaged,

or distorted skeletal morphology in a non-destructive and reproducible fashion. Several different approaches to virtual reconstruction have been proffered by researchers including methods for dealing with post-depositional deformation and restoration of missing anatomy. This work has the potential to democratize paleontology by increasing access to (virtual or printed) 3D models of always rare and often unique vertebrate specimens. The recent recovery of a fragmentary cranium and upper dentition of *Coryphodon* from the early Eocene, Main Body of the Wasatch Formation near Bitter Creek station in the Washakie Basin of SW Wyoming, has allowed us to virtually reconstruct this specimen. We present a novel method for virtual fossil reconstruction that utilizes hardware (e.g., laser and structured light surface scanners) and software (e.g., Geomagic Wrap, Rapidworks, Blender) that is becoming increasingly common in many vertebrate paleontology research laboratories. This approach makes few assumptions, is repeatable and testable, and offers many advantages over traditional physical reconstruction of fossil material. The specimen includes a nearly complete upper dentition with preserved parts of the hard palate, several lower molars and premolars, numerous but extremely fragmentary parts of the cranium, and multiple fragmentary postcranial elements. There is no indication of taphonomic deformation of any of the specimens. We began by scanning all maxillary elements with Next Engine laser scanner, creating .ply models in Rapidworks, and importing these models into Blender, where we placed the scanned fossils upon a photographic template of a well-preserved *Coryphodon* skull, aligned and scaled to the size of the fossil molar row. Mirror imaging was used to create bilaterally symmetrical counterparts to preserved teeth and bony structures, and missing details were modeled based on homologous regions in the photographic template. The modeling process is conservative with baseline assumptions of symmetry and homology, and the final model clearly distinguishes between original, mirror-imaged, and reconstructed elements. A series of linear and areal measurements of the completed virtual model (made in Geomagic Wrap) indicate no significant deviations from these assumptions, and strengthen our confidence in the utility of this novel method.

Grant Information: The fossils were collected under BLM vertebrate paleontology collecting permit 287- WA-PA95 to RLA, and fieldwork was supported by NSF grant BCS-1227329 to RLA.