announced that a "a partial mastodon skeleton had been found in the attic of Macnie Hall" and would the Society want it. It was transferred to Bismarck in 1948 and fell into obscurity until 1991.

The unmineralized bones of the Highgate Mastodon were in remarkably good condition when restoration began in 1991, perhaps because the bones had been "sized" with white glue when collected. The skeleton is 80 to 85% complete. A tusk, left femur, left ulna, tooth, and several foot bones were missing and were fabricated for the restoration. The missing tooth was discovered by Regcraft's granddaughter in an attic in 2006. Dental analysis indicates that this adult male mastodon was 40-45 years old when it died. The bones show no indication of disease. Several broken ribs on its left side may indicate cause of death, perhaps as a result of combat. A pebble size piece of entombing sediment recovered from a hole in the sternum indicates that the Highgate Mastodon inhabited a boreal forest dominated by spruce, probably between about 12,000 and 10,300 yrs BP.

Preparators Symposium, Thursday 8:30

PLASTIC DISPLAY JACKETS

HOGBIN, John, Wyoming Dinosaur Center, Thermopolis, WY

It was observed that large bones, such as those of the WDC supersaur specimen, suffered some breakage during transportation and arrangement in museum display situations. To rectify this situation a removable plastic jacket was proposed; this method proved to be effective in supporting and stabilizing large specimens (1-3 meters). Syn-air Por-a-kast TA, 'mothermold' is a spreadable putty polyurethane which produces a cost effective, durable, and strong form fitting platform. The strength-to-thickness ratio allows for a thin enough jacket to be hidden under the bones while maintaining competent support for display and repeated moving for research and storage.The inclusion of steel handles produces a more ergonomic grip and facilitates transportation and ease of use. The method devised for creating these display jackets involved covering the bone in a protective double layer of foil and spreading successive layers of'Mothermold' infused burlap (similar to layers of plaster infused burlap for field jacketing).After a minimum of two layers, steel supports and handles may be inserted as needed for transportation and structural integrity. Once the plastic has hardened painting it flat black makes it unobtrusive when supporting the bone on display. A promoter spray is recommended to prevent flaking of paint over time. Several designs were instituted, though it was observed that a tripodal mode of support was more stable than four or more points of contact with the floor. In addition to making cost effective transportation cradles, these jackets are also excellent storage solutions as the bones are well supported without drastically increasing their storage volume. Since the advent of this protocol repeated movements of large sauropod bones has produced no breakage.

Poster Session II

FUNCTIONAL MORPHOLOGY OF THE SHOULDER GIRDLE AND THE FORELIMBS IN SAUROPOD DINOSAURS UNDER CONSIDERATION OF 3-D FINITE-ELEMENT STRUCTURE SYNTHESIS (FESS)

HOHN, Bianca, Institute of functional morphology of the Ruhr-Universität Bochum, Bochum, Germany; DISTLER, Claudia, Institut for Zoology and Neurobiology Ruhr-Universität Bochum, Bochum, Germany; PREUSCHOFT, Holger, Institut for functional morphology Ruhr-Universität Bochum, Bochum, Germany; WITZEL, Ulrich, Lehrstuhl für Maschinenelemente und Konstruktionslehre Biomechanics, Bochum, Germany

The functional morphology of the shoulder girdle, which includes the transmission of body weight to the forelimbs as well as the posture of themselves, is still poorly understood even in living animals. Basically there seem to be two widely different ways. One way is realized in amphibians, modern squamata and crocodiles as well as in birds and recent monotremes, the other in cursorial mammals. Our major aim is now to investigate which way was chosen by the sauropod dinosaurs.

Our 3-D FESS studies show that the stress pattern in the shoulder girdle and the trunk depends on mass distribution of the body`s stem and the position and posture of the supporting limbs. These factors where systematically analysed by means of FESS. Length of the neck and the tail were varied as well as the position of the supporting fore- and hindlimbs. The models were resting in symmetrical stance or in an important phase of walking. The results show a flow of compressive stresses in remarkable accordance with skeletal elements (vertebral column, ribs, shoulder girdle) in vertebrates like they were listed above. On the basis of this systematic survey we are now able to confirm our hypothesis by a more detailed model using the 3-D Finite-Element Structure Synthesis (FESS). The variation of different positions of the limbs and the inserting muscles will show diverse stress patterns. As mentioned before, the flow of the compressive stresses indicates the presence or absence of skeletal material in the model. So we can deduce which skeletal and cartilaginous elements are necessary and in which position they had to stand to each other for a successfully transmission of body weight forces from the trunk to the forelimbs.

Poster Session III

CRANIAL AND POSTCRANIAL PERSPECTIVES ON THE AFFINITIES OF *PACHYNOLOPHUS* (MAMMALIA, PERISSODACTYLA)

HOLBROOK, Luke, Rowan Univ., Glassboro, NJ

Pachynolophus is a genus of perissodactyl known from the Eocene of Europe. Previous studies have allied this genus with a number of different perissodactyl groups, including the Equidae, Palaeotheriidae, and tapiromorphs. Most studies have addressed the question of the affinities of *Pachynolophus* with evidence from dental characters. Cranial material of two different species of *Pachynolophus*, however, has been described, and the collection of the Faculty of Sciences of the Univ. of Lyon includes a number of isolated postcranial elements referred to *Pachynolophus*. Skulls and postcranial material referred to *Pachynolophus* were examined in an effort to identify characters relevant to the phylogenetic position of this genus. Overall, the morphology of *Pachynolophus* is similar to that of other primitive perissodactyls, and there are few derived features suggesting a relationship to a particular group. For instance, *Pachynolophus* lacks a preglenoid process characteristic of palaeotheriids, and its orbital foramina, as far as can be told, are not positioned in the derived manner characteristic of equids. There are, however, several interesting derived characters, including a few that suggest a relationship with palaeotheriids. *Pachynolophus* is similar to palaeotheriids in possessing deep pits for the cruciate ligaments, a distinct adductor tubercle on the distal femur, and a "J"-shaped sustentacular facet of the astragalus. In addition, the shape of the glenoid fossa of *Pachynolophus* is similar to that of ceratomorphs, and, perhaps most surprisingly, the fovea capitis of the femur is centrally located, a derived feature of chalicotheres and lophiodontids. Because the postcranial remains are not associated but merely referred to *Pachynolophus*, any phylogenetic conclusions based on postcranial characters are necessarily tentative, but these characters otherwise suggest a close relationship between *Pachynolophus* and palaeotheriids.

Saturday 12:15

A NEW ARRANGEMENT OF THE PALATAL ELEMENTS IN *TYRANNOSAURUS REX*

HOLLAND, Michael, Museum of the Rockies, Bozeman, MT

Previous descriptions of tyrannosaur palates place the posterior end of the vomer medial to and between the anterior pterygoid flanges. This vomeropterygoid complex is then positioned medial to and between the ascending processes of the palatines. This arrangement left an open space between the two posterior plates of the vomer. The recent assembly of two *Tyrannosaurus rex* skulls suggest a different arrangement of these palatal elements. The larger skull MOR 008, was collected from the Hell Creek formation in Montana during the late 1960's, and was mostly articulated upon discovery. Since then, it has existed as largely a collection of broken fragments. Upon reassembly the skull was found to be the largest *Tyrannosaurus rex* skull ever collected. The smaller skull, MOR 1125, also from the Hell Creek formation, was collected in 2002. This exceptionally preserved skull is nearly complete and fully disarticulated. Both skulls were assembled for display in the new Late Cretaceous exhibit hall at the Museum of the Rockies. The MOR 008 mount displays the actual fossil material, the MOR 1125 mount is created with resin casts. Missing or incomplete elements were sculpted for each of the two mounts.

During the reconstruction process, further preparation of MOR 008 clearly revealed an alternate arrangement of the palatines, pterygoids, and vomer that is noteably different from previous descriptions. A series of photographs taken during the process enabled comparison of relevant elements from both skulls. Images of MOR 1125 provide additional supporting evidence for the arrangement revealed by MOR 008. A computed tomography (CT) scan animation sequence of the vomeropterygoid complex of MOR 008 was used to assess the validity of the alternate arrangement without cutting the fossils. The resulting alternate palatal arrangement presented here places the anterior flanges of the pterygoids adjacent to and contacting each other at the midline of the skull. These closely appressed flanges then insert between the paired posterior plates of the vomer, and penetrate well into the middle of the vomer. This revised arrangement may have implications for tyrannosaur phylogeny, ontogeny and functional morphology.

Saturday 1:30

CRITICAL APPRAISAL OF CRANIAL KINESIS IN DINOSAURS

HOLLIDAY, Casey, WITMER, Lawrence, Ohio Univ., Athens, OH

Cranial kinesis (e.g., streptostyly, pleurokinesis, prokinesis) has been postulated to be common among some dinosaurs (e.g., theropods, ornithopods) but absent in others (e.g., ankylosaurs, sauropods). The presence of synovial cranial joints (e.g., otic and basal joints) typically has been the sole indicator of kinesis, whereas the protractor musculature, which supposedly powers these joints, has received little attention. Indeed, previous studies often are unclear as to whether a powered system (as in extant birds and squamates) or a passive system is envisioned. We reviewed the relevant musculoskeletal structures in extant diapsids and fossil taxa to assess the inference of cranial kinesis in dinosaurs. Synovial joints and protractor musculature are ubiquitous among dinosaurs including clearly akinetic taxa (ankylosaurs, ceratopsids). Most of the nonsynovial contacts postulated in dinosaurs are without extant analogs. Although these ubiquitous, plesiomorphic structures (e.g., key synovial joints, protractor musculature) may be *necessary* for powered kinesis, they are not *sufficient* for positive inferences of cranial kinesis, in that another critical requirement, the presence of kinematic linkages between bones that permit movement, is needed.Such permissive kinematic linkages are present in kinetic birds, snakes and many lizards, involving loss of bones, reduced palatal and temporal bars, and novel flexion zones. Any inference of powered (or even passive) cranial kinesis in dinosaurs must go beyond the mere presence of synovial cranial joints and address kinematic linkages, the vast majority of which appear non-permissive. Indeed, although many extant lizards bear all the "necessary and sufficient" morphological features suggestive of kinesis, they do not express *in vivo* cranial kinesis, which thus represents an important caveat for any fossil inferences. As an alternative hypothesis, we suggest that persistent synovial joints may represent growth sites that facilitate cranial growth and remodeling during ontogeny.