Abstract 59: American Journal of Physical Anthropology; Suppl. 35. 2003.

guished by posteriorly positioned molar bite points relative to masseter lever arm length. Phylogenetic, functional, and ecological implications of these results are discussed.

This research was supported by NSF Research & Training Grant #BIR 9602234 (NYCEP) and NSF Special Program Grant #ACI-9982351 (AMNH).

Kinematics and EMG activation of head-neck muscles during locomotion in *Erythrocebus patas*.

J.S Sipla, C.F. Ross, S.G. Larson. Dept. of Anatomical Sciences, Stony Brook University.

In quadrupedal primates, dorsal extensor muscles of the neck are presumably needed to hold up the head and counteract gravitational torques at the atlanto-occipital and cervico-thoracic joint interfaces. During locomotion, additional demands are placed on these muscles to reduce or eliminate head oscillations due to body motion in order to maintain a reasonably stabile field of vision. To evaluate the muscular mechanisms for head stabilization during locomotion, recruitment patterns for trapezius, sternocleidomastoid, semispinalis capitis, splenius capitis, rhomboid capitis, and spinalis, and kinematic data on head and neck posture were collected for two individuals of *Erythrocebus patas*. The EMG data and kinematic measurements were taken to assess patterns of intracycle variability in head attitude and muscle use during a variety of locomotor tasks.

The data reveal a stereotyped pattern of head-neck movements in the sagittal plane during locomotion. Orbital inclination, measured as the angle relative to the gravity vector of the line joining supraorbitale and infraorbitale, was not observed to change significantly during the locomotor cycle, despite large oscillatory movements of the body in the sagittal plane (mean orbital inclination = 6.98°, s = 3.44°). Judging from qualitative observations of neck kinematics during walking and galloping behaviors, we find that the dorsal neck muscles act in synergy to extend the head during forelimb support phases. This suggests that quadrupedal primates stabilize the head in pitch axes during locomotion, possibly to reduce the computational load of the vestibular apparatus in the neural control of head, neck, and eye movements.

Research supported by NSF Grant BCS 0109331.

Limitations in the use of predominant collagen fiber orientation for inferring loading history in cortical bone.

J.G. Skedros[1], B. Demes[2], S. Judex[3]. [1]Utah Bone and Joint Center, [2]Interdepartmental Program in Anthropological Sciences, Dept. of Anatomical Sciences, State University of New York, Stony Brook, [3]Dept. of Biomedical Engineering, State University of New York, Stony Brook.

Predominant collagen fiber orientation (CFO) is considered to be highly reliable for inferring loading history in bones where obtaining strain data is difficult or impossible. For example, predominant CFO has been used to indirectly establish putative differences in habitual strain mode (e.g., tension, compression) distribution across the femoral necks of chimpanzees and humans (chimps: habitual bending; humans: net compression) (Kalmey and Lovejoy, 2002 Bone). However, few studies have examined the reliability of using this characteristic in this context. The ulnae of rhesus macaques (n=4) and tarsometatarsi (TMT) of chickens (n=7) were obtained from mature animals. The medial ulna and cranial TMT cortices sustain net compression; the lateral ulna and caudal TMT cortices sustain net tension during functional ambulation. Using circularly polarized light, we quantified predominant CFO in the cranial, caudal, medial, and lateral cortices. 'Control' bones included horse radii and deer calcanei (habitual bending), and sheep tibiae (torsional loading). Expected results include CFO that is significantly more longitudinal in "tension" regions vs. oblique-to-transverse CFO in "compression" regions, and no significant regional differences in torsional loading. The results were unexpected: 1) TMTs: the cranial ("compression") cortex had more longitudinal CFO than the opposing "tension" cortex, 2) ulnae: the medial vs. lateral ("compression" *vs.* "tension") differences were insignificant. In two ulnae, there was evidence of newly deposited bone, suggesting that cortical maturity lags behind growth plate fusion. But this explanation is not parsimonious for the TMTs. These data suggest that significant limitations may exist when using predominant CFO for inferring strain history.

ESR Dating at Mezmaiskaya Cave, Russia.

A.R. Skinner[1], B.A.B. Blackwell[1], S. Martin[1], S. Abouelleil[2], A. Ortega[2], J.I.B. Blickstein[2], L.V. Golovanova[3], V.B. Doronichev[3]. [1]Dept. of Chemistry, Williams College, [2]RFK Science Research Institute, Flushing, NY, [3]Institute of Prehistory, St. Petersburg, Russia.

Mezmaiskaya Cave has yielded more than 10,000 artefacts, thousands of very well preserved faunal remains, and hominid remains, found in eight Middle Paleolithic (Mousterian) and three Upper Paleolithic levels comprising silty sands with *éboulis*. A post-cranial Neanderthal infant skeleton was preserved in anatomical juxtaposition lying on a large limestone block, overlain by the earliest Mousterian layer, Layer 3. No burial pit was observed. Twenty-four skull fragments showing *post-mortem* deformation from a 1-2 year-old infant occurred in a pit originating in the Mousterian Layer 2 and penetrating into underlying layers. The Middle Paleolithic industries have high sidescraper, but variable bifacial tool, percentages. Some bone tools were found in Layer 3. Excepting *Ursus spelaeus*, some bird, rodent, and carnivore remains, the majority of the bovids, cervids, caprids, and other ungulates represent human kills hunted by selecting prime adults. Bone from Layer 2A was dated by AMS ^{14}C at 35.8-36.3 ± 0.5 kyr BP. Twelve ungulate teeth from Layers 2 to 3 have been dated by standard and isochron ESR. Low U concentrations in both the enamel and dentine ensure that ESR ages do not depend significantly on the U uptake model, but do depend strongly on the sedimentary dose rates and water concentrations. Sedimentary dose rates range from 500 to 800 ± 100 mGy/yr, depending mainly on the *éboulis* concentrations in each layer. Assuming a sedimentary water concentration equals 20 wt% (the modern concentration), preliminary ESR ages for the layers range from 38.2 to 42.0 ± 0.5 ka for the Mousterian layers.

Age-related changes to the intervertebral discs of the human sacrum.

M. Skinner. Hominid Paleobiology Doctoral Program, The George Washington University.

While investigations into the phylogeny, ontogeny, and comparative external morphology of the modern human sacrum exist, similar studies of the *internal* morphology of the modern human sacrum are few. This project investigates age-related changes to the intervertebral discs sealed within the modern human sacrum. Specifically, it tests the hypothesis that, if sacral intervertebral discs are not functional, the results of disuse, such as poor nutrition, will result in resorptive remod-