Palaeoanthropological Society of Canada
Société canadienne de paléoanthropologie

PASC SCPA 3rd annual meeting 2017

Edmonton, AB

Held in conjunctions with CAPA/ACAP conference

Schedule of Papers and Posters

Titles marked with an asterisk (*) are entered into the student prize competition.

Friday, October 27 (continued)

8:00 am – 10:00 am: **Podium Session 4** (Quartz Ballroom) *Palaeoanthropological Society of Canada/ Société canadienne de paléoanthropologie Symposium:* Exploring the Limits of the Discipline: Defining PaleoAnthropological Research

The research presented in this session aims to explore the diversity in palaeoanthropological research in Canada and beyond. We invite members of the PalaeoAnthropology Society of Canada, and Canadian Association of Physical Anthropology to present an assorted discussion of palaeoanthropological topics. A special focus is pushing the limits of which types of research are traditionally considered as "palaeoanthropological". Presentations of research that may be considered adjunct or adjacent to the discipline, as well as multidisciplinary and interdisciplinary are included. This symposium will present interdisciplinary topics conducted by physical anthropologists, archaeologists, and geologists through research that has the potential to shed light on hominid behavior and biological evolution.
Palaeoanthropology has also recent adopted many methodological approaches, including genetics and three-dimensional reconstructions. These methods have allowed for an expansion of research topics in the fields of past human and non-human life. In bringing together researchers working in a variety of contexts, geographical regions, and methodological approaches, this session will provide CAPA members with an opportunity to examine the diversity of research that is considered "palaeoanthropological" in nature.

Chair: Kirsten Bruce

8:00 - 8:15 Using model organisms to reconstruct locomotor behaviors in fossil primates **Bradley, M.M.**; Hou, L.; Sparrow, L.; Pellatt, E.; Farooq, S.; and Rolian, C.P.

8:15 - 8:30 Unique body size and shape phenotypes among Middle and Later Stone Age southern Africans
Pfeiffer, S.; Cameron, M.E.; and Stock, J.

8:30 - 8:45 A quantitative genetic approach for investigating skull diversity in *Homo* Schroeder, L.; and Ackermann, R.R.

8:45 - 9:00 Survival vs. Extinction: An interactive guided story of human evolution*
Vizely, K. and Calce, S.E.

9:00 - 9:15 Is *Paranthropus* a good clade?
Collard, M.; Dembo, M.; and Mooers, A.

9:15 - 9:30 Applying common Plio-Pleistocene paleoenvironmental proxies in deep(er) time: challenges and opportunities
Cote, S.; Hall, A.; Butts, C.; and Kingston, J.

9:30 - 9:45 Researching the evolution of modern humans in southern Tanzania
Willoughby, P.R.

9:45 - 10:00 Microbotanical Proxies in Palaeoanthropology: The Stone Tools, Diet, and Sociality reference collection at the University of Calgary as an underutilized resource for Canadian Bioanthropologists
Mercader, J.; Abtosway, M.; Bird, R.; Brown, M.; Bundala, M.; Clarke, S.; Favreau, J.; Gerlach S.C.; Inwood, J.; Itambu, M.; Larter, S.; Larter, F.; Lee, P.; Maley, J.; Mollel, N.; Patalano, R.; Rajdev, V.; Sammynaiken, R.; Soto, M.; Tucker, L.; and Walde, D.

ABSTRACTS:

1. Using Model Organisms to Reconstruct Locomotor Behaviors in Fossil Primates

Bradley, M.M. (1); Hou, L. (2); Sparrow, L. (3); Pellatt, E. (3); Farooq, S. (4); and Rolian, C.P. (1,3)
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Reconstructing the behaviour of extinct primates is a common objective of palaeoanthropology. Due to the limitations of the primate fossil record, comparisons with the morphology and behavior of model organisms is a helpful means of studying questions that would otherwise be unapproachable. Models with analogous body proportions, and with similar shape, robusticity and microarchitecture of bone can inform our interpretations of how an extinct organism moved. For example, living primates with elongated and gracile limbs include runners (humans) and jumpers (galagos and tarsiers), thus extinct primates with similar body plans are often interpreted as employing the same types of locomotion. This interpretation rests on the largely untested assumption that hind-limb elongation evolved adaptively due to increased performance in specific ecological contexts. This assumption can be tested using the Longshanks (LS) mouse model. The LS selection experiment has produced mice with tibiae on average 15% longer than those of mass-matched and randomly bred controls. Using the LS, we can directly study the effect of limb length on locomotor performance within a population (the level at which selection operates and speciation occurs), rather than comparing species with highly derived morphology or distantly related taxa. To date, we have conducted several studies with implications for reconstructing fossil locomotor behaviors. We first investigated the effect of longer limbs on gait and cost of transport (COT) during running. COT reduction should result from longer stance durations and reduced stride frequencies. Similarly, during jumping, longer limbs should increase the time over which muscles contract, increasing acceleration and take-off velocity. Theoretical biomechanical models for both running and jumping have not been adequately studied within species, but can be validated empirically by comparing performance variables and morphological correlates in Longshanks and control mice. Our results provide mixed support for these relationships, but also show that the preserved signals in bone require more caution when used to infer locomotor behaviors. These ongoing projects, as well as future studies, aid our ability to interpret fossil remains by providing biological parameters and restrictions, as well as a platform for hypothesis testing.

1. Is *Paranthropus* a Good Clade?

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The relationships of the three species in the robust australopith genus, *Paranthropus*, remain contentious. One hypothesis avers that *P. aethiopicus*, *P. boisei*, and *P. robustus* share a common ancestor to the exclusion of all other hominin species and therefore form a clade. The main alternative hypothesis contends that *P. boisei* and *P. robustus* are more closely related to *Australopithecus africanus* and *Homo* than either is to *P. aethiopicus*. According to this hypothesis, the similarities between *P. boisei* and *P. robustus* on the one hand and *P. aethiopicus* on the other are homoplasies that reflect the effects of convergent evolution in relation to heavy chewing. While both hypotheses have been supported in previous studies, they have yet to be formally compared. Here we report the results of such a comparison. We conducted a series of dated Bayesian analyses using a large craniodental dataset compiled from the literature. The dataset included scores for 391 characters for 24 hominin species that span the last seven million years. Various phylogenetic hypotheses for the *Paranthropus* species were converted into partially constrained tree models, and we then used Bayes Factors to evaluate the relative likelihood of these models given the craniodental evidence. To begin with, we carried out an analysis in which we used all 391 characters. Next, we repeated the analysis after excluding characters related to heavy chewing. In the third and final analysis, we divided the characters into four developmental-functional groups and then tested between the hypotheses with each developmental-functional group of characters. Overall, the results we obtained provide strong support for the hypothesis that the three *Paranthropus* species form a clade. However, they also show that we need to investigate the phenomenon of homoplasy in more detail.

3. Applying Common Plio-Pleistocene Paleoenvironmental Proxies in Deep(er) time: Challenges and Opportunities

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2. Department of Anthropology, University of Michigan

A common goal in paleoanthropology is to reconstruct past environments. Fossilized plant remains and geological data (e.g. sedimentary systems, soil chemistry) provide the most direct paleoenvironmental data, but are often not available. In addition, access to paleoanthropological specimens, particularly for destructive analysis, is often not possible. Consequently, paleoanthropologists often turn to methods that rely on the fossil remains of other mammalian taxa found at the site. These include stable isotopic analysis, various measures of tooth wear, ecomorphology, and community composition. These methods are well-established for paleoanthropological sites in the Plio-Pleistocene and hundreds of studies have been published. Applications in deeper geological time are becoming more common, but pose additional challenges. The old adage “the present is the key to the past” becomes more difficult to apply as we move back in time, as many modern analogues begin to fail. With increasing time comes the increasing possibility that the world looked fundamentally different than it does today. Here, we present work using mammalian fossils as paleoenvironmental proxies for early ape environments in the early Miocene of East Africa demonstrating some of these complexities. Were these datasets from the African Plio-Pleistocene, they would be clearly interpretable, but several important factors make this more difficult: (1) early Miocene faunas include many taxa that are phylogenetically distinct from living groups, making it difficult to know which modern taxa to use as analogues; (2) we may be dealing with environments that have no modern analogue, including the presence of a number of actively erupting carbonatite volcanoes and the possibility of C3 ecosystems unlike any documented on earth today. Our carbon isotope results provide compelling evidence that early Miocene apes lived in more open habitats than today, but the precise nature of these environments is difficult to pin down without additional data. Data from ruminant tooth mesowear and hypsodonty, which we hoped would clarify the matter, provide conflicting results. Grasses may be widespread, but ruminants don’t appear to be consuming them. In the future, we hope to incorporate data from additional sources, including postcranial ecomorphology, microwear, and ideally, remains of well-preserved fossil plants.

4. Microbotanical Proxies in Palaeoanthropology: The Stone Tools, Diet, and Sociality Reference Collection at the University of Calgary as an Underutilized Resource for Canadian Bioanthropologists

Mercader, J. (1); Abtosway, M. (1); Bird, R. (1); Brown, M. (2); Bundala, M. (1); Clarke, S. (1); Favreau, J. (1); Gerlach, S.C. (1); Inwood, J. (1); Itambu, M. (1); Larter, S. (2); Larter, F. (2); Lee, P. (1); Maley, J. (3); Mollel, N. (4); Patalano, R. (1); Rajdev, V. (5); Sammynaiken, R. (3); Soto, M. (1); Tucker, L. (1); and Walde, D. (1)

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For over twenty years, our research group has collected botanical samples from phytochoria in Central, West, Southern, and East African nations; including Angola, Botswana, Burundi, Cameroon, D.R. Congo, Equatorial Guinea, Ivory Coast, Kenya, South Africa, Swaziland, Tanzania, Uganda, and Zimbabwe and more. Our collection represents about 100 families and more than 500 species, and includes various plant tissues (bark, leaf, grain, bean, fruit, nut, rhizome, root, seed, and tuber). Modern referentials play a key role in establishing baselines that galvanize multidisciplinary work. For example, we use this resource to explore new fields in palaeoanthropology comprising primate archaeology, hominin ecology (ethnobotany), phytolith studies, starch analysis, analytical and organic chemistry (FTMS, PyGCMS, Stable Isotopes), and the application of cutting-edge instrumentation (SEM, TEM, Spectroscopy) to archaeological problems. A growing dataset demonstrates that stable isotope variations exist between and amongst tissues of the same plant, such as fruits, seeds, and leaves. With our extensive collection, we are able to contribute to this dataset by measuring bulk isotopes (carbon and nitrogen) in order to analyze variations amongst different plant parts, but also from plants growing in diverse ecoregions. In addition, by using referential material from roots, nuts, and legumes, we can characterize the isotope values of modern species, and use preliminary results to explore dietary variability in relation to human evolution. The University of Calgary's extensive collection is an invaluable resource to ethnobotanists seeking to delimit the Linnean taxonomic designation of their botanical collections. Furthermore, by working with the communities who live amongst and utilize the samples we collect, we can understand human ecological situations that such communities navigate and preserve for future generations the multifaceted and sophisticated categorizations, preparations, and uses of botanical specimens. This presentation will illustrate the types of research topics that palaeoanthropologists explore through the use of microbotanical proxies; and encourage members of the Canadian Association for Physical Anthropology to collaborate on research that utilizes the University of Calgary's plant reference collection; a rich database open to everyone.

5. Unique Body Size and Shape Phenotypes Among Middle and Later Stone Age Southern Africans

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Holocene Southern African Later Stone Age (LSA) skeletons and their contemporary descendants, the KhoeSan peoples of southern Africa, have small adult body sizes and gracile builds. Genetic analyses indicate that contemporary KhoeSan groups diverged from non-Khoesan groups approximately 110– 160 kya, during the Middle Stone Age (MSA). The most diverse group of MSA postcranial fragments comes

from the Klasies River Mouth Main Site (KRM) on the southern Cape coast. The KRM materials include a lumbar vertebra, left clavicle, left proximal radius, right proximal ulna, and left first metatarsal. We compare the external linear dimensions, shape characteristics, and cross-sectional geometric properties (CSGP) of KRM postcrania to those of LSA southern Africans to see if distinctive small body sizes and shapes are evident in the MSA. Discriminant function analyses (DFAs) and analyses of variance (ANOVAs) are used to compare each of the KRM elements to adult LSA southern Africans (n=108) and other Holocene groups (n=149) encompassing a range of body sizes. The DFAs group the KRM elements with LSA southern Africans when predicting group membership ($\alpha<0.01$), except for the ulna that shows archaic shape features. The similarities between KRM and LSA southern African materials are driven by size. KRM clavicle and metatarsal CSGP have greater torsional and compressive strength properties than analogous elements from LSA southern Africans. These results demonstrate that small southern African adult body sizes may have great temporal depth. They provide further evidence for biological continuities between MSA and LSA southern Africans, consistent with
genomic studies.

6. A Quantitative Genetic Approach for Investigating Skull Diversity in *Homo*

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New fossil discoveries have highlighted the remarkable variation and diversity within our genus, *Homo*, fuelling the debate surrounding our evolution. Previous interpretations of this diversity have focused on scenarios of adaptation, rarely considering the contributions of non-adaptive processes such as gene flow and genetic drift. Understanding the action of these underlying processes on our lineage is an essential step in identifying probable evolutionary scenarios, and provides further evidence informing possible relationships between species. Here, we use statistical tests developed from quantitative genetic theory to test whether genetic drift (as opposed to selection) could be responsible for the cranial and mandibular variation observed in *Homo*. Analyses were performed on 3-D scan data collected from early and later *Homo* specimens from eastern and southern Africa, Dmanisi, Georgia, as well as Java, Indonesia. Results show that for the majority of cases, the cranial and mandibular phenotypic diversity seen between these geographical and spatially separated Homo groups is consistent with genetic drift. Rejections of drift, signifying possible selective forces, are associated with: 1) the Dmanisi hominins (the earliest migration of Homo out of Africa); 2) maxillary and mandibular diversity among groups, possibly connected to dietary differences; and 3) the divergence of *Homo rudolfensis* from other *Homo* groups. These results indicate that genetic drift played a much larger role in driving our evolution than previously thought, suggesting that a significant amount of the variation and novelty we see in *Homo* could be due to random chance, likely acting in small populations.

7. Survival vs. Extinction: An Interactive Guided Story of Human Evolution*

Vizely, K. (1) and Calce, S.E. (1)
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Games have been a part of society and culture since ancient times, and there is evidence to suggest that the use of games in teaching may support higher-order cognitive development and strengthen motivation in skills-based learning. Teaching human evolution by natural selection through cooperative games provides a platform for informal learning of otherwise complex scientific concepts. Survival versus Extinction is a live-action-role-play game that approaches human evolution as an interactive guided story, taking students through a theoretical version of early human development starting with a hypothetical population and a last common ancestor. A moderator alternates between rounds of selective pressures that affect morphological change, and ultimately causes speciation or, population extinction. The game structure employs a step-wise approach to learning as the outcome varies each time the game is played. This sequence-based approach also allows for careful and reflective reasoning, important skills that lead to synergetic associations. The story itself can be adapted and expanded to specific levels of comprehension. Moderators can adjust the length of

the guided story for time or material constraints. We present this game as a model for integrative and informal learning in
biological anthropology, with the goal of improving science literacy and education.

8. Researching the Evolution of Modern Humans in Southern Tanzania

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Our own species, *Homo sapiens*, evolved in Africa sometime around 200,000 years ago. This was towards the end of the Acheulean and the start of the Middle Stone Age (MSA). Descendants of these MSA people subsequently dispersed out of the continent starting around 50,000 years ago, interbred with indigenous people in Eurasia, and ultimately settled the globe. But what was happening in sub- Saharan Africa at the time? In many regions, glacial periods saw increasing dry and cold conditions and local extinction of plants, animals, and possibly hominins as well. But the Southern Highlands of Iringa, Tanzania may have been more or less continuously occupied over the past 200,000+ years.

There is extensive evidence of human occupation starting in the Acheulean and extending through the MSA and Later Stone Age (LSA) into later and modern times. Two sites have already yielded human skeletal remains, including MSA teeth and a LSA skeleton. This presentation reviews the various lines
of evidence being used to examine the Pleistocene and early Holocene history of the Iringa highlands.