Dental microwear texture analysis at the Gobero site complex (Middle-Late Holocene), Niger

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The locality Gobero in the southern Sahara (Niger) preserves more than 200 burials spanning ~5,000 years during the African Humid Period. Two sustained successive phases of occupation, referred to as Kiffian (9,700-8,200 BP) and Tenerean (7,200-4,500 BP), are separated by an arid horizon recognized across the Sahara. Dental remains from both occupations provide an opportunity to use dental microwear texture analysis to assess diet and compare the temporally calibrated records for enamel isotopes, barbed bone points for fishing, the vertebrate fauna from middens and the nearby paleolake, and palynomorphs. These other lines of evidence indicate both groups remained fisher-hunter-gatherers, as opposed to cattle pastoralists, and that C4 plants during the second occupation were predominant. We applied standard DMTA methods to dental replicas from 11 individuals (5 Kiffian, 6 Tenerean). Data collection used a white-light confocal profiler at 100X; horizontal data spacing was 0.17, and vertical spacing was 0.20 microns. Texture calculations were made with scale-sensitive fractal analysis software. Texture variables included complexity, anisotropy, and textural fill volume. Microwear results support the interpretation of both occupations as fisher-hunter-gatherers, as opposed to cattle pastoralists or farmers, but shows a significant difference between occupations. Tenereans had a higher complexity. Using binary logistic regression, these two groups clustered 82% of the individuals tested, each including a single individual of the other group with atypical complexity. Overall, the diet among Kiffians appears to have been softer than among Tenereans, which may indicate more reliance on terrestrial foraging or C4 plants during the younger occupation.

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Why do large apes trot? The ontogeny of trotting gaits in gorillas and its implications for understanding hominoid locomotion

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Gait selection by primates has been an important part of discussions about primate locomotor evolution. Primates are thought to differ from other mammals in adopting diagonal sequence (DS) gaits, in which the timing of ipsilateral footfalls exceed 50% of the stride duration (limb phase, D), and in avoiding running trots. Yet walking trots (D=50%, no aerial phase) are common in large-bodied apes. Although trotting provides long periods of contralateral limb support, it can also generate interference between ipsilateral limbs. Using an ontogenetic model, we test the hypothesis that the use of walking trots is related to body shape in gorillas. Seven gorillas ranging in age from 5 to 30 years were video-recorded moving freely in a level outdoor enclosure at the NC Zoo. The majority of gaits were walking trots, at or within 5% of D=50% (mean=54, 47-64 for <8 years; mean=48, 44-55 for >8 years; $p < 0.0001$; persisting after correction for speed). Younger individuals behaved in a more primate-like fashion using DS gaits and trots ($D \geq 50\%$), while older individuals used lateral sequence gaits and trots ($D \leq 50\%$). As gorillas age, their body mass increases causing the abdomen to become relatively larger and the hindlimbs relatively shorter, both hypothetically limiting potential for limb interference. In this study, gait selection appears to be related to overall body shape in large apes. Trotting may be a good solution for animals with limited limb interference providing stability especially at heel strike in these primates.

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Assessment of endocranial differences between *Pan troglodytes* and *Pan paniscus*

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Proper interpretation of differences in endocranial form between hominin fossil specimens requires comparisons with modern species. Bonobo (*Pan paniscus: Pp*) vs. common chimp (*Pan troglodytes: Pt*) differences are particularly interesting in this regard: They are our closest living relatives, and they are one example of within-genus variation (having split ~3 MYA). We applied functional neuro imaging methods to compare endocrania in 23 *Pp* and 34 *Pt* endocasts (from RLH). Species shape averages were rigidly aligned and distances measured from corresponding surfaces. Non-rigid diffeomorphic mappings were also derived, allowing calculation of localized scaling coefficients (Jacobians). The average distance from *Pt* to *Pp* was 1.98 mm (SD: 1.07, range: -1.10 to 6.68). The average Jacobian was 1.10 (*Pt* 1.10x larger than *Pp* at each point on average; SD: 0.92). For comparison, the same analyses comparing endocasts of KNM-ER 1813 and KNM-ER 1805 – two hominin fossils generally assumed to be the same species – resulted in similar differences: Average = 1.64 mm (SD: 2.28, range: -8.43 to 8.49); average Jacobian: 1.09 (SD: 0.88). Comparison with analyses on size-equated virtual endocrania (focusing on shape) will be discussed. The pattern of differences highlights more protruding anterior prefrontal areas - but less so for orbital prefrontal and parietal areas - in *Pt* vs. *Pp*. Possible behavioral significance of these differences in *Pan* will be discussed. Although *Pan* comparisons are species averages, whereas these fossils are ostensibly within species, the differences are similar. What this might mean for interpreting hominin fossils will be addressed.

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Biomolecular Evidence for Stress and the Death Experience in Ancient Nubia

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One of the challenges bioarchaeologists face when analyzing and interpreting skeletal remains is that bones remodel relatively slowly and, thus, reflect a lived experience from years prior to death. Biomolecular analysis of archaeological hair offers a unique opportunity to examine the months leading up to death via sequential longitudinal sampling, and when coupled with skeletal analysis, can offer important insights into life history. Here, I combine hair cortisol (psychosocial stress), hair nitrogen (physiological stress), and skeletal indicators of stress (physiological stress, employing the Index of Frailty) in an Ancient Nubian/Kushite population from the site of Abu Fatima (*ca*. 2500-1500 BCE; *n*=16). The aims of this study are two-fold: (1) to elucidate stress in the months and years leading up to death, what I refer to as Death Experience, and (2) couch results within an interpretation of the osteological paradox.

Results suggest that, in this relatively small sample, there is variation between hair cortisol, hair nitrogen, and skeletal indicators of stress within and between individuals (cortisol 54-2,656 ng/g, $\bar{x}$ 1,109±968 ng/g; nitrogen $\delta^{15}N_{ker}$ 8.73-15.59‰, $\bar{x}$ 12.17±1.85‰). This is not surprising, but does present an opportunity to examine, in a more refined way, how people experienced stress in the past and how this may have been related to their death. Biomolecular analysis of hair can unhide some aspects of hidden heterogeneity; we are able to (1) examine stress directly prior to death, (2) establish a lifecourse timeline of stress, and (3) assess biochemicals (e.g., hormones), which until recently were undetectable.

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