The biological history of the occupants of Nubia throughout the Holocene remains a topic of debate; specifically, there is some tendency to assume a discontinuous history of occupation and cultural development based on traditional anthropological and archaeological evidence. Population movements, a shift in subsistence strategies and in-situ evolution have all been used to explain the biological variation observed in Nubian remains, particularly in the cranium. Here we investigate craniofacial and mandibular shape patterns, as well as ancient DNA variation, among populations from Upper and Lower Nubia spanning 12,000 years and reflecting a transition from hunting-gathering to intensive farming.

Our sample includes 150 adult specimens from six archaeological sites along the Nile River in Egypt and Sudan that belong to eight chrono-cultural groups spanning from the Late Mesolithic through the Christian periods. All individuals were digitized with a surface scanner, then 397 and 120 three-dimensional landmarks and semilandmarks respectively were extracted on skulls and mandibles of each specimen. Landmark configurations were subjected to generalized Procrustes analysis, tangent space projection, principal component analysis, discriminant analysis, and MANOVA. Endogenous DNA was extracted and sequenced from a subsample in order to explore variation in Nubian population genetics throughout time and space using informative SNPs and haplogroup determination.

Our results highlight a strong distinction between Mesolithic and the Neolithic samples. Craniofacial patterns underline the importance of gene flow and give some support to the hypothesis of regional continuity among more recent groups, while patterns of mandibular morphology show high correlation with subsistence strategy.

Patterns of collagen fiber orientation in the human fibula middle-to-proximal diaphysis suggest a history of anterior-posterior bending and torsion consistent with "intermediate complexity" loading

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Patterns of predominant collagen fiber orientation (CFO) strongly correlate with habitual unidirectional bending, making this characteristic important for distinguishing bending from more complex loading (e.g., prevalent torsion). When in vivo strain data are not obtainable, a large data set must be assembled in bones with known and unknown strain histories in order to establish the relative reliability of CFO vs. other histomorphological characteristics for determining load history. The lack of in vivo strain data from the human fibula prompted our investigation of regional CFO data as an indirect way to determine whether or not the proximal-to-middle diaphysis receives relatively simple anterior-to-posterior bending vs. more complex loading (i.e., "low" vs. "intermediate-A" vs. "intermediate-B" vs. "high" complexity). Modern human fibulae (n=11; mean age 47y; range 25-65y; 8 males, 3 females) were sectioned transversely at the proximal-to-middle diaphysis. Sections were milled to 100 microns and circularly polarized light images were taken in the anterior, posterior, medial, and lateral cortices, and predominant CFO and secondary osteon population density (OPD) were analyzed. Results showed: (1) a trend ($p = 0.08$) in anterior vs. posterior CFO differences (posterior = more oblique-to-transverse ("compression adapted") collagen) and compression-adapted CFO medially ($p = 0.05$), and (2) no trends or statistical significance in OPD data. These results likely reflect significant torsion in some bones, which reduces regional CFO differences, especially when data from many individuals are averaged. Consequently, the proximal portion of the human fibula diaphysis should be placed in the "intermediate-B" complexity load category.

Enamel-dentine junction morphology and enamel thickness of the Dinaledi dental collection

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The dental remains of the *H. naledi* hypodigm constitute one of the largest samples of teeth and jaws of any fossil hominin species. Estimated to derive from at least 15 individuals, they offer an opportunity to characterize dental morphology in a temporally and geographically restricted population belonging to the genus *Homo*. We apply microtomography to examine the morphology of the enamel-dentine junction (EDJ) of the mandibular molar sample. Previous research has demonstrated that EDJ morphology carries a strong taxonomic signal, facilitates the examination of discrete dental traits, and provides insights into the developmental processes underlying tooth crown morphology. Using geometric morphometrics (GM), we compare molar EDJ morphology of the *H. naledi* remains to a comparative sample that includes numerous Plio-Pleistocene hominin species from *Australopithecus*, *Paranthropus* and *Homo*. We also measure 2D average and relative enamel thickness and conduct a qualitative analysis of the EDJ expression of dental traits. Results of the GM analysis indicate that the molars of *H. naledi* are distinct from both *Australopithecus*/*Paranthropus* and early/later *Homo*; presenting a unique combination of dentine horn size and spacing and cervix shape. 2D enamel thickness of *H. naledi* is relatively thick, overlapping with *P. robustus* and some specimens of early *Homo*. Discrete traits, such as cusp 6 and the protostylid, are both rare and only mildly expressed and the molar occlusal basin lacks complexity in terms of crest development. The molar EDJ morphology of *H. naledi* is discussed within the context of both early and later species of the genus *Homo*.

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Analyzing the biological relatedness of individuals from a late 1800s Missouri cemetery

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Biodistance studies are valuable tools in biological anthropology because they help address questions about population structure and demographics. In this study, metric and nonmetric data are used to examine the biological relatedness of 11 American Black individuals whose graves in the abandoned 19th century Shiloh Methodist Cemetery were exposed during flooding of the Missouri River in 1993. The purpose of the study is to provide more information about the life of Black Americans in this community and in 19th century central Missouri.

Analyses of the metric and nonmetric data indicate the Shiloh individuals align most closely with American Blacks from the era than African populations. Mahalanobis distances between each pair of crania (D=2.79) are less than expected (D=3.61) for an American Black population, and indicate that the Shiloh individuals examined were members of the same biological and cultural community. The results of this study do not support that the Shiloh individuals were recent migrants from Africa or members of a single family unit. The contrast between the funerary adornment of Shiloh Feature 13 and the other 10 individuals combined with their morphological similarities imply there were likely multiple social levels in the Black community. Future research will include DNA analyses of the Shiloh sample to define their biological relationships, which will be compared with the current results to evaluate the relationship between metric and nonmetric data and their level(s) of genetic influence.

Visualization and Materialization for High-dimensional Morphometric Data

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