Accessing and Interpreting Juvenile Identity

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Archaeologists and bioarchaeologists have been interested in identity studies since the genesis of anthropology. Recently, we've moved toward understanding identity through a holistic lens by examining how different categories of identity intersect, influence one another, and cannot be understood in isolation. This is often referred to as intersectionality theory. Bioarchaeologists are interested in key categories of identity-related to indicators or changes we document during osteological analysis (age, biological sex, pathology, trauma, and biocultural modification, to name a few). These categories are then interpreted in conjunction with archaeological data to create a more complete view of the lived experiences of past societies. Of interest to my research is a subpopulation within past societies, juveniles (<16 years). Investigating this group provides a window into childhood and adolescence, which are unique phases in the life history of individuals who are particularly vulnerable while still developing socially and biologically.

A large gap in bioarchaeological research is the inability to estimate the biological sex of prepubescent individuals accurately. Sex is an important identity category to consider because it is used as a reference point for inferring other identity categories like gender, social age, and differential treatment between individuals during life and after death. Bioarchaeologists traditionally use osteological methods to estimate sex from human remains, with methods focusing on observing differences in the size and robusticity of various skeletal features/areas or methods that evaluate features related to reproductive physiology and parturition. These methods are either nonmetric, macroscopic observations of morphological differences, or metric, quantifying size differences of features, with the most significant sexually dimorphic differences arising during puberty. Nonmetric and metric analyses of the pelvic, dentition, long bones, and mandible are sometimes used to estimate the sex of juvenile individuals. However, these methods have mixed results, ranging in accuracy between 40% and 80%. Recent trends in sex estimation studies include using genomic and 9 methods, which are destructive but more accurate than osteological methods.

My research aims to examine the range of vulnerability within two juvenile populations and what identity categories or combinations of them resulted in increased vulnerability, with vulnerability defined as the qualities an individual possesses that create greater morbidity and early mortality. Two precolonial skeletal samples from Sonora, Mexico, are used in this study. The earlier of the two comes from the archaeological site of La Playa and dates to the Early Agricultural period (2100 BCE – 50 CE), and the second sample is from El Cementerio and dates to the Middle and Late Ceramic periods (879 – 1635 CE). To investigate the range of vulnerability within these two populations, osteological analysis was conducted at the Museo del Sitio Cerro de Trincheras in Trincheras, Sonora, Mexico, and proteomic analysis was conducted at the Parker Lab at the University of California, Davis.

An initial goal of this study is to compare osteological and proteomic sex estimation methods. A recent study by bioarchaeologists associated with INAH found that certain nonmetric traits of the pelvis and mandible accurately estimated juvenile sex. Therefore, the present study attempted to replicate these results on a similar skeletal population. The presence/absence of four nonmetric traits (sciatic notch angle, iliac crest curvature, mandibular protrusion, and gonial eversion) was scored on this study's sample population. Proteomic sex estimation is used to verify osteological sex estimation. The proteomic method used in this study is based on the patent owned by Parker Proteomics LLC and is minimally invasive, involving the dissolution of a small portion of enamel on a tooth. The process includes sample preparation, protein extraction and proteolytic digestion, sample cleanup, proteomic mass spectrometry, and data analysis (Figure 1).

Figure 1. Enamel sample preparation

Mass spectrometry produced a dataset of proteins present in the submitted sample, and the peptide matching software PEAKS XPro was used to identify amelogenin proteins. Amelogenin is found in dental enamel and is expressed as isoforms on each sex chromosome (AMELX and AMELY). The proteins encoded on amelogenin genes have unique amino acid sequences (peptides), and detecting what peptides are present can allow for highly accurate sex estimation. Publications by Dr. Glendon Parker are suggested if the reader is interested in learning more about proteomics and the method employed in this study. Figure two displays a protein spectrum output from PEAKS with multiple sexually dimorphic peptides associated with the male sex. The light blue bars represent peptide sequences matched to the sexually dimorphic Y-chromosome isoform (AMELY).

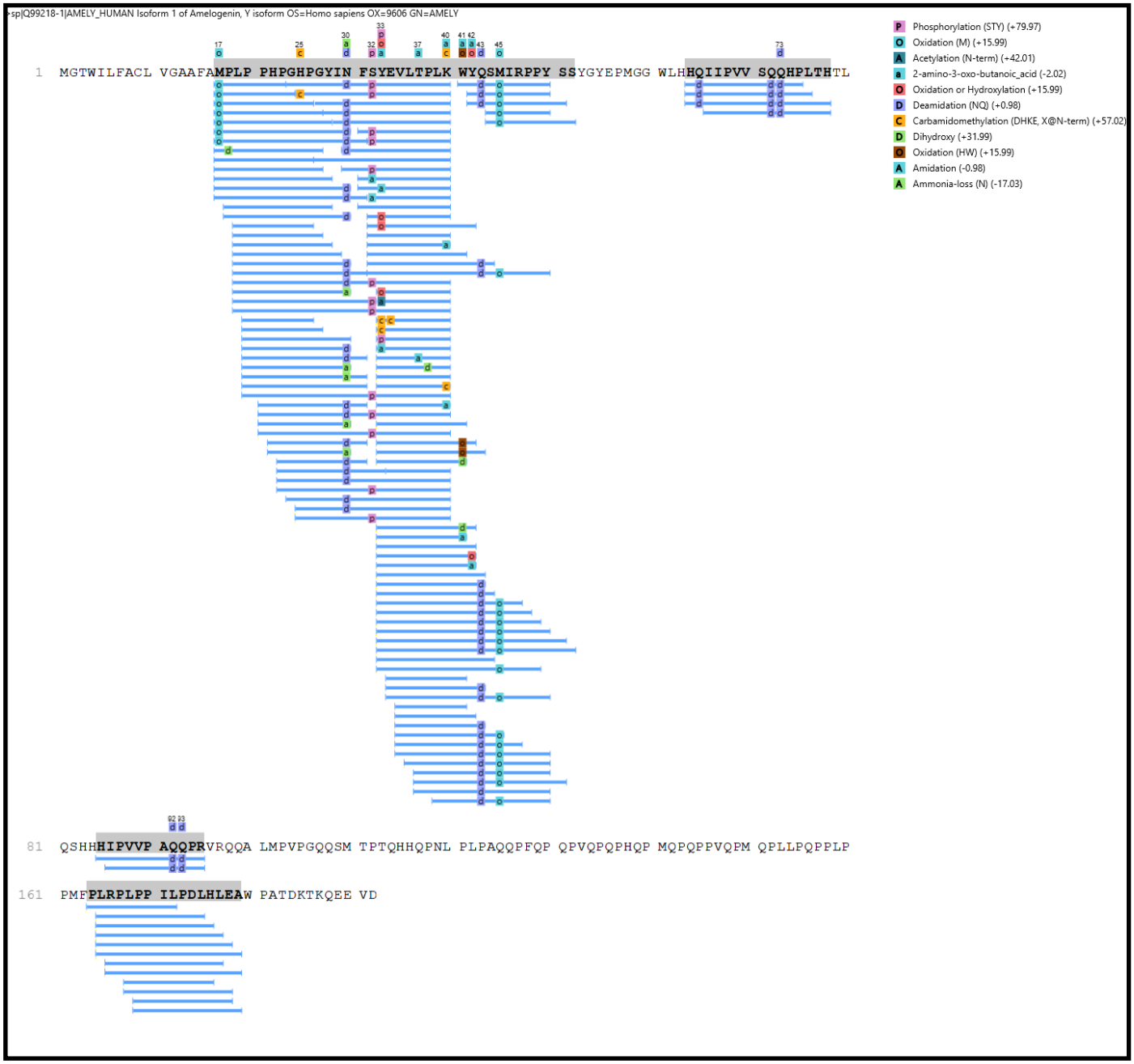

Figure 2. Multiple peptides associated with AMELY

The results of comparing sex estimation methods indicated that the osteological traits used could not accurately estimate the sex of juveniles in this study's sample. Some traits are more reliable at estimating the sex in males than females, specifically traits in the ilium, which is a common finding. However, the goal of 75% accuracy for sex estimation was not met with any trait used in this study. These initial results suggest that the osteological sex assessment of pre-teen individuals should be avoided. Instead, proteomic or genomic methods can be used when appropriate/available, as researchers should be cognizant of the ethical concerns surrounding using destructive methods on human remains.

Other preliminary findings of this research are that juvenile postmortem body treatment at La Playa is not sex-based or age-based. Red ochre was applied to the body in nearly equal quantities among both sexes and occurred as early as 2 years old. Therefore, it can be argued that red ochre is unrelated to social age or gender. Additionally, three of these individuals were also interred with associated funerary objects. Nonperishable funerary objects are rare at La Playa (~12% of all individuals) and even rarer among juveniles. These associated funerary objects include necklaces associated with both sexes among juveniles and shell discs with a male individual. Among the El Cementerio sample, male juveniles typically displayed more pathology than females, and associated funerary objects were more common among female juveniles. These conclusions are preliminary, and statistical analysis, like a hierarchical log-linear analysis, is still required to determine whether the association between identity categories is significant. When an association is significant, it is possible to conclude that these variables created a greater vulnerability for some juveniles.

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