

Introduction

Questions regarding diet, environment, and human/animal mobility are frequently investigated in archaeology through the application of stable isotope analysis (SIA). This approach has provided valuable insights into the archaeological record which have not been previously visible through traditional methods. SIA is variable in the questions that it can address, but parameters surrounding assemblage preservation dictate the viability of different SIA methods. My ongoing thesis research involves conducting SIA of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) to investigate the ancient environments and animal management practices within the Amuq Valley, Türkiye, during a period of transition between the Early Bronze Age (EB) IVA and IVB (2400-2000 BCE). This will be conducted through an analysis of the stable isotope compositions of faunal materials dated to the Early Bronze Age IV levels from the site of Tell Tayinat.

Before beginning this analysis, a robust sampling strategy is required. The current lack of available data on bone collagen preservation in the region has hampered the creation of a sampling strategy for the site and period under investigation. To rectify this, I conducted a pilot study of 15 samples from several time periods (EB, Iron (IR) I, and IR III) from Tell Tayinat to see the preservation of bone collagen across the occupied periods of the site. Collagen was extracted from these samples and analyzed for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ to reveal the preservation of bone collagen.

Quality Control Criteria	Accepted Range	Reference
Weight % carbon	$\geq 13\%$	Ambrose (1990)
Weight % nitrogen	$\geq 4.8\%$	Ambrose (1990)
C:N _{Atomic}	2.9 – 3.6	DeNiro (1985)
Collagen yield (%)	$> 2\%$	Ambrose (1990) DeNiro & Weiner (1998) Van Klinken (1999)

Table 1. The quality controls used for establishing collagen preservation and extraction for SIA.

Sample	Date	Element	Species
41366	EB	Mandible	Ovis/Capra
41367	EB	1st phalanx	Bos
41368	EB	1st phalanx	Bos
41369	EB	Humerus	Ovis/Capra
41370	EB	Humerus	Ovis/Capra
41371	Iron I	Mandible	Ovis/Capra
41372	Iron I	Astragalus	Bos
41373	Iron I	1st phalanx	Bos
41374	Iron I	Astragalus	Sus
41375	Iron I	1st phalanx	Bos
41376	Iron III	Humerus	Canis
41377	Iron III	Humerus	Ovis/Capra
41378	Iron III	Humerus	Ovis/Capra
41379	Iron III	Metapodial	Sus
41380	Iron III	Radius	Bos

Table 2. The samples selected for collagen extraction and SIA.

Methodology

There were 15 faunal samples selected from Tell Tayinat material, containing a variety of animals and elements, 5 from each occupied period. Samples were photographed and cut into chunks with a dental drill, and an additional portion was powdered. Samples were demineralized in 9mL of 0.5M HCl; the chunked bones were left in solution for 48hrs, and the powdered samples were left for 3 hrs. The samples were determined to be demineralized once they stopped bubbling and the texture was similar to “hard cheese” (chunk) or they were translucent (powder). The acid was removed, and samples were rinsed with Type I water (resistivity $>18.2\text{ M}\Omega\cdot\text{cm}$). Due to the samples being archaeological, they were treated once with 8mL of 0.01M NaOH to remove humic contaminants.

After more Type 1 water (resistivity $>18.2\text{ M}\Omega\cdot\text{cm}$) rinses, 3.5 mL of 0.01 M HCl was added to the samples and they were placed in an oven at 76°C for 48 hours for refluxing (solubilization). They were removed from the oven and transferred into 4mL glass vials and freeze dried for 48 hours. The samples were then weighed to calculate collagen yield, and then weighed again into tin capsules for SIA. The samples were analyzed using a EuroVector EA coupled to a Nu Horizon IRMS at the Trent University Water Quality Center. The quality control (QC) measures used to determine the preservation of the collagen were collagen yield (%), weight % carbon, weight % nitrogen, and the C:N ratio. These QC measures are standard to every project conducting SIA on carbon and nitrogen.

Results and Conclusion

The results of this analysis support three important conclusions about the feasibility of future SIA in the Amuq. **First**, the date of the sample had the greatest impact on collagen preservation compared to other variables such as context, skeletal element, or species analyzed. **Second**, EB samples had the lowest rate of collagen preservation among the three periods, but most samples still passed QC and had enough collagen preserved for SIA. **Third**, powdered samples had lower collagen yields, but more frequently passed QC overall, especially evident in the EB samples. These results show that there is collagen preserved in all occupied periods of the site, which means that future SIA at Tell Tayinat will be able to provide new insights into ancient diet and environments at the site. Additionally, this provides needed data in the region for collagen preservation, which will ideally encourage more projects to employ SIA in their research.

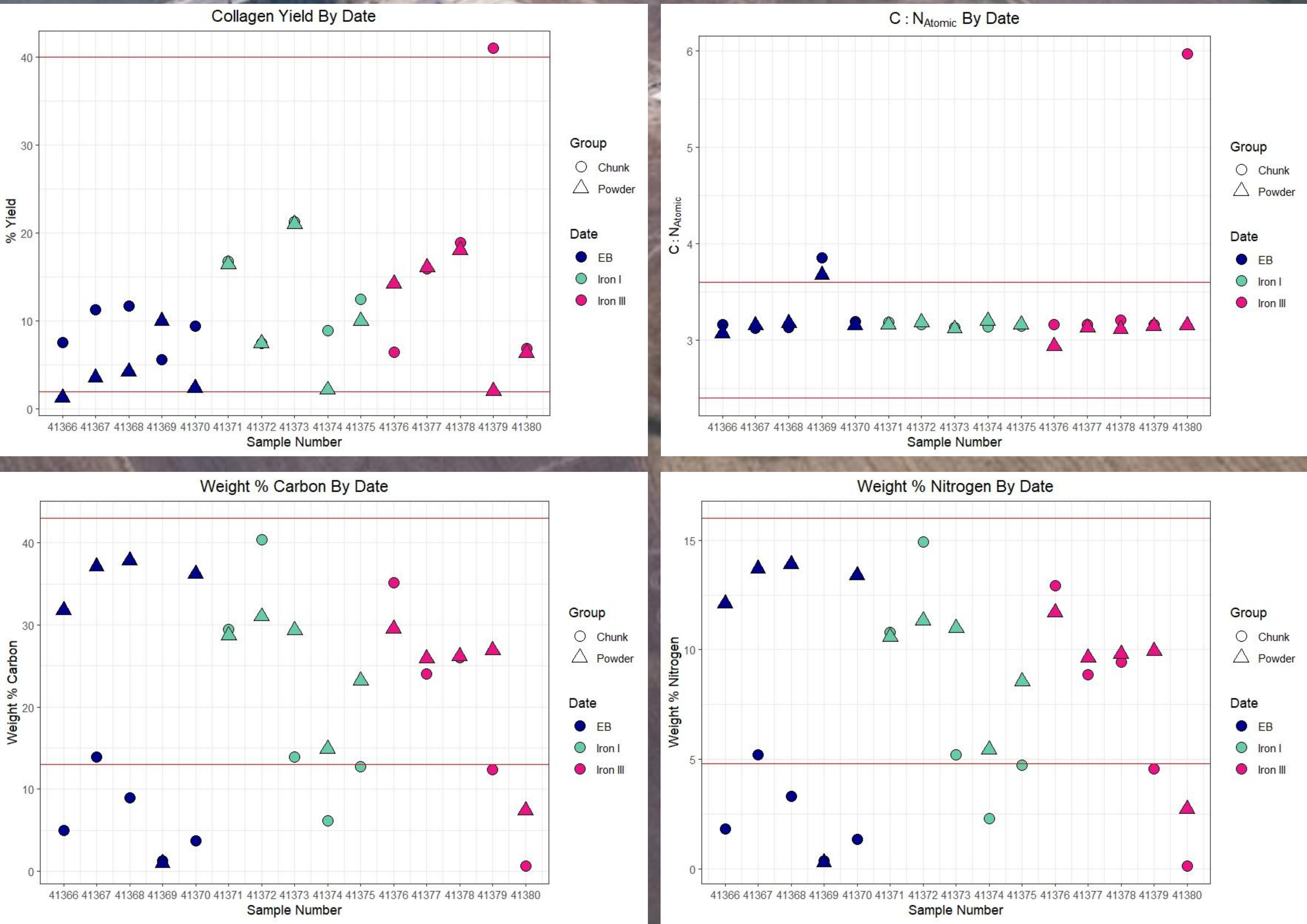
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Figures 1-4. These graphs show the results of all the samples compared to the four QC measures. The upper left graph shows collagen yield (%), the upper right graph shows the C:N_{Atomic} ratios, the bottom left shows the weight % carbon values, and the bottom right shows the weight % nitrogen.