QUANTIFYING DIAGENESIS OF FLORIDA FISH SCALES USING IR SPECTROSCOPY

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Introduction

- In Florida, there are archeological sites that are getting flooded by rainfall, affecting many aspects
- For this experiment, we are testing fish scales that have been excavated from South Inlet Park, Florida
- Comparing our fish scales to modern scales will give us a better understanding of how they have changed over time
- Infrared spectroscopy (IR) is a powerful tool in archaeology to understand the chemical composition of artifacts
- Bone digenesis is the chemical and physical process by which bones degrade over time
- Using the IR will show us a chemical reaction towards the fish scales that have been exposed to water, seeing what changes had occurred
- Phosphate peaks/crystallinity will tell us if the scales are fossilizing or degrading
- Carbonate peaks tell us if other carbonate is replacing other chemical elements in the scale
- Comparing to the modern tells us if this method can be used to distinguish between species
- When proven that there is a significant difference in the fish scales, we can apply this research to other types of archaeological bones through digenesis

References

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Sponheimer, M., & Lee-Thorp, J. A. (1999). Alteration of enamel carbonate environments during fossilization. *Journal of Archaeological Science*, *26*(2), 143-150.

Monnier, G. F. (2018). A review of infrared spectroscopy in microarchaeology: Methods, applications, and recent trends. *Journal of Archaeological Science: Reports*, *18*, 806-823.

Methods

Figure 1: Photos show the different categories of degradation, pristine, degraded, and very degraded.

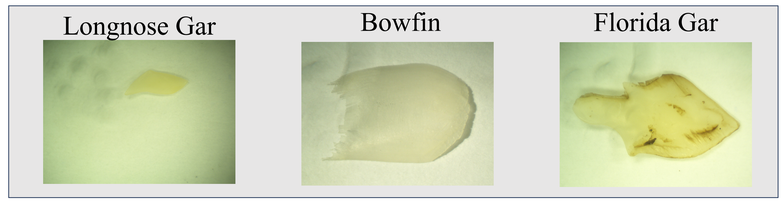

Figure 2: Photos show the modern scales used to compare to the archaeological scales in Florida.

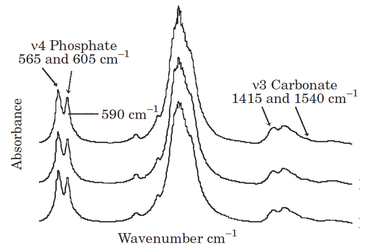

Figure 3: This figure shows where the phosphate and carbonate bonds appear on the spectra

- Scales were classified into three categories: Pristine, Degraded, and Very Degraded. Pristine has no damage, degraded, having slight damage to the enamel, and very degraded, having chips missing or deep damage to the enamel.
- Pictures were taken of each scale using a stereoscope
- Each of the scales was measured in length and weighed before measuring the spectra on the infrared spectrometer
- Scales will be compared to modern scales to see if they have the same structure
- The spectra show two bond peaks, that can be used to assess fossilization or damage

Preliminary Results

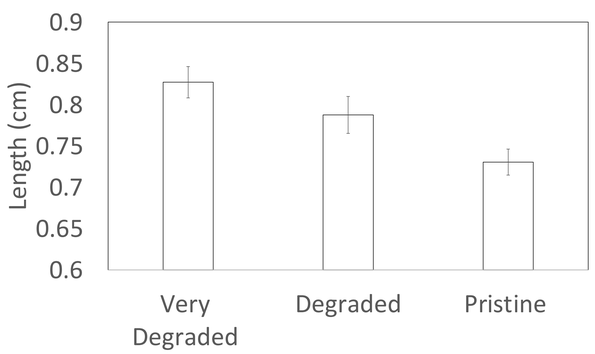

Figure 4: Average length of all fish scales that were divided into the three different categories

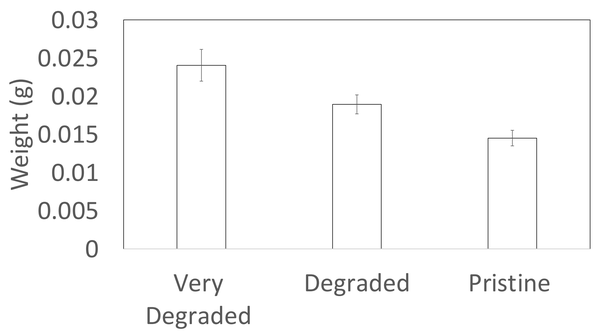

Figure 5: Average weight of all fish scales that were divided into the three different categories

- Results show a difference between the fish scales in weight and length. Very degraded, being the heaviest and longest fish scale
- A question arises: why are very degraded fish scales heavier and longer than the other scales? Is it because they've undergone more chemical reactions? Are the larger scales more resistant to complete destruction?