



COLLEGE OF SCIENCE
Accelerator
Mass Spectrometry Lab



Assessing Marine Turtle Bone as a Viable Material for Radiocarbon Dating: Insights from Zooarchaeology by Mass Spectrometry and Stable Isotope Analysis

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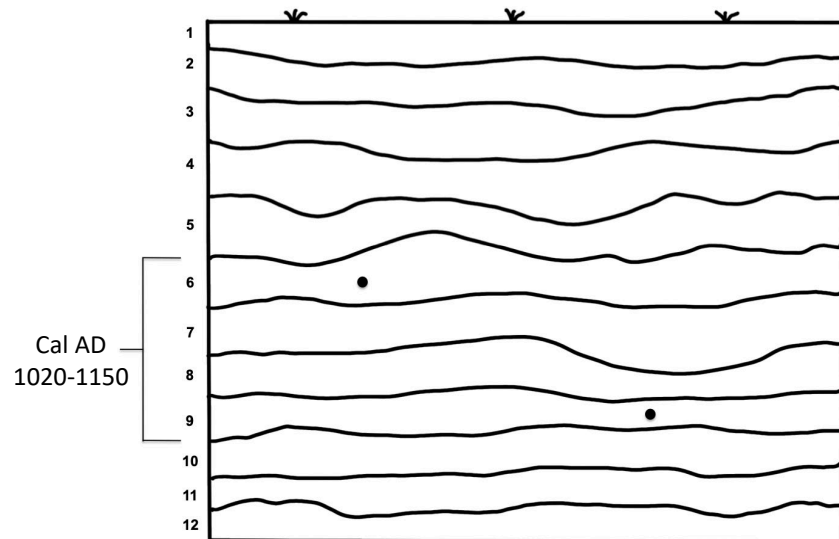
Introduction

- Abundance of marine turtle remains in coastal archaeological sites
- Challenges in radiocarbon (^{14}C) dating of marine taxa due to Marine Reservoir Effect (MRE) necessitating determination of local deltaR (ΔR) factor
- Implications that the MRE has on radiocarbon dating of turtle remains:
 1. Low temporal resolution limits applicability of prehistoric marine turtle population dynamics to modern conservation efforts
 2. Less suitable, or rarer, materials often selected for ^{14}C assay due to lack of research, limiting the accuracy of coastal cultural chronologies

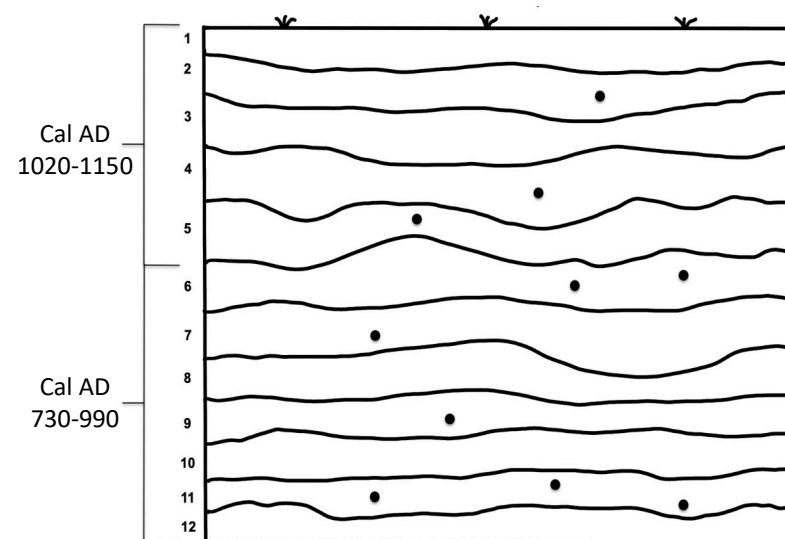
Methods

- Sample selection informed by Paired Marine Terrestrial Sample Method to establish local deltaR (ΔR) correction factor
- Methods employed to constrain ecological factors impacting ^{14}C assay
 1. Zooarchaeology by Mass Spectrometry (ZooMS)
 2. Stable Isotope Analysis

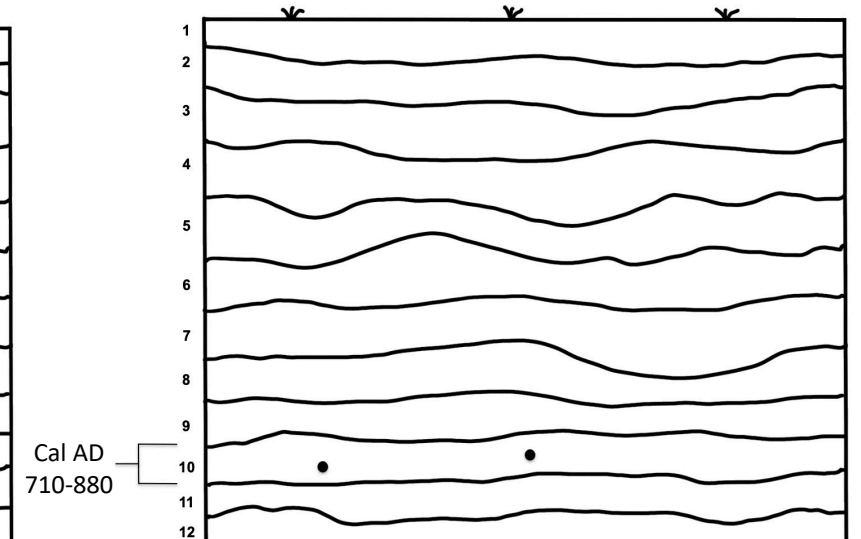
Planum # Trench 1/Square 1



Planum # Trench 2/Square 1



Planum # Trench 3/Square 1



ZooMS

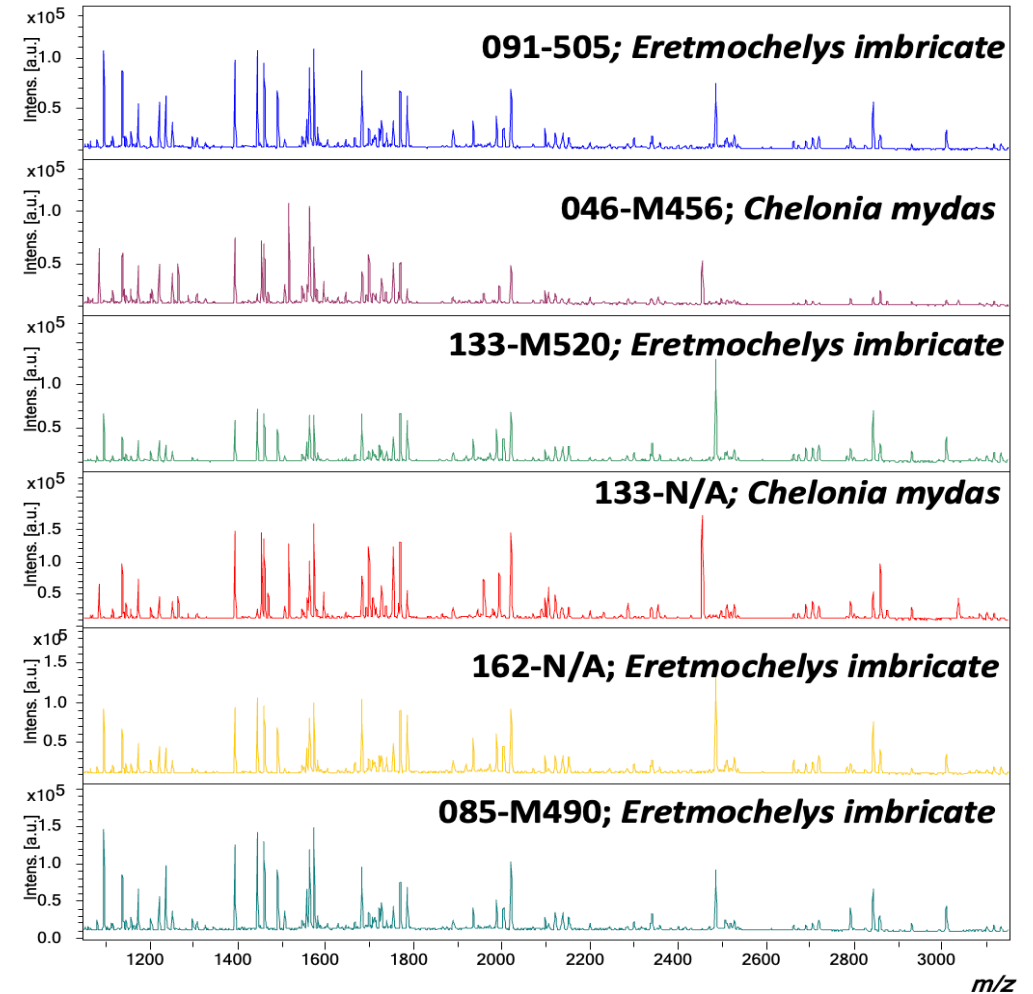
- Six samples positively identified to species indicating adequate preservation of collagen for subsequent analyses
- Species identified



Eretmochelys imbricata
(Hawksbill)



Chelonia mydas
(Green Turtle)

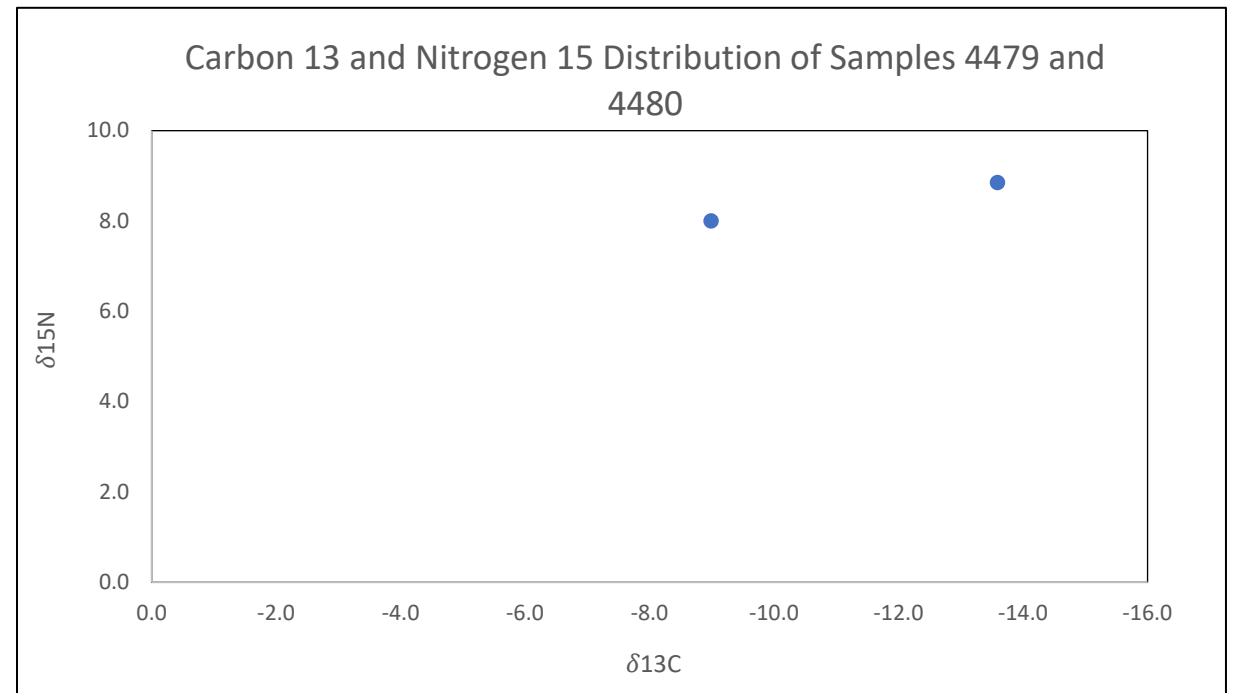


Marine Samples								Terrestrial Samples					
Event #	Bag #	Find #	Species	Trench	Square	Layer	Planum	Cal. AD (2σ)	Trench	Square	Layer	Planum	Type
2	N/A	0707CSZ000075	<i>E. imbricata</i>	1	1	3	8	1020-1150	1	1	3	6	Charred seed
	505	0707CSZ000091	<i>E. imbricata</i>	1	1	4	9	1020-1150	1	1	4	9	Charcoal
	456	0707CSZ000046	<i>C. mydas</i>	2	1	3	5	1020-1150	2	1	3	4	Charcoal
1	520	0707CSZ000133	<i>E. imbricata</i>	2	1	3A	11	870-970	2	1	3A	9	Charcoal
	521	0707CSZ000133	<i>E. imbricata</i>	2	1	3A	11						
	N/A	0707CSZ000133	<i>C. mydas</i>	2	1	3A	11	890-990	2	1	4	12	Charred seed

Stable Isotope Analysis

- Using the modified Longin Method, requiring ultrafiltration to remove exogenous contaminants, two samples met collagen threshold for stable isotope analysis
- C:N ratios in both samples did not meet 2.9 to 3.6 standard indicating poor collagen preservation

Sample #	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	$\delta^{34}\text{S}$	C:N
046-M456	-8.99	8	9.2	4.28
091-M505	-13.59	8.85	15.3	4.68



Conclusions

- Not enough data to produce a robust ΔR correction factor
 - ZooMS results complement previous ZooMS research in the region
 - Marine turtle bone highly subject to diagenetic effects that alter chemical composition
 - Recommendations for larger sample size and sample requirements for future analyses
 - Awaiting ^{14}C results from Arizona Accelerator Mass Spectrometry
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- Acknowledgements: Michael Richards, Laura Termes, and Rebecca Macdonald