Contribution ID: **42** Contribution code: **AAC-7** Type: **Oral Presentation**

# Assessing the Reservoir Effect in Radiocarbon Dating of Archaeological Sites Dependent on Freshwater Resources

*Tuesday, 22 October 2024 11:40 (20 minutes)*

The preservation of bone collagen at many ancient archaeological sites in Southern China is often poor, complicating the process of effective radiocarbon dating. To address this, our study has employed a method focused on extracting hydroxyproline—a non-essential, but abundant amino acid in collagen involved in human metabolism. This approach was chosen due to its presumed stability and abundance in archaeological bone. Nonetheless, we observed that hydroxyproline is susceptible to the freshwater reservoir effect, which results in anomalously old radiocarbon ages compared to those of contemporaneous plant or wooden artifacts. This effect, while generally less impactful than its marine counterpart, can significantly skew radiocarbon dating results at sites heavily reliant on freshwater resources.

Our analysis at sites such as the Banpo in Xi'an and the Qujialing in Hubei, which are characterized by extensive fish remains and fishing tools, reveals a clear dependency on freshwater biota. By analyzing single amino acids, we found that the radiocarbon ages of essential amino acids (e.g., leucine, isoleucine, and methionine) were consistently younger by 60-100 years compared to non-essential amino acids (e.g., aspartic acid, glutamic acid, and alanine). This pattern indicates a significant influence of the freshwater reservoir effect.

Our findings highlight the necessity of considering this effect when conducting radiocarbon dating at sites with a strong reliance on freshwater resources. Ignoring this factor could lead to substantial errors in the chronological reconstruction of past human activities. Thus, incorporating adjustments for the freshwater reservoir effect is crucial for accurate and reliable dating of archaeological remains.

## Student Submission

No

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**Session Classification:** Applications in Archaeology

**Track Classification:** Applications in Archaeology