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Experimental archaeology of traditional Andean foods: a contribution from organic residue analysis.

Agustina Vázquez Fiorani y Mark Schurr.

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INTRODUCTION

Lipid residue analysis [LRA] offers a unique opportunity to expand our understanding of ancient foodways and subsistence practices obtaining biomolecular data of absorbed foodstuffs preserved in pottery's walls during millennia. When coupled to anthropologically-oriented research questions, LRA can be highly informative of the adoption of agropastoral lifeways by understanding the manners and tempos of incorporation of new foods and pottery technologies (Roffet-Salque et al. 2017). Yet, because LRA requires an in-depth consideration of the physical, chemical, cultural, and taphonomic processes involved in residue formation, experimental research is pivotal for achieving a solid framework for archaeological interpretation (Evershed 2008; Miller et al. 2021; Reber 2022; Whelton et al. 2021).

This poster focuses on South America species of economic and cultural interest within prehispanic societies by presenting the results of experimental and community-based work conducted in the Argentinian Andes with indigenous communities (Tafí del Valle, Tucumán). We asked **two** main questions:

(1) How can lipid analysis to inform the archaeological interpretation of ancient foodways and culinary practices?

(2) In which ways can experimental research on lipid analysis contribute to enhance interpretative frameworks?

FIGURE 1: Pottery making, ingredients used, and cooking experiments.

EXPERIMENTS

With the aim of tracking chemical transformations in food residues' structured under controlled conditons, during the summer of 2023, we partnered with E. Chaile, a local potter in Tafi del Valle (Tucumán, Argentina). We made 10 replica pots using traditional coiling methods. Then we cook 8 different dishes in an archaeologically recreated hearth, replicating the process five times each.

(1) C4 and C3 plant-based stews (*locrillo*).
(2) C4 porridge (*mazamorra*, maize).
(3) C3 stew (quinoa and beans).
(4) Llama roast.
(5) C3 plants and llama stew.
(6) C4 and llama soup.
(7) Vegetable soup (x4) and a final llama meat stew.
(8) *Locro* with llama meat.

FIGURE 2: Replica pots and experiments.

After the final use, use-wear marks were recorded, and each pot was photographed.

Pots were buried for two months to simulate post-depositional decay.

Then, charred food crusts were sampled for EA-IRMS analysis, and a fragment of each pot's rim was grounded to powder for GC-MS and GC-C-IRMS analysis. A one-step acidic extraction was conducted to recover absorbed lipid residues. In parallel, reference samples (raw and cooked ingredients) were analyzed in EA-IRMS and GC-MS.

FIGURE 3: Sample preparation procedure during experiments.

RESULTS

(1) EA-IRMS on adhered residues and reference samples

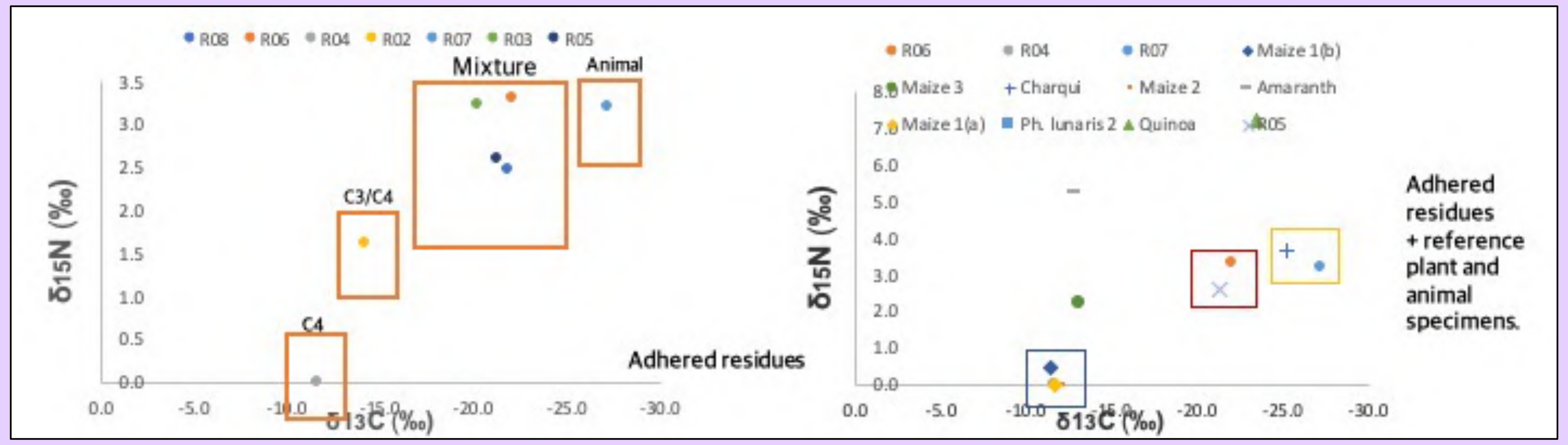
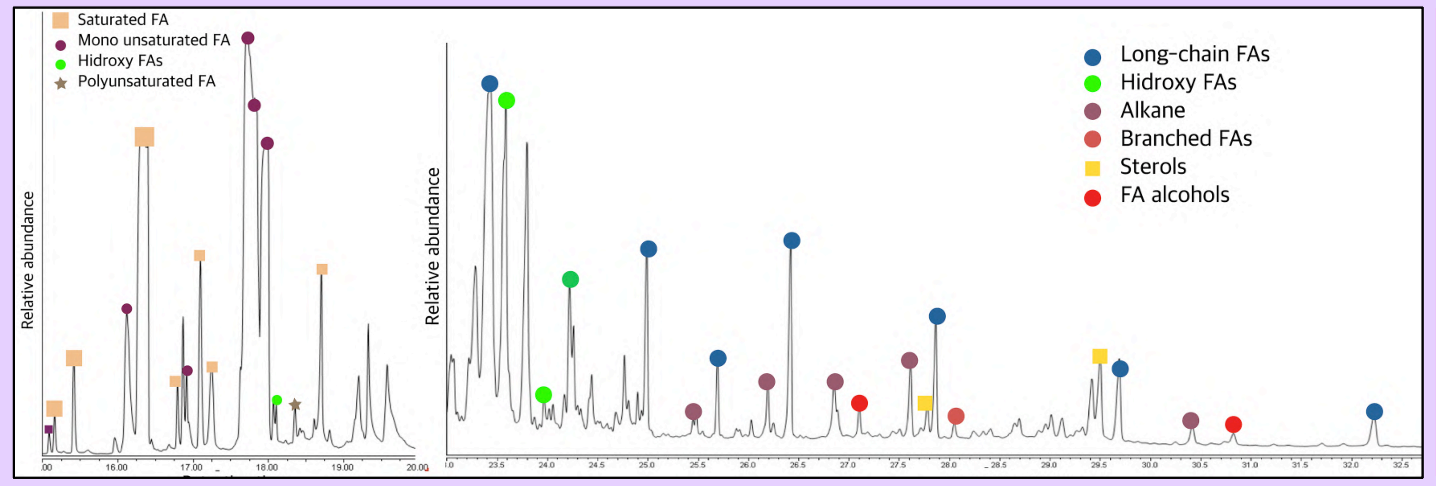


FIGURE 4: Biplot graph of stable carbon and nitrogen stable isotopes in charred food crusts and animal/plant specimens.

(2) GC-MS on absorbed food residues

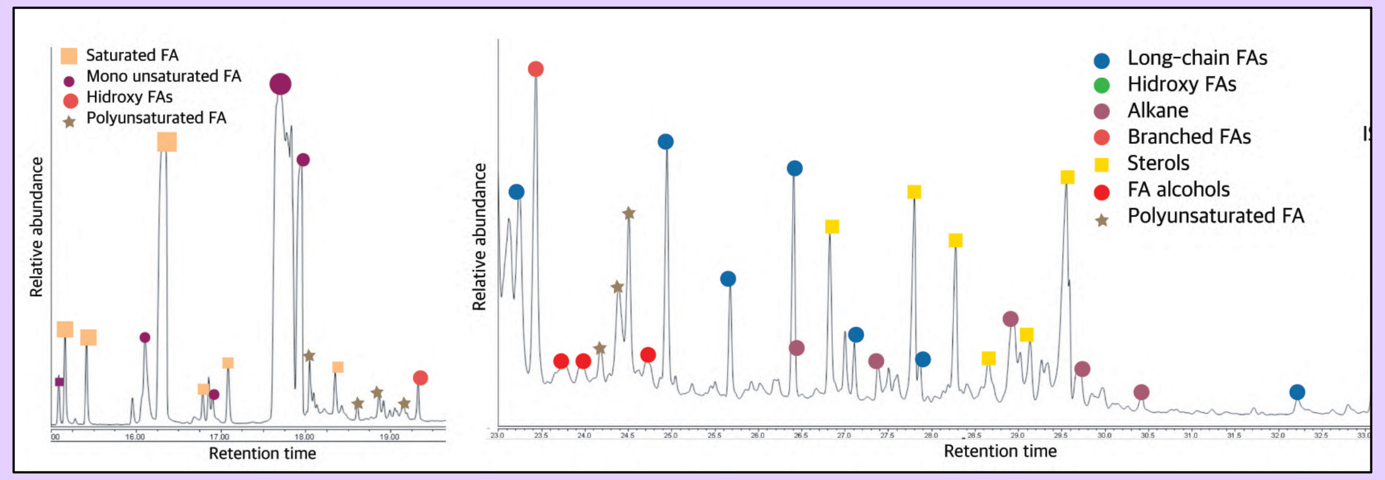
1 Plant based experiments



COMPOUNDS OF INTEREST
-Even numbered long FA(s)
-Stigmasterol
-Beta sitosterol
-Mono and polyunsaturated FA(s) (linoleic, oleic acids)

FIGURE 5: Experiment and partial chromatogram of R04 (maize experiment).

2 Plant + animal experiments



COMPOUNDS OF INTEREST
-Even numbered long FA(s)
-Beta sitosterol
-Mono and polyunsaturated FA(s) (linoleic, oleic acids)
-Cholest-5-en-3-ol
-Branched FA(s)

FIGURE 6: Experiment and partial chromatogram of R03 (C3/C4 plant + animal expriment).

3 Animal experiment

COMPOUNDS OF INTEREST
-Odd chain FAs
-Oleic acid
-Poly-unsaturated FAs.
-Cholesta-2,4-diene

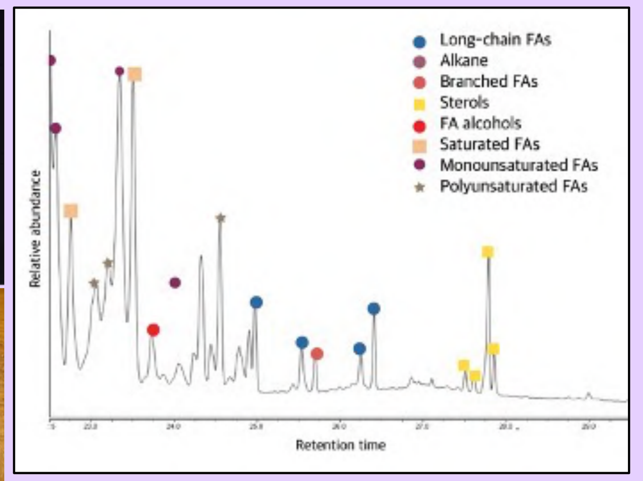


FIGURE 7: Experiment and partial chromatogram of R07.

4 Plant-based (x4) with final animal experiment

COMPOUNDS OF INTEREST
-Even-numbered long chain FA(s)
-Beta-sitosterol
-Mono- and polyunsaturated FA(s) (linoleic, oleic acids)
-Cholest-5-en-3-ol

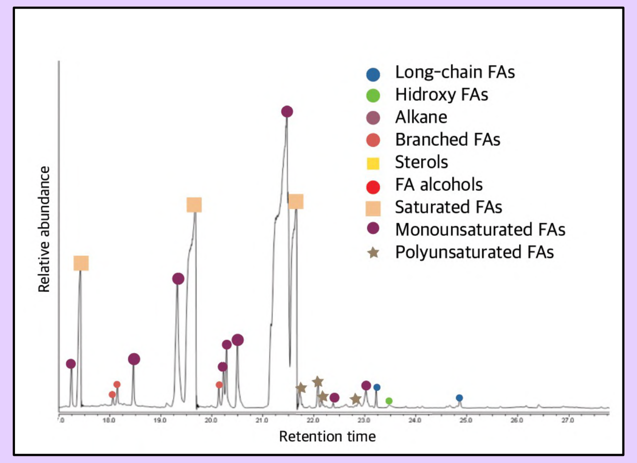


FIGURE 8: Experiment and partial chromatogram of R08.

CONCLUSIONS

(1) Plant-based experiments display stable isotope values compatible with the main ingredients used, although we observe that maize tends to mask the contribution of C3 plants. Mixed plant and animal experiments exhibit differences in $\delta^{13}C$ $\delta^{15}N$ reflecting the contribution of animal fats to the residue.

(2) Lipid profiles reflect clearly the types of ingredients (plant vs. animal foods) used for cooking. In plant/animal mixtures, animal fats do not overlap completely plant's waxes and oils fingerprints. Yet, fine-resolution mixture are undetectable in lipid profiles, rather lipid profiles seem to represent a promediated snapshot of several uses.

(3) Experimental lipid experiments offer an opportunity to enhance the interpretation of archaeological food residues in Formative Period (ca. 200 BC-AD 900) Argentina providing a framework to identify plant processing and consumption in high-altitude environments.

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REFERENCES