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Science-ing Ceramics in the Southern Andes

Erik J. Marsh, Cecilia Frigolé, and Rosa Moyano from Laboratorio de Paleo-Ecología Humana and Facultad de Ciencias Exactas y Naturales write the final entry in the series dedicated to The Senses and Aesthetics of Archaeological Science. Responses follow from co-editors of the issue, Andrew Roddick and Colleen Morgan.

Science-ing Ceramics in the Southern Andes

Erik J. Marsh, Cecilia Frigolé, and Rosa Moyano

Here in Mendoza, Argentina, the last few years have been lively times for science-ing ceramics. Besides the classic field interactions with sherds during survey and excavation, we have been exploring a variety of laboratory approaches to ceramics, such as petrography, experimental reproductions, Atomic Absorption Spectrophotometry (AAS), and X-ray Fluorescence (XRF). The basic idea is to identify materials used by potters and to see if they were made locally or not.

One central problem is mobility. Beginning around two-thousand years ago, hunter-gatherers (or pastoralists?) in the region started using ceramics and should have become sedentary... but didn't. Continuing to hunt and now with llama herds, they stuck to their seasonal comings and goings through and over the Andes. It seems that they saw these high and foreboding mountains as less of a barrier and more of a conduit. The laboratory's working hypothesis is that many of the settlements near Mendoza were seasonally occupied by people who spent the rest of the year on the other side of the Andes.

Were potters traveling with raw materials or finished vessels? From where and how far? Or did they not bring anything with them and make new vessels with local materials?

It is not simple to identify potting ingredients from archaeological sherds. Potters move around, collect materials from different places, and mix them together. The materials themselves could be geological mixtures. A kiln's heat renders a transformation that turns the whole into more than the sum of the parts. Only then is a vessel used for cooking, storage, and transport.

Deciphering a potter's recipe is like savoring a rich Bolognese sauce. Can you taste the basil? The subtle rosemary? Or was it a unique combination of flavors? The spices might not even matter that much, but instead how much time it spent simmering. Great cooks say the secret is love and tears, just like archaeological field and lab work.

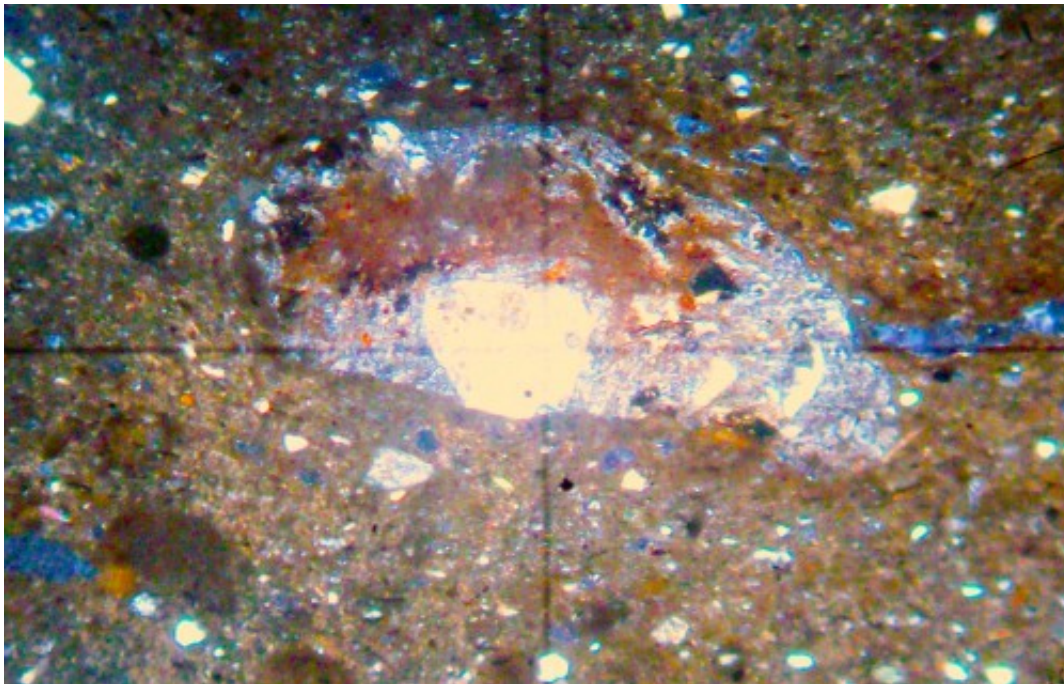


Figure 1. Thin section with metamorphic temper from ARQ-18.

First, we tried to identify individual recipe ingredients. For example, near a high-altitude archaeological site in the Province of San Juan, we fired and tested locally available clays, none of which could produce vessels similar to the high-quality archaeological sherds. Using the laboratory's petrographic microscope, we identified metamorphic temper (Figure 1); this was unusual because there are no metamorphic outcroppings in the area. Turning to geological maps we identified possible sources of this temper, the closest of which was over 50 km from the site. Neither the temper nor the clay seemed to be local, and the geological map gave us an idea of where potters acquired (and probably made) this vessel.

Second, we experimented with methods that offer composite chemical signatures of the total recipe, AAS and XRF. Relative proportions of trace elements were compared in archaeological

and experimental vessels, which have in some cases were similar or different enough to infer local or non-local production. Most pottery in the region is undecorated, so we focused on distinguishing paste types and elements.

AAS results can be directly compared to those from portable XRF instruments. These “pistols” are very expedient for large samples, even though the sensitivity and data resolution is much lower than with neutron activation. A few months ago we ran our first sets of portable XRF analyses with the help of a team that has been using this approach with obsidian for many years, part of long-standing collaboration with Michael Glascock and the MURR archaeometry laboratory.



Figure 2. The XRF team in the recently christened Laboratory of Human Paleo- Ecology. The portable XRF unit and the screen with the dancing chemical curves are to the right, and the players, from back to front, are Ramiro Barberena, Michael Glascock, Valeria Cortegoso, and Martín Giesso. Víctor Durán was hiding in this photo, but couldn't escape the visiting reporter. Thanks for all your help and support.

After convincing the obsidian freaks to let us have a turn (Figure 2), we ran XRF analyses of clays, experimental vessels, and archaeological sherds. In these preliminary tests, we wanted to control for a few potential sources of variability, so we ran analyses on different parts of sherds (interior, exterior, and profile) and with different pre-treatments (direct from the field and unwashed, washed with distilled water, cut and sanded profiles). Our impression was that these factors had little impact on the overall patterns.

While running the tests, we watched in real time as X-rays bounced back and forth. The chemical curves bumped and flowed, and seemed to be telling us that there were at least two different chemical signatures for pastes and clear differences in paints and slips (we will see if this is borne out by a proper treatment of the data!). This informal interaction with the ceramics and X-rays generated ideas, speculation, and discussion in the laboratory. Far from the visceral experience of excavating the sherds, here it felt like we were collectively working on the subjective crux of the scientific method—generating hypotheses, inspired ideas, or sometimes just fancy guesswork. The laboratory experience gave us enough space to speculate creatively without knowing the results. This aspect of the multi-faceted craft of archaeology seems to have enriched potential interpretations of the yet-to-be-seen final numbers.

As results from different analyses begin to come back, we hope to savor some of the spices in the recipe and detect how potters mixed and matched them. By comparing and contrasting methods, we hope to tease out patterns and identify the most effective methods for different situations. These patterns are important pieces of the puzzle of the movements and practices of Mendoza's ancient potters.

Recipes of the past: In and Out of the Laboratory

Andrew Roddick

In their short piece Marsh, Frigolé, and Moyano present the research they have been conducting into Argentine ceramics. Drawing on analytical techniques from the geosciences to identify minerals and trace elements, the authors are interested in exploring trade interactions of population around Mendoza. They suggest we think of research into pottery paste recipes as analogous to “savoring a rich Bolognese sauce.” As a fellow ceramicist, I couldn't agree more. The use of “recipe” for the constituents of ceramic pastes is useful, and one that has been used for quite some time.



Pottery sherd from Late Formative highland Bolivia
showing the mineral constituents of a paste recipe.

As it is our last post on the sensorial in archaeological science, I'd like to tease out the sensorial elements a bit further. The authors in this post suggest that the work in the laboratory is far from the visceral aspects of excavation, suggesting that the lab is a unique kind of scientific space. Given the previous blogs in this series, I do wonder if that's quite right.

“Archaeology relies on the embodied expertise of individuals, but the common perception of ‘good science’ within the broader scientific community and among the general public is that science is impersonal. Paying more attention to how archaeologists do, in fact, produce knowledge in the field would require drawing attention to the centrality of embodied expertise to archaeological practice.” (Leighton 2015)

Their use of the Bolognese analogy does do some important sensory work for us. As any decent cook will tell you, your recipes is right when it smells, tastes right, and when the texture feels and even sounds right. Similarly, and as mentioned in a previous post, the sensorial elements involved in the production of pottery must go beyond the visual. Many of the technological choices might be linked to other elements. The potters I have been spending my time with stress that the final product must sound right to sell. This past summer I watched for hours in local markets as vendors (who sell but did not produce the vessels themselves) demonstrated the quality of the recipes by demonstrating the hardness, texture and sound of the cooking pots.



Pottery vendor in La Paz, Bolivia demonstrating her procedure (but common to all vendors and many buyers), which involves the use of a safety pin to check for proper texture and sound.

Taste is similarly at work in the use life of a vessel. This can include for instance, the tasting of clays by producers, and perhaps the smell of souring clays. But it is also about how the fabric interacts with the food being consumed. For instance, I have spoken with women who travelled vast distances specifically to buy a particular pot from a particular potter, claiming that they simply taste better in pots from this community. In the American Southwest, Pueblo potters produce waterproof micaceous vessels, glittery vessels that please the eyes. However, many still seal the vessels with oil as a final component of the recipe to keep food from tasting too earthy (Trimble 1993: 33). Marsh et al. stresses that a kiln transforms clay into something distinct and new. So too does a lifetime (or more) of use of a particular vessel. Such old, cheap, yet cherished things look, cook and taste different.



A cooking pot that has been used for three generations in the highlands of Bolivia.
"Simplemente tiene mejor sabor!" (It just has a better taste!)

As always, some of these sensory elements may initially appear too fragmentary to access, but there are some research lines beginning to explore these possibilities. My current Master's student is working to combine paleoethnobotany and ceramics to explore foodways through pots. She is finding an exciting scholarship of microarchaeology and lipid analysis, but also of ceramic technology and ancient recipes – both on particular continents and associated with specific technologies. This, of course, permits those in the field house, the classroom, or even the brewhouse to enjoy new tastes and perspectives on the past.

Such approaches, however, are also providing new kinds of questions for those of us investigating the movement of pre-Columbian ceramics: Were potters moving pots because of different tastes in vessels or foods? Did they get drawn into a distinct sensory environment when they were deployed? Like Colleen Morgan's comments below, I wonder if such admittedly creative questions are answerable. But I do believe (and as the posts in this series clearly demonstrate) it is useful to both reflect on both our own embodied expertise as well as that of the people we wish to know in the past.

Leighton, Mary

2015 Excavation methodologies and labour as epistemic concerns in the practice of archaeology. Comparing examples from British and Andean archaeology. Archaeological Dialogues 22 (1): 65-88.

The Creativity of Potheads

Colleen Morgan

Why would you carry a pot?

Would you carry something in it? What could you carry in a pot that you couldn't carry in a basket? A wooden box? A perfectly dried gourd? Do you need it to make something? Something special?

How would you carry a pot?

Would you lash it to your llama? Make your child carry the pot, carry it very carefully up the mountain? Put it in a sack? Wear it like a hat? Can it stack with other pots?

What is your pot worth?

Is it worth more because your mother made it? Is it worth less because one of the handles was knocked off when you got up in the middle of the night to see what the dog was barking at? Is it replaceable? Can you work up another one in an hour? A day? Is there a fortnight of planning, gathering materials, firing your kiln, appeasing some capricious god of ceramics that bursts your pots at the seams?

What is your pot?

Do you take personal pride in the pot? Do the thumbprints and faint decorations wind a story around your senses? Or is it like a pair of socks? So much temper and finely ground clay, a bit of water, there you go. Is it seen as a separate entity from you at all, or is it part of a galaxy of objects that move around in your daily life, pushing and pulling on your flesh, your self? Is it as much part of you as your eyebrows? Is it as much part of your kin group as it is part of you? Is it an alien creature that emerges from the fire, threatening, barely tamed?

It's probably for the best that I don't study pottery.

The questions above fall somewhere between testable and questionable, probably a stretch from what is it made of and subsequently what does it mean. Many scientists get very impatient with such nebulous brainstorming, unwilling to venture into the clouds above Hawkes' Ladder of

Inference. The patient scientists will explain that using current methods we can't know for certain and it would be difficult to speculate.

My favorite scientists will turn over the pot, put it on their head, and say: "it's possible." Then: "how could we test for that?"

I was encouraged to read that such creative speculation was winging around in the lab with Marsh, Frigolé, and Moyano as they contemplated the potters of Mendoza. After the long delay in the publication of this post, they might even have a few of the "final numbers" that they are looking for. Rather than constricting possibilities, sourcing results can open up a whole new range of questions, and that is the joy of materials science in archaeology.

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Colleen Morgan recently received her Ph.D. in Anthropology at the University of California, Berkeley. After receiving her B.A. in Anthropology/Asian Studies in 2004 at the University of Texas, Colleen worked as a professional archaeologist. Since that time, she has worked in Turkey, Jordan, Qatar, England, Greece, Texas, Hawaii and California, excavating sites 100 years old and 9,000 years old and anything in-between. Her dissertation is based on building archaeological narratives with New Media, using digital photography, video, mobile and locative devices. She is deeply interested in excavation methodology, high falutin' theory, interstitial spaces, skeuomorphs and good bourbon.

[View all posts by Colleen Morgan →](#)

📅 September 29, 2015 👤 Colleen Morgan 📁 Archaeological Science 💎 Archaeology, archaeometry, pottery, xrf
