ONLINE RESOURCE 1
REFLECTIVE LIGHT MICROSCOPY AND ATTRIBUTE ANALYSIS

Ceramic Production and Exchange in the Chavín Heartland: An Archaeometric Study from Canchas Uckro (1100-800 BCE), Ancash, Perú
Submitted to: *Archaeological and Anthropological Sciences*

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This supplementary information highlights the findings of reflective light microscopy (RLM) using a handheld DinoLite microscope, which took place during the 2018, 2019 (Model # AM4815ZTL). Analyses focused primarily on characterizing general paste recipes within each site's ceramic assemblage, emphasizing the identification of mineral aplastic inclusions (following procedures outlined in Druc 2015). Sampling for RLM focused on diagnostic materials, selecting at least ten sherds from each site context.

Several images of each paste group are presented to illustrate the variability encompassed within identified groups; each image is approximately 5mm wide. Summary tables and charts relate paste groups to other technological features, such as vessel forms, decoration, surface finishing techniques, firing regimes and excavation contexts to consider diachronic trends in manufacture process and assess evidence for technological continuities.

Canchas Uckro (n=160)

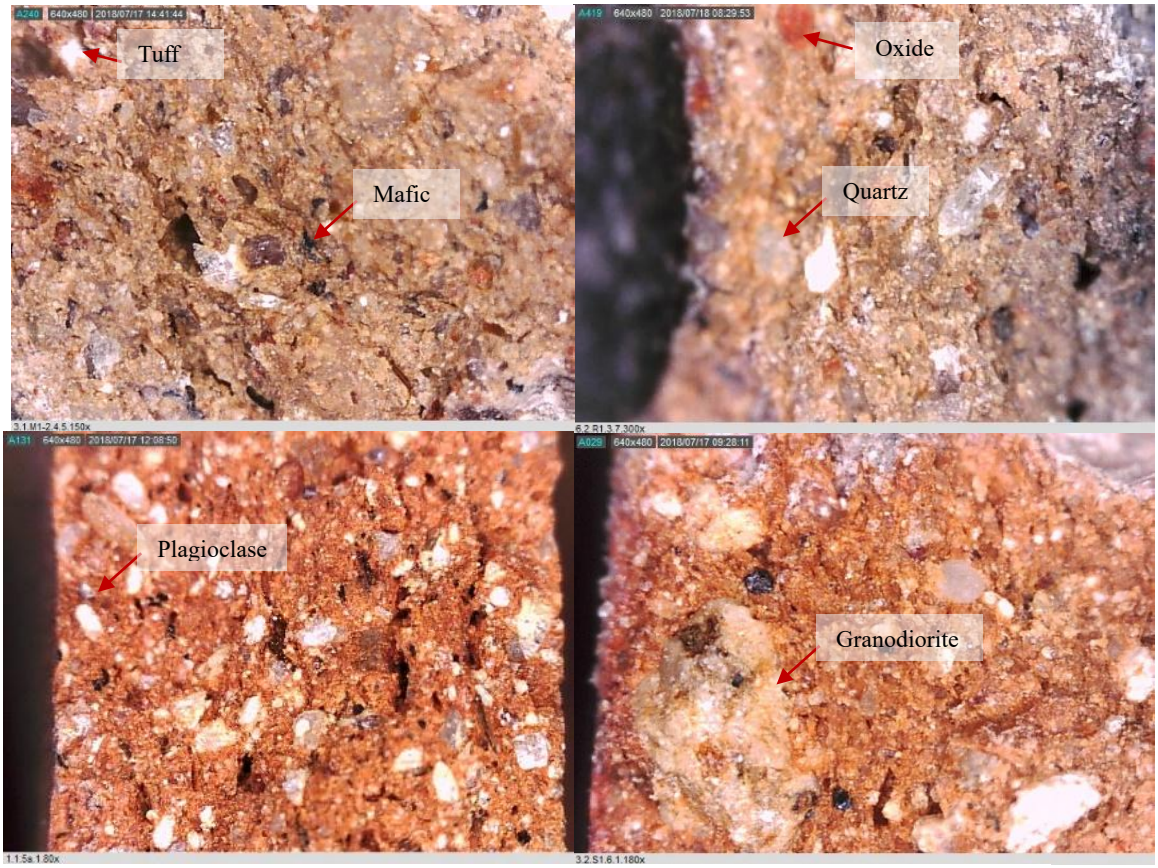

Figure A-1. Felsic Sand Paste (n=59, 37%); This group generally combines "Micaceous" and "Granodiorite" groups (Johnson and Nesbitt 2019, Nesbitt et al. 2021). It is dominated by felsic mineral inclusions, such as quartz, plagioclase, and mica, as well as intrusive volcanic rock fragments and more limited tuff fragments. Accessory inclusions include red oxides and mafic (back) minerals. These materials represent the one of two dominate paste types identified within the assemblage.

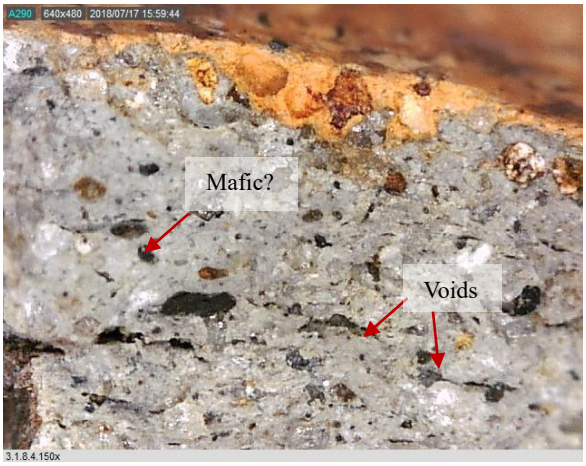

Figure A-2. Outlier Paste: Fine gray paste with a high proportion of voids, dark grains, quartz, and red oxides, accompanied by unique orange slip (n=1, <1%).

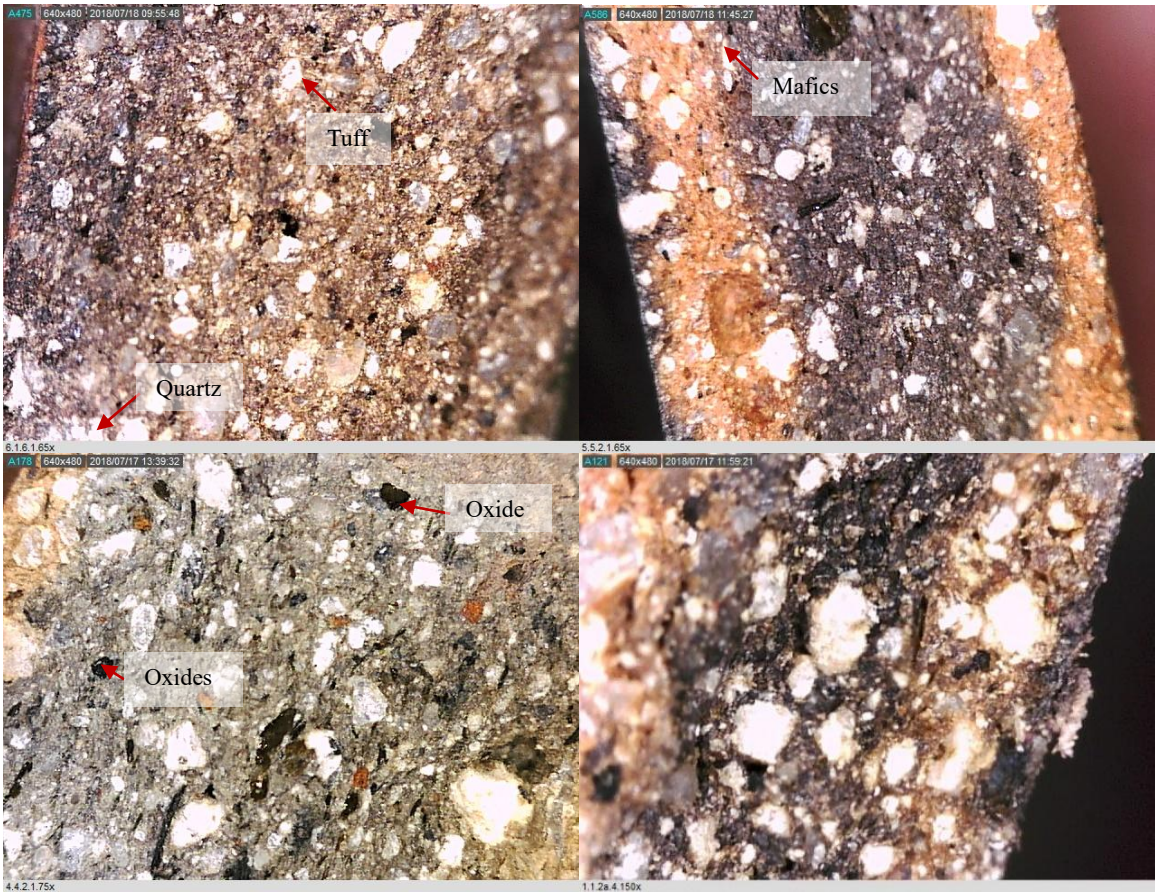

Figure A-3. Tuff Paste (n=33, 21%): tuff temper inclusions are generally angular to sub-angular, moderately sorted and accompanied by quartz (clear and reflective grains), mafic minerals, such as hornblende or other amphiboles (black grains) and red iron oxides. These materials were initially grouped with the "granodiorite" paste, however, further review distinguished volcanic inclusions from intrusive rock fragments.

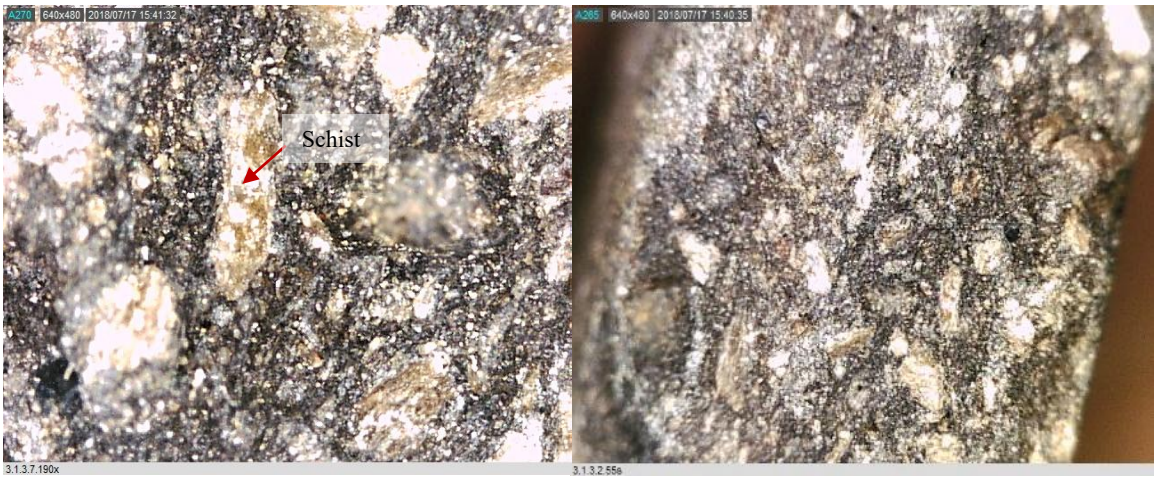

Figure A-4. Schist Paste (n=4, 2%): this group is defined by the inclusion of schist fragments. High mica content gives both the clay and the inclusions an identifiable sheen. There are few other mineral inclusions outside of black oxides.

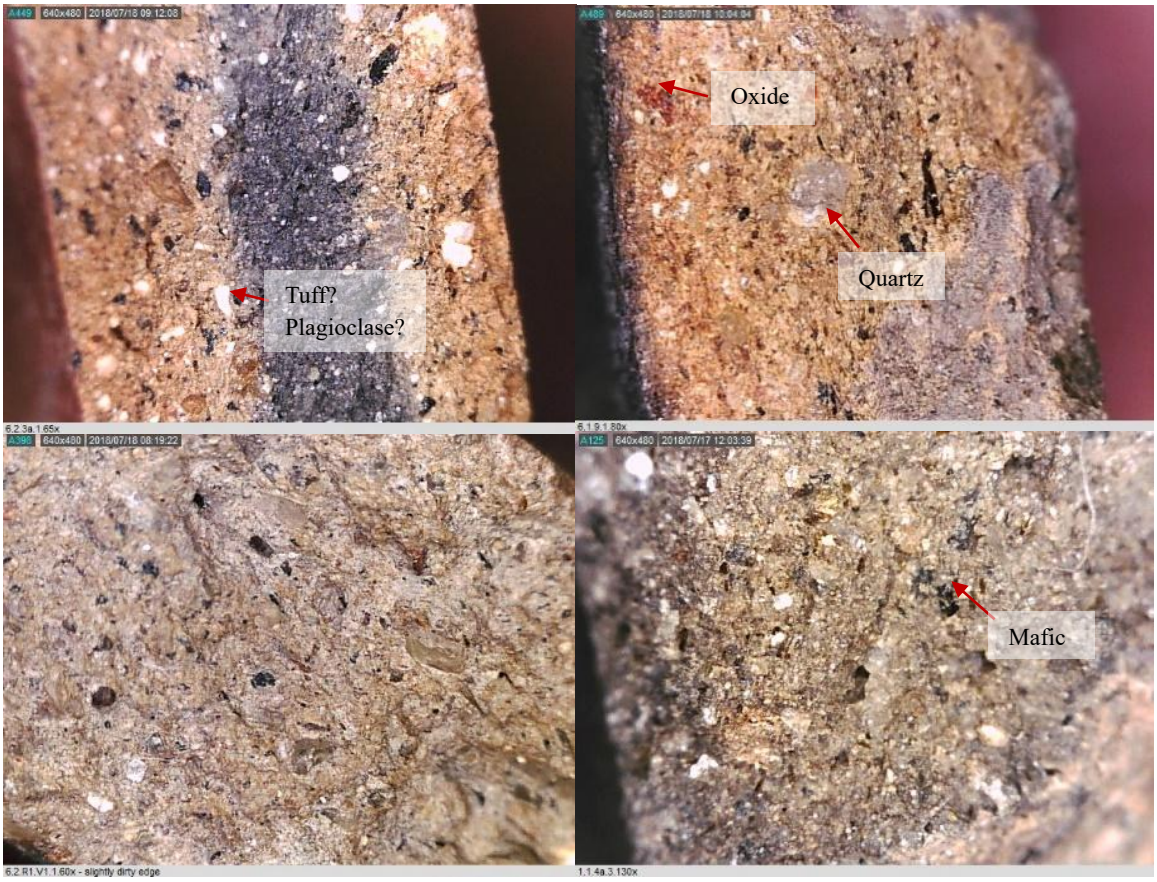

Figure A-6: Fine Felsic Sand Paste (n=51, 32%): These materials are similar to the previously described felsic sand paste; however, the inclusions are generally finer and better sorted. Additionally, there is a higher portion of mafic grains, relative to felsic inclusions. Of note: geochemical and petrographic study later identified the top left artifact (CU-99) as a probable import, illustrating the difficulty of relying on seemingly minor paste differences to generate technological groups.

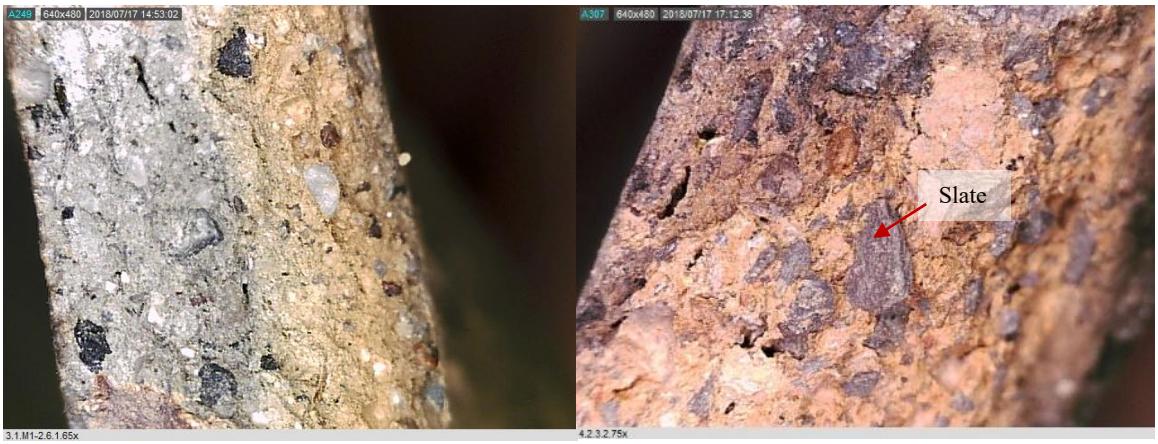

Figure A-5. Slate Paste (n=11, 7%): this group is defined by dark metamorphic rock inclusions with variable carbon content, broadly termed slate. In generally, these inclusions are sub-angular to sub-rounded, suggesting the natural inclusion or the intentional addition of weathered slate grains. Though sate was available nearby, this paste's low prevalence suggests these materials represent a "nearby" technological tradition.

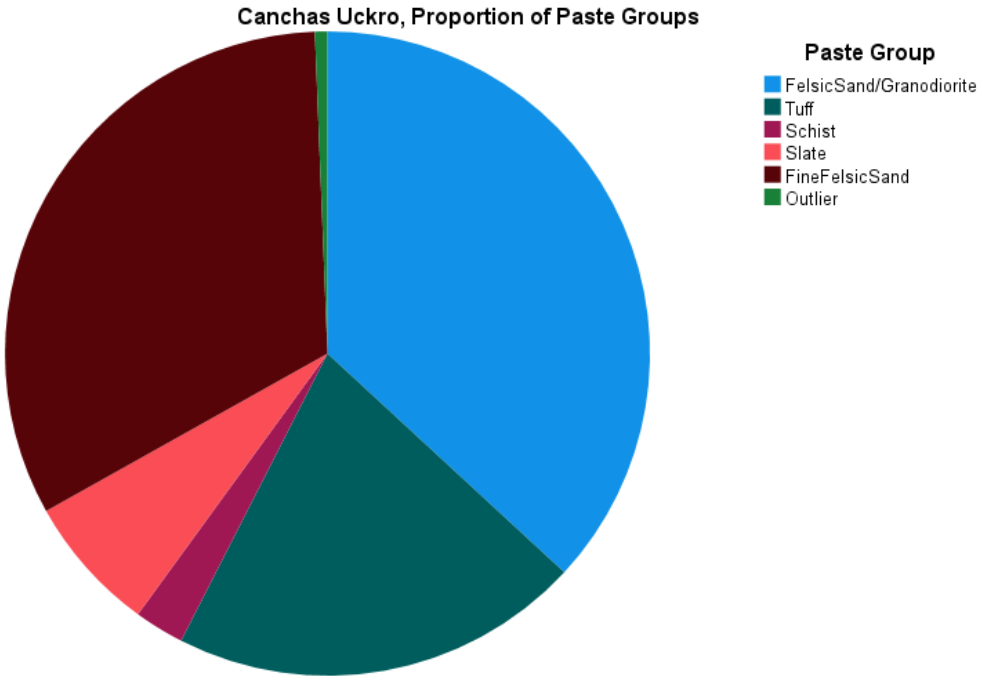

Figure A-7. Canchas Uckro proportions of different paste groups. There are 2 or 3 predominant paste groups (two similar felsic sand-tempered styles and a tuff tempered style).

Table A-1. Canchas Uckro Paste Counts, Unit 1

Paste Category	Layer 1	TOTAL
Felsic Sand	2	2
Tuff	2	2
Schist		
Slate		
Fine Felsic Sand	3	3
Outlier		
	TOTAL	**7**

Table A-2. Canchas Uckro Paste Counts, Unit 3

Paste Category	Layer 1	EM 1-2	EM 1-2	DM 2	TOTAL
	1	1	2	4	
Felsic Sand	1	1	2	2	6
Tuff			1		1
Schist	1				1
Slate			1		1
Fine Felsic Sand	1		3		4
Outlier	1				1
				TOTAL	**14**

Table A-3. Canchas Uckro paste Counts, Unit 4

Paste Category	**Layer** 1	1	1	1	EM 3-4	DM 3	
	1	2	3	4	1	1	TOTAL
Felsic Sand		5	1		2	2	10
Tuff		1		1			2
Schist							0
Slate	1		1			1	3
Fine Felsic Sand		3	4		2	1	10
Outlier							0
						TOTAL	**25**

Table A-4. Canchas Uckro Paste Counts, Unit 5

Paste Category	**Layer** 5	5	5	5	5a	5a	5b	5b	5b	
	1	3	4	EM 3-4	1	2	1	2	4	TOTAL
Felsic Sand	3	1			5	1	4	2	1	18
Tuff			1	1			3	2	2	9
Schist								1		2
Slate	3						1			5
Fine Felsic Sand	1	1		1	5	1	1		1	11
Outlier										
									TOTAL	**45**

Table A-5. Canchas Uckro Paste Counts, Unit 6

Paste Category	**Layer** 6	6	6	AS1	S1	
	1	2	3	1	1	TOTAL
Felsic Sand	2	5		1	2	10
Tuff	1		1	2	2	6
Schist				1		1
Slate						0
Fine Felsic Sand		2	1	7	2	12
Outlier						
					TOTAL	**29**

Artifacts from surface collections or profile cleanings that lack stratigraphic control (n= 16) are not included in these object paste counts. The RLM sample was intentionally designed to cross-cut different contexts to consider technological differences between different areas at the site. Altogether, review of the data shows that most paste types are associated with most contexts, suggesting no real differences. Furthermore, the distribution between different types are roughly similar for each context, with roughly equivalent felsic sand and fine felsic sand sherds and a smaller proportion of tuff paste.

Table A-6. Canchas Uckro Paste Counts, Units 7B and 8C

Paste Category	Layer		
	7B	8C	TOTAL
Felsic Sand	6	4	10
Tuff	8	3	11
Schist		1	1
Slate		2	2
Fine Felsic Sand	3	7	10
Outlier			0
		TOTAL	**24**

Table A-7. Canchas Uckro, paste counts associated with dated contexts.

	Phase 1		**Phase 2**		
Unit	S1	4,2	4,2	3	4
Layer	1	DM3	EM3-4	1	3
Paste Types					
Felsic Sand	2	2	2	1	1
Tuff	2			1	1
Schist					
Slate		1			
Fine Felsic Sand	2	1	2	1	4
Outlier				1	
C14 Date	2920±20	2865±29	2775±35	2720±30	2715±25
68.3% (Mixed)	1122(62.7%)1046 1029(5.6%)1020	1051(54.1%)970 956(14.2%)932	930-832	894(20.8%)874 838(47.5%)806	896(27.2%)872 840(41.1%)809
95.4% (Mixed)	900-802 BCE	1114-921 BCE	994-820 BCE	900-802 BCE	902-806 BCE

Table A-8. Canchas Uckro descriptive statistics of sherd thickness by paste group.

Paste Type	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**
Felsic Sand	59.00	2.00	9.00	5.90	1.48
Tuff	33.00	3.00	12.00	6.06	2.09
Schist	4.00	5.00	8.50	6.38	1.49
Slate	11.00	4.50	8.00	6.36	1.32
Fine Sand	51.00	3.50	9.50	6.16	1.34
Outlier	1.00	3.00	3.00	3.00	

Review of the descriptive statistics for sherd thickness, as separated by paste group, does not identify any significant differences dependent on technological style, as the sample means and standard deviation for each group are roughly the same. Because the values are so similar, no t-tests were conducted to determine if any group is significantly thinner or thicker when compared to another technological style.

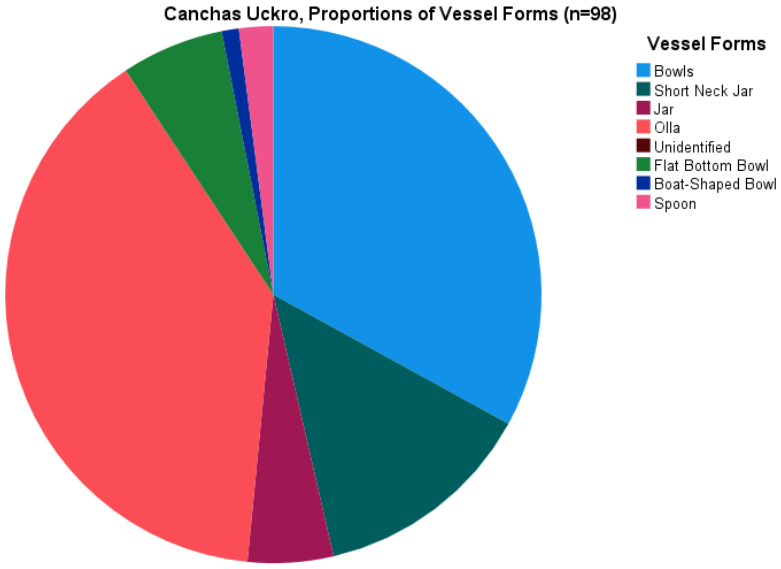

Figure A-8. Canchas Uckro, proportions of vessel forms in sample, excluding body sherds.

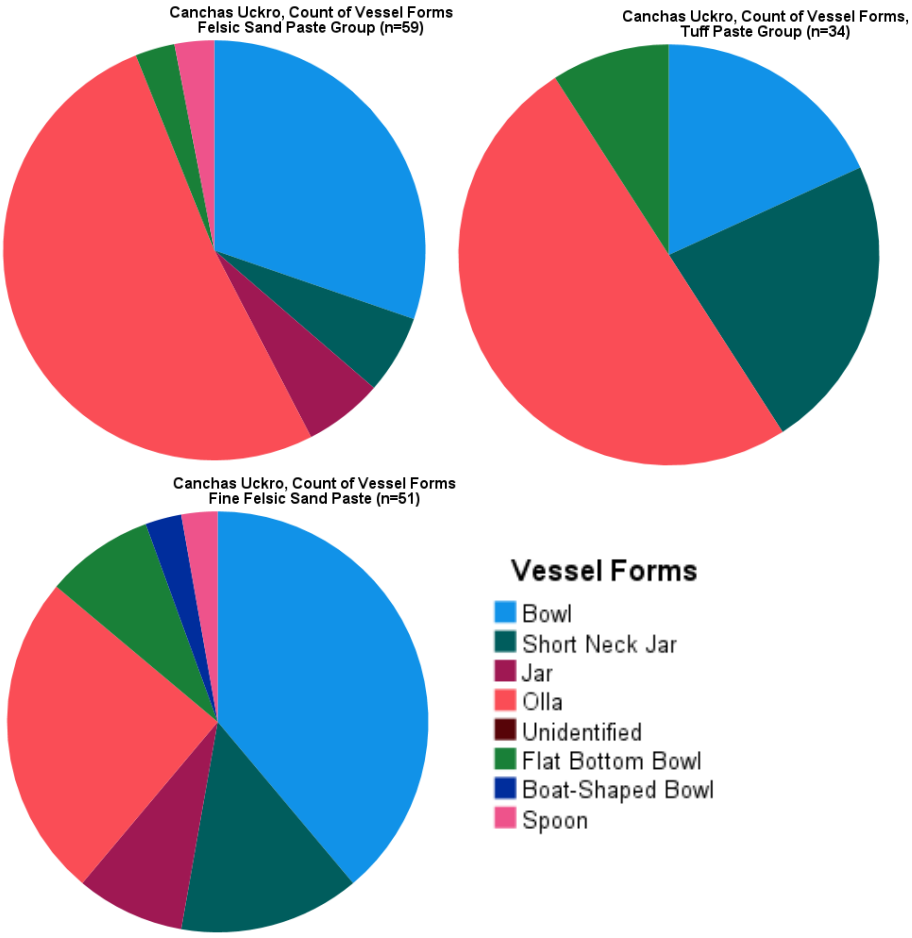

Figure A-9. Canchas Uckro, proportions of vessel forms by paste group, excluding body sherds. Slate sherds were primary associated with non-diagnostic sherds and are therefore not included.

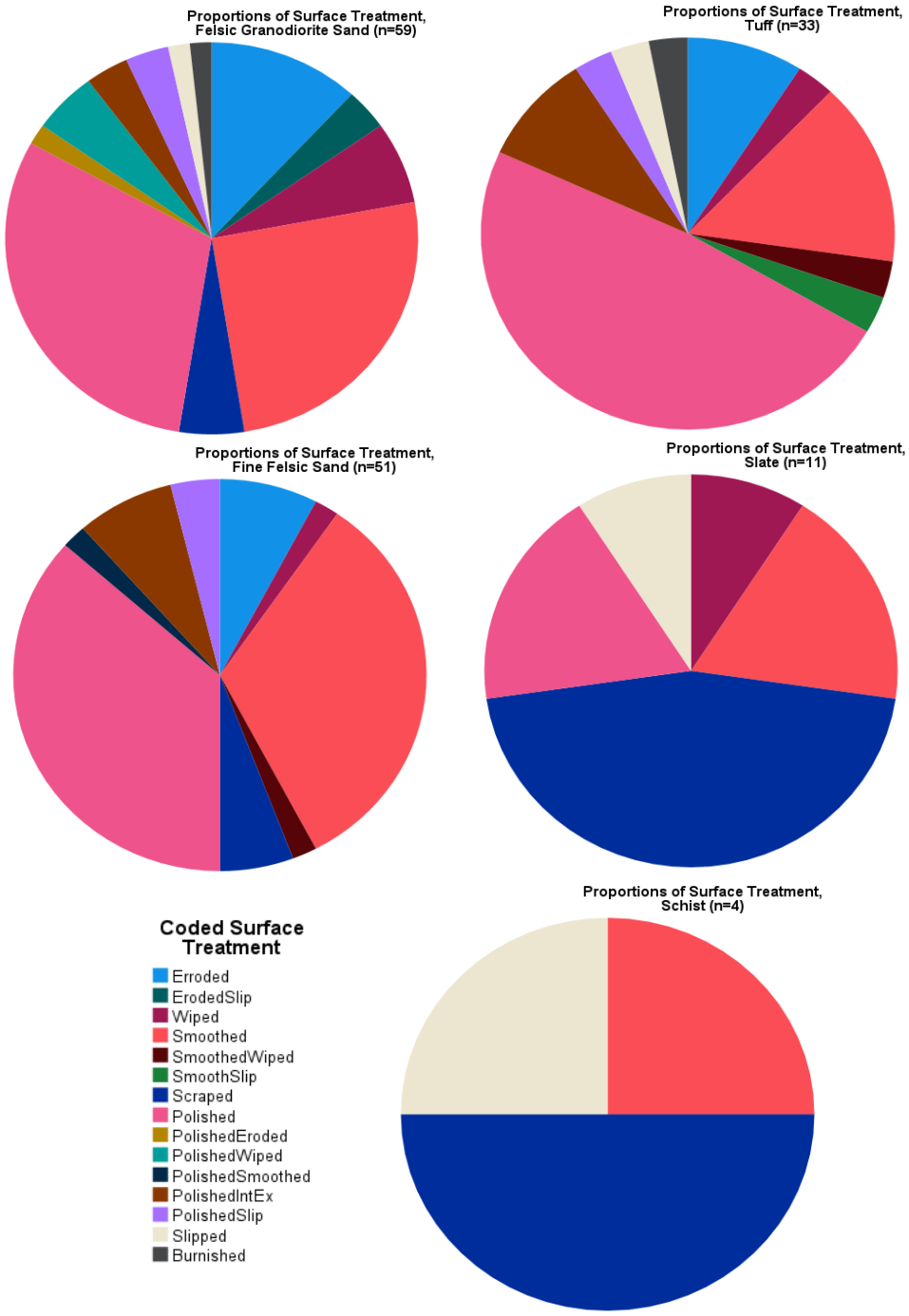

Figure A-10. Canchas Uckro, proportions of vessel surface treatments by paste group.

More utilitarian pastes, like slate and schist, are primary scrapped and smoothed
Tuff, the most decorated paste type, notably contained the highest proportion of polished vessels.
Felsic and fine felsic sand pastes contain similar proportions of many surfaces, though the felsic sand paste does contain more variations on surfaces treatments.

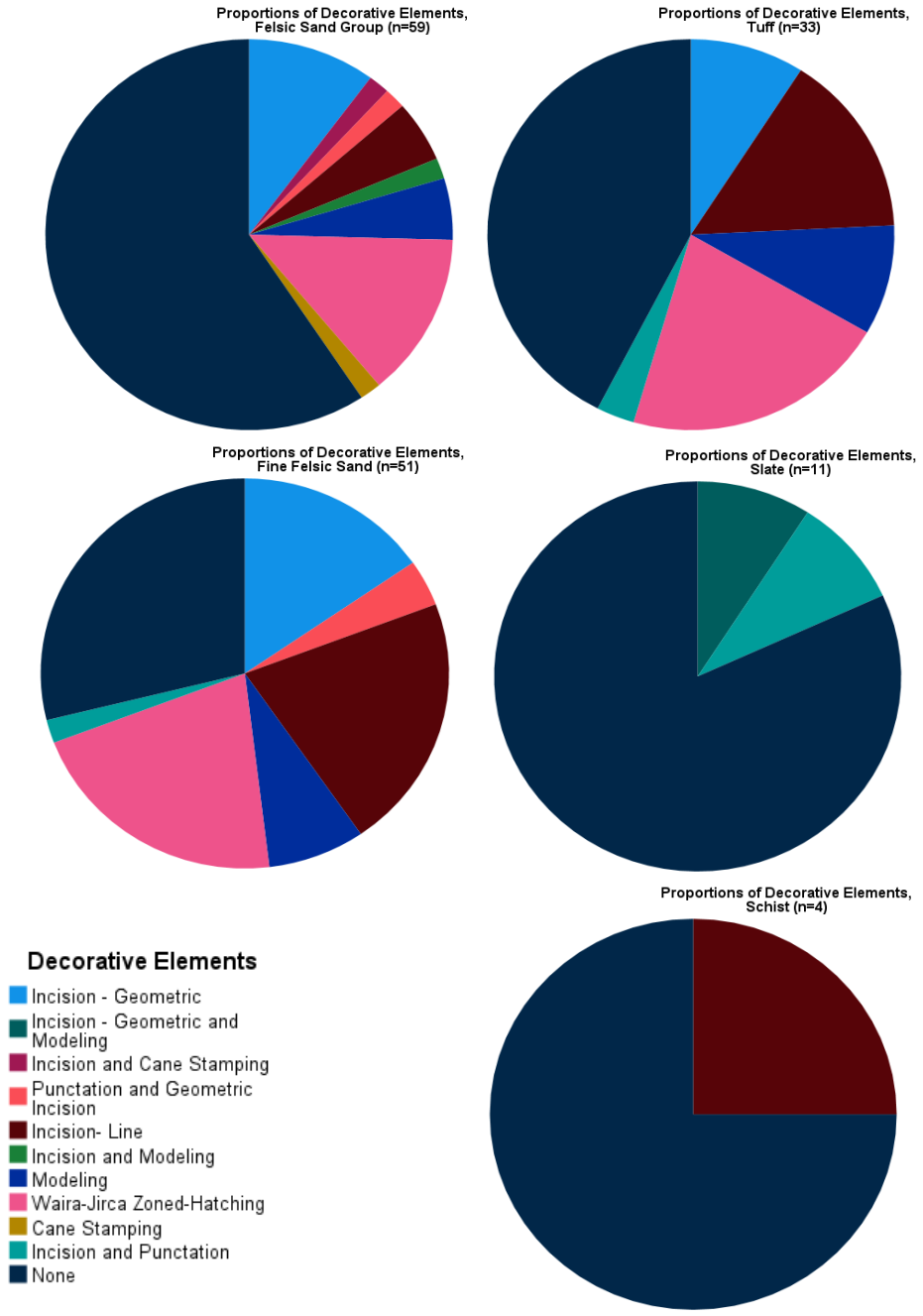

Figure A-11. Canchas Uckro, proportions of decorative techniques by paste type.

When considering the relationship between paste categories and decoration, it appears that waira-jirca designs are associated with several paste types, including the dominate types believed to be associated with local production practices. Felsic/granodiorite sand paste is primarily undecorated, with the most typical designs being incised geometric and Waira-jirca motifs. The fine felsic sand paste is by far more typically associated with decorated pieces, suggesting the size sorting of temper inclusions or potential clay sieving is associated with decorated pieces. The majority of slate and schist, though with smaller sample sizes, are undecorated.

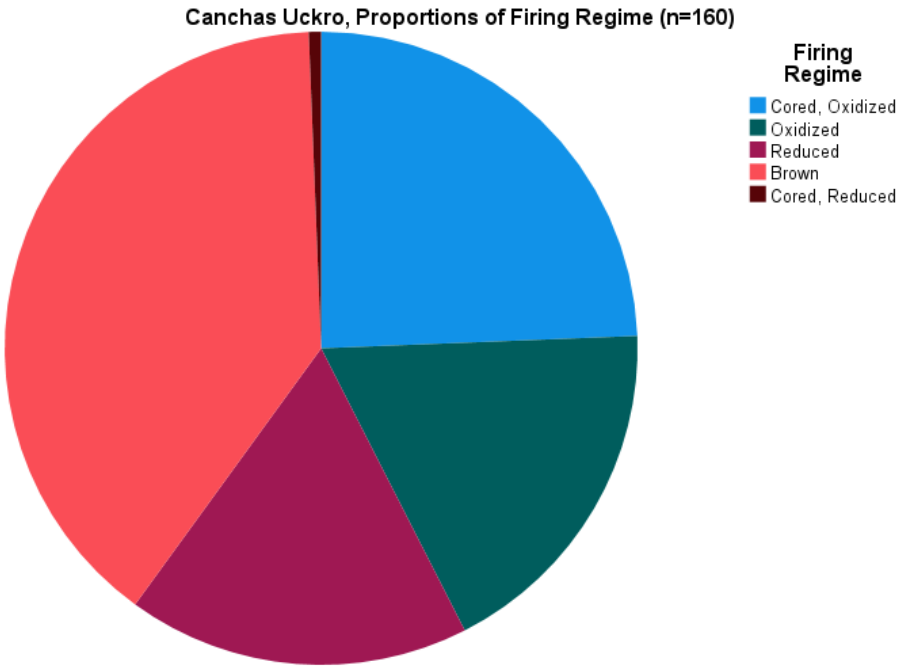

Figure A-13. Canchas Uckro, overall proportions of firing regimes.

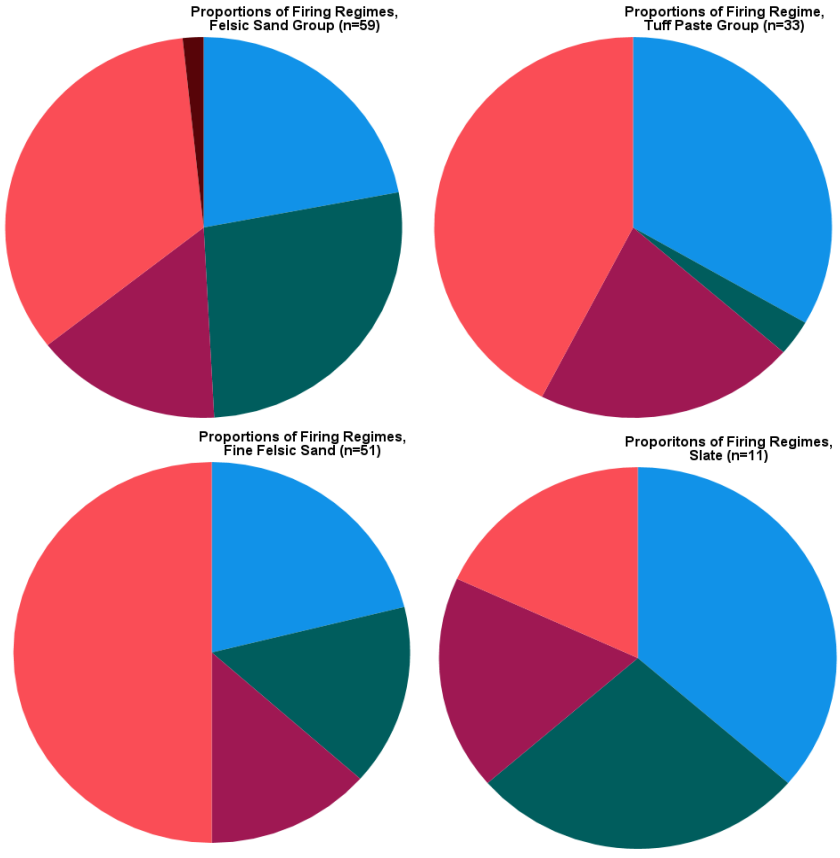

Figure A-12. Canchas Uckro, proportions of firing regimes by paste group. The tuff temper group contains less fully oxidized sherds compared to other types, while fine felsic sand temper is majority "brown/dark brown".

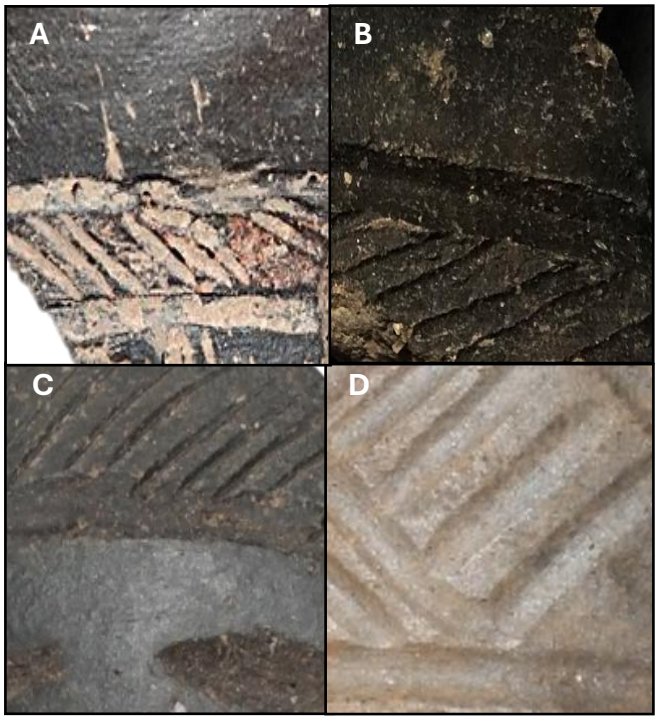

Figure A-14. Wairajirca incision types. A: Sharp, B: Wide/Dull, Narrow/Sharp, C: Wide/Sharp, Narrow/Sharp, E: Wide/Dull

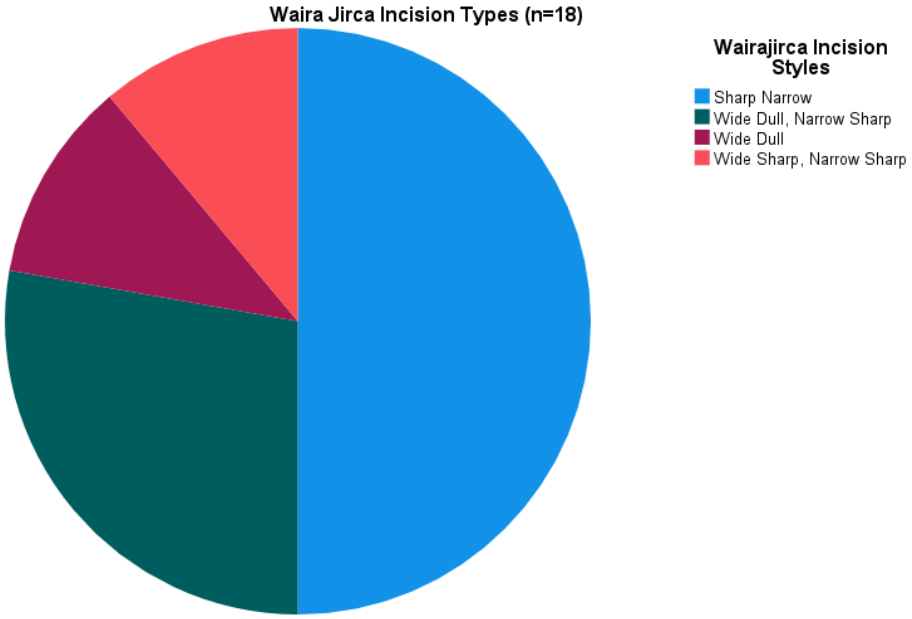

Figure A-15. Canchas Uckro, Wairajirca decorated incision types.

Incisions made with sharp tools during the leather-hard stage are the most common. The next most common technique are a combination of wide/dull bands made with a blunt too creating a smoothed edge filled with hachure made with sharper implement that creates edge scaling on the incision

Figure A-16. Results of petrographic analysis of Wairajirca related sherds. See Appendix D for further details. A single zoned-hatched sherd fits within the non-local technological group: a fragment of a boat-shaped partially-completed vessel.

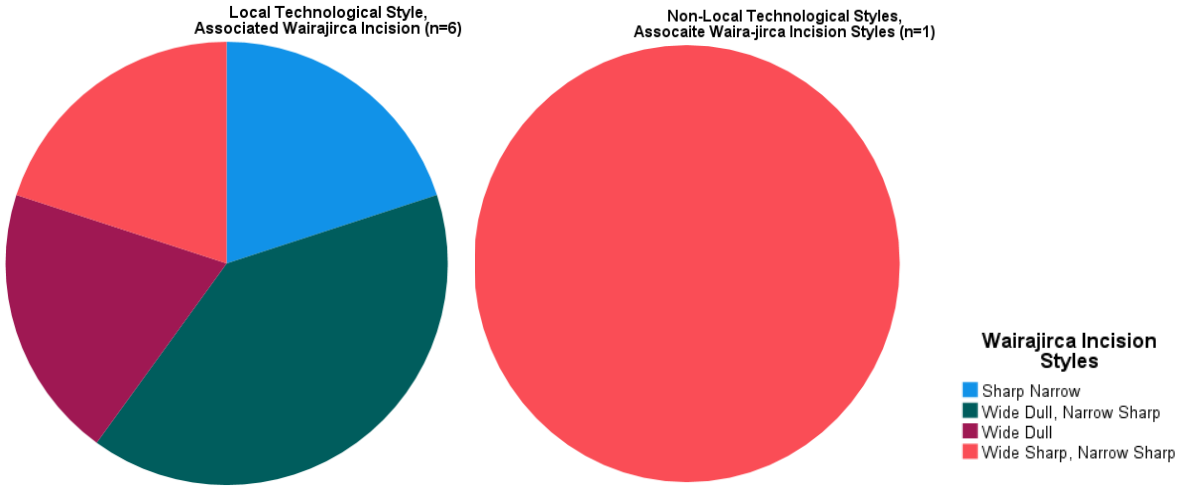

Figure A-17.Wairajirca incision types associated with petrographically-identified local and non-local waira-jirca related sherds. The small sample size of zoned-hatched non-local sherds limits wider discussion. The local assemblage within the sample contains almost every incision variation, which may point to local imitation of the foreign style.

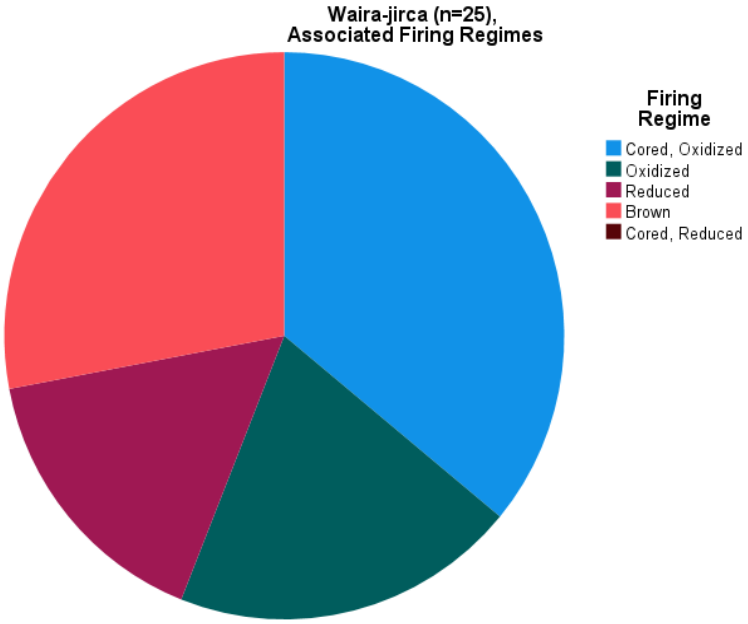

Figure A-18. Firing Regimes associated with Wairajirca style sherds, based on RLM sample.

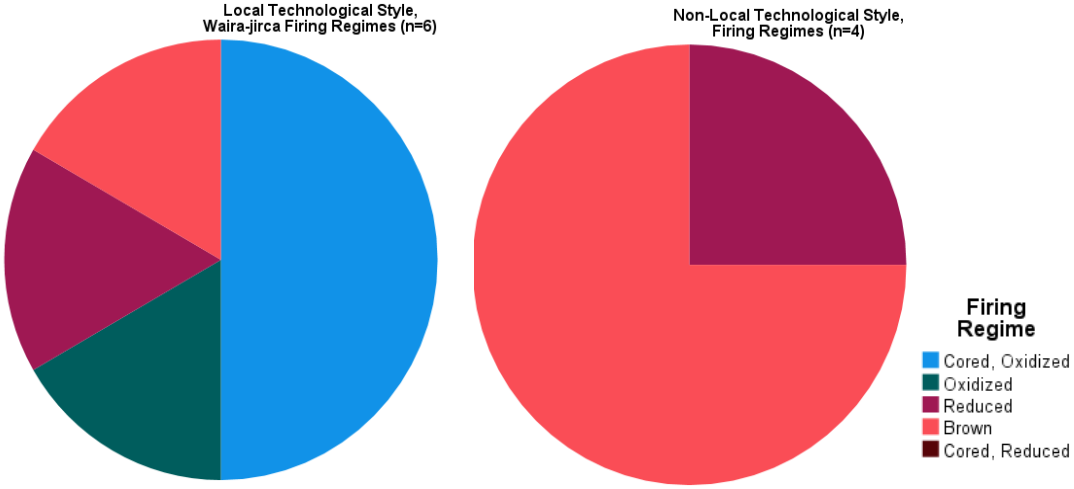

Figure A-19. Firing regimes of Wairajirca designs associated with local and non-local technological styles. Local styles tend to exhibit a higher proportion of cored pastes, while non-local styles tend to be more associated with reduced, brown, and dark brown pastes at a much higher rate than local styles.

These conclusions are drawn from petrographically identified local and suspected non-local ceramics. The Waira-jirca styles linked to local technological style contain an assortment of firing techniques that generally parallels the broader assemblage. This group contains a higher proportion of cored sherds relative to other analyzed paste types, which may suggest a distinct firing process, though the sample size limits broader discussion. Suspected non-local pastes are more typically dark in color, ranging from dark gray and dark brown, reflecting reducing firing conditions.

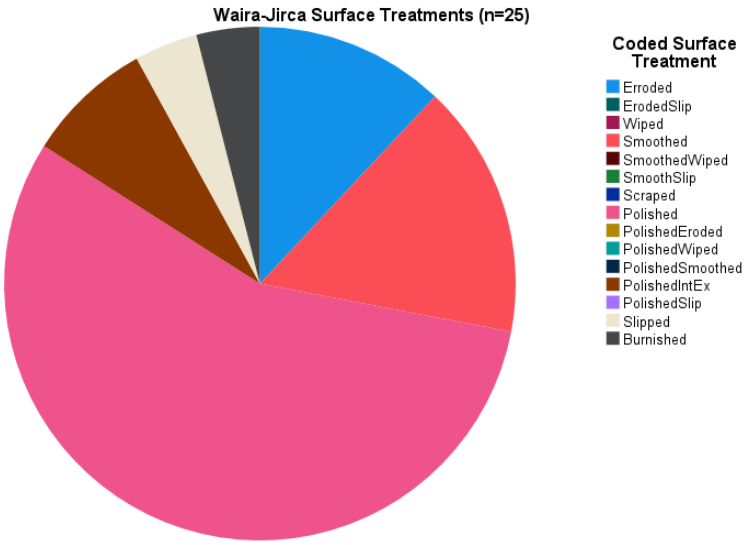

Figure A-20. Canchas Uckro, Wiarajirca surface treatments.

All Wairajirca sherds in the petrographic sample exhibited polished surfaces (n=10). There does not appear to be any significant technological differences with regards to surface treatment. In terms of decoration, the local technological style is linked to several incision schemes exhibiting a variety of skill levels. However, only one zoned-hatched sherd was clearly identified as non-local, and notably, this sherd is associated with smashed vessel found above the hearth in Recinto 1. The variation in incision skill may suggest that some of these sherds were perhaps imitations of the Waira-jirca style, as opposed to stylistic replicas in local raw materials. Furthermore, the clear difference in firing regimes may indicate that non-local sherds are more heavily associated with reducing firing regimes. Local firing techniques instead produce a variety of cored, oxidized, and reduced cross sections.