

# UC Berkeley Archaeobotany Laboratory Report #82: Pachacamac, Peru archaeological *Capsicum* seed analysis, Katherine L. Chiou and Christine A. Hastorf

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## Background

Research conducted in the last few years and published in the 2014 article “A systematic approach to the identification of chile pepper (*Capsicum* spp.) seeds: Establishing the groundwork for tracking the domestication and movement of chile peppers through the Americas and Beyond” suggests that *Capsicum* seeds are morphologically distinct and can be identified based on the preservation and several diagnostic attributes (Chiou and Hastorf 2014). This methodology was applied to archaeological seeds from the sites of Huaca Prieta and Paredones in Peru, leading to the identification of various *Capsicum* domesticates at those sites through a period of approximately 4,000 years (Chiou et al. 2014). During the course of our research, we became interested in the prospect of gathering *Capsicum* seed data from other archaeological sites in Peru. We acquired some seeds from the Harvard University Herbaria and Botanical Museum that were given to Margaret Towle for analysis in the mid-20<sup>th</sup> century. Among the well-preserved seeds in that collection were several from the possibly Inca-period site of Pachacamac identified by Towle based on fruit morphology, and verified by our own seed identification procedure, as *Capsicum baccatum* and *Capsicum chinense*. Interested in exploring the role of *Capsicum* further, we contacted Dr. Peter Eeckhout for examples of *Capsicum* seeds from more current excavations.

Seeds identified as *Capsicum* spp. recovered from the site of Pachacamac in Peru were then exported and sent by Dr. Peter Eeckhout and Tatiana Stellian of the Université Libre de Bruxelles to Dr. Christine Hastorf and Katherine Chiou in the McCown Archaeobotany Laboratory at the University of California, Berkeley for analysis. Contextual information concerning the provenience associated with the *Capsicum* seeds was provided by Tatiana Stellian.

## Methods

Details concerning the photography and measurement methodology can be found in UC Berkeley McCown Archaeobotany Laboratory Report #77 available online at: <http://archaeobotany.berkeley.edu/Research/LabReport/lab77/lab77.pdf> (Chiou 2014).

## Results

- **Seed #P1 (Original ID: 1-1-E8-121-1-2)**

*Provenience:* The sample containing this seed comes from within a vessel found in a trench located to the south of an exterior wall of Building 8— a storage facility comprised of a large, walled patio, two rows of 10 storage rooms and a *kipu* keeper's lodge. According to the excavation data, this sample dates to the Late Horizon.

*Description:* This seed is in poor condition, lacking preservation of the central portion of the testa, endosperm, and embryo. From the general outline of the seed, it appears to maintain a circular shape with a “fish mouth” type beak, which is generally associated with *Capsicum chinense*, the chile pepper containing such varieties as habanero and specifically in Peru, *ají limo* that did exist across South America in the past. Due to the delicate preservation state of this desiccated seed, the seed was not sectioned but only photographed, as we provide here.

*Source:* Eeckhout, P. 2012. Inca Storage and Accounting Facilities at Pachacamac. *Andean Past* 10: 212-238.



- **Seed # P2 (Original ID: 1-18-E8-101-d-2)**

*Provenience:* This sample comes from one of the storage rooms in Building 8. It dates to the Late Horizon times.

*Description:* This seed is in better condition than the previous one. It appears to maintain a circular shape with a “fish mouth” type beak—both attributes suggest a *Capsicum chinense* identification. Furthermore, the attachment scar margins also appear similar to those of *C. chinense*.



- **Seed # P3 (Original ID: 2-25-P13-100-Cxeste-4)**

*Provenience:* This seed is from the cemetery excavated near the Temple of Pachacamac. It was recovered from within a vessel associated with Burial E259. This funerary bundle did not contain any human bone but did contain hair braids. The seed dates to the Late Intermediate Period (LIP). The associated C14 date indicates that the burial is dated to between ca. 1100 and 1200 A.D. (cal. 95.4%). Stylistic features of associated burial goods suggest Early Ychsma cultural affiliation (ca. AD1000-1250).

*Description:* This seed has a oval-shaped form, and appears to also be *C. chinense*. It has a large attachment scar opening, strengthening the case for the *C. chinense* identification, as well as the surface texture that appears to be smooth. Given what we can see, it is more likely to be *C. chinense* or *C. baccatum*, due to the attachment scar and shape. The beak however suggest *C. chinense* over *C. baccatum*, if a choice had to be made.

*Source:* Eeckhout, P. and L.S Owens. 2008. Human Sacrifice at Pachacamac. *Latin American Antiquity* 19: 375-398.



- **Seed #P4 (Original ID: 4-40-P13-100-Cxeste-4)**

*Provenience:* This seed is also from the same cemetery where seed #P3 was recovered in a vessel associated with the funerary bundle E232. It dates to the Late Intermediate Period, with the associated radiocarbon date suggesting a date around 1300 A.D. (cal 95.4%). Stylistic features of associated burial goods suggest Early Ychsma cultural affiliation (ca. A.D.1000-1250).

*Description:* The prominent beak and the smooth testa texture support a *C. chinense* or *C. frutescens* or *C. frutescens* identification. The beak angle suggests these two species rather than *C. baccatum* as that tends to have a smaller angle than what we see here. The attachment scar is badly preserved, making it impossible to use this in identification. In the end the imperfect data weakly supports *C. chinense*.



- **Seed #P5 (Original ID: 11-267-P13-100-d-4)**

*Provenience:* This seed is also from the same cemetery as P4. This sample is associated with funerary bundle E162. It dates to the Late Intermediate Period (no radiocarbon date available). Stylistic features of associated burial goods suggest Middle Ychsma cultural affiliation (c.a. A.D. 1250-1350).

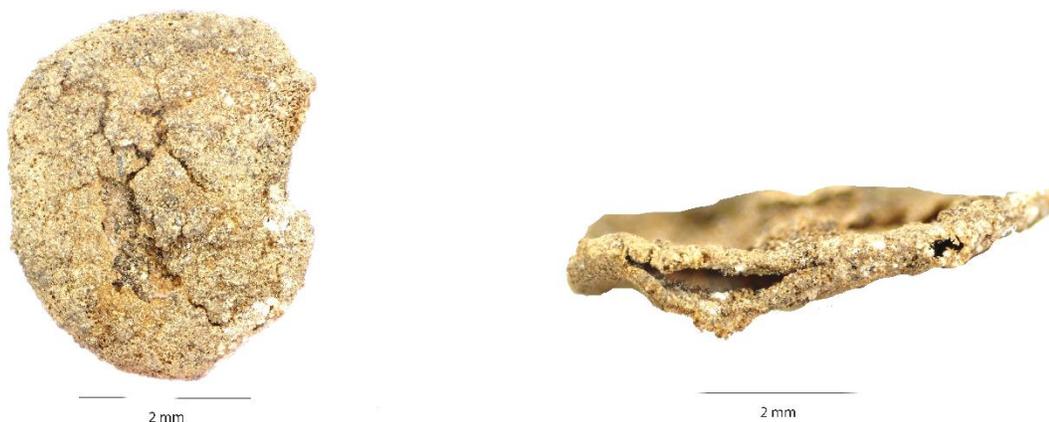
*Description:* This seed has an oval shape suggesting a *C. baccatum* identification. It has a strong beak prominence, also supporting *baccatum*. Its large attachment opening also supports this identification. It further looks like the Late Horizon samples from Pachacamac that M. Towle originally studied and we were privileged to look at recently (Chiou et al 2014). The seed, however, appears to be smaller than the ones from the Towle collection. This possible *C. baccatum* specimen measures 10.7 mm<sup>2</sup> in area while the seeds we examined from Towle's collection measured from 11.5 mm<sup>2</sup>-17.9 mm<sup>2</sup> in area.



- **Seed #P6 (Original ID: 2-15-P13-100-g-4)**

*Provenience:* This seed is again, from the same cemetery as above and was recovered from within a ceramic vessel associated with funerary bundle E156 dating to the Late Intermediate Period (no associated radiocarbon date). Stylistic features of associated burial goods suggest Early Ychsma cultural affiliation (ca. A.D.1000-1250).

*Description:* This is a circular shaped seed with a quiet beak, suggested *C. chinense*. The attachment scar is not well preserved but also supports the same identification. Due to its color it cannot be *C. pubescens*, supporting *C. chinense*.



## Discussion

While the six specimens we have studied are in relatively poor preservation, they conform to being mainly *Capsicum chinense* with potentially one *C. baccatum* and one *C. frutescens*. Several of the key attributes could be not applied in this analysis, specifically the testa surface; thus, these identifications must remain approximate. The *C. chinense* taxon was widespread in the prehistoric Andean coast from what we can see thus far in *Capsicum* species analysis. *C. baccatum* also was present along the coast and we had thought we would see more of this at this site, based on the earlier work of Margaret Towle from earlier excavations there. Nevertheless, Towle's collection at Harvard also include *C. chinense* specimens. The storage room evidence (the first two specimens) are all *C. chinense* whereas the burials include more taxa diversity, perhaps representing different groups providing burial offerings. These three taxa are all widespread across this part of the Andes in prehistory. This very small sample contains none of the highland *Capsicum* the *C. pubescens* species, informing us that these specimens in storage rooms and burials were more likely locally produced rather than being brought in from other areas.

## Bibliography

Chiou, Katherine L. 2014. *Capsicum* spp. Project Procedure for Seed Photography. University of California-Berkeley Archaeobotany Report #77. Available at: <http://archaeobotany.berkeley.edu/Research/LabReport/lab77/lab77.pdf>

Chiou, Katherine L. and Christine A. Hastorf. 2014. A systematic approach to species-level identification of chile pepper (*Capsicum* spp.) seeds: Establishing the groundwork for tracking the domestication and movement of chile peppers through the Americas and beyond. *Economic Botany* 68(3): 316-336.

Chiou, Katherine L., Christine A. Hastorf, Duccio Bonavia, and Tom D. Dillehay. 2014. Documenting cultural selection pressure changes on chile pepper (*Capsicum baccatum* L.) seed size through time in coastal Peru (7,600 B.P.-Present). *Economic Botany* 68(2): 190-202.

Eeckhout, Peter. 2012. Inca Storage and Accounting Facilities at Pachacamac. *Andean Past* 10: 212-238.

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## Appendix 1: Pachacamac *Capsicum* Data

Note: table is wrapped due to length

ID	Temp ID	Site	Genus	Condition	Possible Species	Seed Shape	Relational Length (mm)			
1-1-E8-121-1-2	P1	Pachacamac	Capsicum	D	chinense	Circular with fish mouth	4.73			
1-18-E8-101-d-2A	P2	Pachacamac	Capsicum	D	chinense	Circular with fish mouth	3.99			
2-25-P13-100-Cxeste-4	P3	Pachacamac	Capsicum	D	chinense?	Oval	3.65			
4-40-P13-100-Cxeste-4	P4	Pachacamac	Capsicum	C	chinense/baccat	Circular	3.46			
11-267-P13-100-d-4	P5	Pachacamac	Capsicum	C	baccatum/chine	Oval	3.95			
2-15-P13-100-g-4	P6	Pachacamac	Capsicum	D	chinense?	Oval	4.26			

Relational Width (mm)	RL:RW	Max Length (mm)	Perpendic	ML:PW	Aspect Rat	Perimeter	Sphericity	Area (mm <sup>2</sup> )	Diameter Max (mm)
3.88	1.219072	5.41	4	1.3525	1.36	16.56	0.6	15.32	5.45
3.38	1.180473	4.45	3.35	1.328358	1.32	19.38	0.6	10.84	4.48
2.75	1.327273	3.68	2.92	1.260274	1.29	14.94	0.58	8.35	3.7
3.13	1.105431	4.05	3.4	1.191176	1.19	18.14	0.73	9.48	4.08
3.12	1.266026	4.28	3.66	1.169399	1.2	16.73	0.68	10.7	4.31
3.21	1.327103	4.26	3.93	1.083969	1.2	26.47	0.67	11.89	4.33

Diameter Mean (mm)	Diameter I	Testa texti	Beak Prom	Beak Angl	Attachment scar length mm	Attachment scar width mm
4.87	3.99		3	30		3.03
4.03	3.37		3	25		2.04
3.5	2.86		1	23	NA	NA
3.72	3.34		4	43		1.81
3.98	3.4		3	20		1.84
4.11	3.59		1	20		1.66

Attachment scar area (mm <sup>2</sup> )	Attachment Scar Sphericit	Testa (thin 1) mm	Testa (thin 2) mm	Testa (thin 3) mm	Testa thin	Testa thick 1
1.24		0.05	0.03	0.04	0.03	0.033333
0.99		0.08	0.06	0.05	0.05	0.053333
NA	NA	NA	NA	NA	#VALUE!	NA
0.13		0.01	0.03	0.03	0.04	0.033333
0.58		0.05	0.06	0.04	0.03	0.043333
0.3		0.1	0.04	0.03	0.03	0.033333

Testa thick 2	Testa thicl	Testa thicl	Ratio (thic	Notes
0.15	0.11	0.14	4.2	H651159?
0.09	0.07	0.076667	1.4375	CS740; partial preservation on the beak so ID with caution
NA	NA	#VALUE!	#VALUE!	Can't read, seed broke after first pic
0.06	0.06	0.063333	1.9	Can't read; beak is partially preserved; embryo and endosperm no longer there
0.09	0.09	0.08	1.846154	CJ962
0.05	0.09	0.06	1.8	