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## UC Berkeley Archaeobotany Laboratory Report #75

### Pampa Grande, Argentina *Capsicum* Analysis

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Date: 4/23/2013

Three seeds collected from the Formative site of Pampa Grande, Argentina were analyzed in the University of California, Berkeley McCown Archaeobotany Laboratory using an Olympus SZ-61 microscope and an Olympus DP-72 camera. Measurements and photographs were taken using the Olympus MicroSuite program. Photographs were taken of the whole seed while lying flat and of the attachment scar. The measurements that were taken concerned whole seed and attachment scar morphometrics (see list of attributes and Excel spreadsheet with seed data). The seeds were found to be in excellent condition (desiccated), with testa largely intact. While the sizes of the seeds appear to be in the range of *Capsicum* seeds, it is possible that not all the seeds are examples of domesticated *Capsicum*.

#### Seed ID# PG1

PG1 is an oval seed with no apparent “beak,” an attribute which usually distinguishes *Capsicum* from the rest of the Solanaceae. Of the domesticated chile peppers, only *C. pubescens* exhibits little to no beak. This seed, however, does not appear to be *C. pubescens*, a taxon characterized by black seeds, reticulation in the testa, and pronounced seed margins. The seed, with its ruminate testa, could possibly be a *Solanum*. Given that our study has not included much in the way of wild *Capsicum*, that is a possibility as well.

#### Seed ID#PG2

PG2 is a round seed with a beak that appears to be *Capsicum* in nature. The shape of the seed most resembles *C. frutescens*, a chile pepper that was domesticated in the Amazon/Caribbean. However, *C. frutescens* generally display a very smooth testa texture while this one appears to be ruminate. Out of the wild seeds we have looked at, this seed also resembles *C. chacoense* and *C. galapagoense* (especially the latter), so there is a possibility that this one is wild as well. We have not studied enough wild taxa for me to determine this with confidence. I can say that it is not *C. pubescens*, *C. chinense*, *C. annuum*, or *C. baccatum*.

#### Seed ID#PG3

The beak on this seed appears to be mostly intact. PG3 is an oval seed which is generally the shape associated with *C. baccatum*. The attachment scar has a low sphericity (.02), which is exhibited exclusively among the domesticates in *C. baccatum* as well. While *C. baccatum*, generally features a longer, upright beak as well, I would say that this seed appears to be a *C. baccatum*. Although the testa has worn away in most of the central portion of the seed, the outer margins appear to be tightly reticulated, which is also seen in *C. baccatum*.

Seed ID# PG1: Top is image of whole seed; Bottom features the attachment scar



Seed ID# PG2: Top is image of whole seed; Bottom features the attachment scar



Seed ID# PG3: Top is image of whole seed; Bottom features the attachment scar



<b>ID</b>	<b>Collection</b>	<b>Country of Origin</b>	<b>Site</b>	<b>Provenience</b>	<b>Fase</b>	<b>Genus</b>	<b>Condition</b>	<b>Species</b>	<b>Seed Shape</b>
PG1	Lema	Argentina	Pampa Grande?		259-433 AI	Capsicum	Good	Solanum?	Oval
PG2	Lema	Argentina	Pampa Grande?		259-433 AI	Capsicum	Good	cf. <i>C. chacoense</i>	Circular/Pac Ma
PG3	Lema	Argentina	Pampa Grande?		259-433 AI	Capsicum	Excellent	<i>C. baccatum</i> ?	Oval

Relational Length (mm)	Relational Width (mm)	RL:RW	Max Length (mm)	Perpendicular width (mm)	ML:PW	Aspect Ratio
3.73	2.75	1.356364	3.93	3.01		1.38
3.29	2.87	1.146341	3.52	2.89		1.2
3.36	2.37	1.417722	3.52	2.63		1.42

Perimeter (mm)	Sphericity	Area (mm <sup>2</sup> )	Diameter Max (mm)	Diameter Mean (mm)	Diameter Min (mm)	Testa texture
16.29	0.52	8.55	3.97	3.56	3.56	2.84 Ruminant
15.75	0.68	7.62	3.54	3.29	3.29	2.81 Ruminant
13.34	0.49	6.87	3.6	3.22	3.22	2.52 Tight reticulation



Beak Prominence	Beak Angle	Attachment scar length mm	Attachment scar width mm	Attachment scar area (mm <sup>2</sup> )
0	0	1.5	0.18	0.24
2	40	1.07	0.27	0.18
2	15	1.84	0.21	0.36

<b>Attachment length:Relational seed length</b>	<b>Attachment Scar Sphericity</b>
0.402144772	0.02
0.325227964	0.1
0.547619048	0.02

1. Seed Shape\*  
There are several categories of seed shapes. These include Oval, Circular with Fish Mouth, Teardrop, and D-shape.

2. Relational Length  
This is defined as the length of the seed measured using the MicroSuite program. The seed was oriented with attachment scar facing right and in an "upright" position. Length was then measured on the 0° line.

3. Relational Width  
This is defined as the width of the seed measured using the MicroSuite program. The seed was oriented with attachment scar facing right and in an "upright" position. Width was then measured on the 90° line.

4. RL:RW  
This is the ratio of relational length to relational width.

5. Maximum Length  
This is somewhat of a misnomer. For the majority of seeds, the maximum length (a.k.a. "maximum diameter") was generally measured from the attachment scar to the widest end of the seed. Given that this was mostly the case, all seeds were measured from the attachment scar to the widest end across the seed. Sometimes, (i.e., in the case of *C. frutescens*), the maximum length would turn out to be much shorter than max diameter, due to the shape of the seed (an oval on its side).

6. Perpendicular Width  
The width was measured 90° (perpendicular) from where the maximum length was measured.

7. ML:PW  
This is the ratio of maximum length to perpendicular width.

8. Aspect Ratio  
Aspect ratio is defined as the ratio of the width of a shape to its height. This was calculated by MicroSuite.

9. Perimeter  
The length measurement of the perimeter of the whole seed when laid flat. This is calculated by MicroSuite.

10. Sphericity\*  
Sphericity refers to how spherical an object is. The closer the measure is to 1, the more the object represents a sphere. Since the photos were taken in 2D, sphericity in this case means how close an object is to a perfect circle. This was calculated by MicroSuite.

11. Area  
The extent of the Capsicum shape, measured in mm<sup>2</sup>. This was calculated by MicroSuite.

12. Maximum Diameter  
The greatest diameter, calculated by MicroSuite.

13. Mean Diameter  
The mean diameter, calculated by MicroSuite.

14. Minimum Diameter  
The minimum diameter, calculated by MicroSuite.

15. Testa Texture\*  
This is a description of the testa surface. Categories include smooth to broad, tight reticulation, and dramatic reticulation.

16. Beak Prominence\*  
This is a ranking scale of the extent of the protrusion of the "beak" of the seed: the area above the attachment scar.  
1=No Protrusion  
2=Nub  
3=Small  
4=Medium  
5=Long

17. Beak Angle\*  
Beak orientation in relation to body of the seed. To take this measurement, seed was oriented so that attachment scar pointed right. Generally, seed is oval in shape and oriented so that it sat "straight up". Procedure for measuring angle involved placing protractor so that 0° line lines up with right edge of seed. Vertex was then moved up so that it was located in the center of beak. Ruler was used to measure from vertex to tip of beak.

18. Attachment Scar Length  
The length of the longest horizontal distance of the attachment scar measured in MicroSuite.

19. Attachment Scar Width  
The width of the attachment scar, measured at the midway point of the attachment scar length in MicroSuite; perpendicular to length.

20. Attachment Scar Length: Relational Length  
A ratio of the attachment scar length to the measure of relational length.

21. Attachment Scar Area  
The area of the attachment scar opening, measured using tools in MicroSuite.

22. Attachment Scar Sphericity\*  
This measure indicates how close the shape of the attachment scar opening is to a perfect circle. Calculations were made by MicroSuite.

23. Testa Thin (1, 2, 3)  
Three measurements of testa width on the dorsal and ventral sides of the seeds (the thinnest areas).

24. Testa Thin Average  
The mean of the three measurements above.

25. Testa Thick (1, 2, 3)  
Three measurements of testa width on the margins of the seed in cross section (the thickest areas).

26. Testa Thick Average  
The mean of the three measurements above.

27. Ratio (Thick to Thin)\*  
A ratio of the testa thick average to the testa thin average.