APPENDIX A1

SHELL DATA: *Concholepas concholepas*

SHELL ANALYSES OF *Concholepas concholepas*: MODERN SAMPLES

*Concholepas concholepas* – Analysis of the modern shells

Table A1.1

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<th>Angle (0,1)</th>
<th>1 = upward sloping (ups)</th>
<th>0 = downward sloping (dws)</th>
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<td>Line numbers (0,1)</td>
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<td>4 Seasons (1,2,3,4)</td>
<td>1 = spring, 2 = summer, 3 = fall, 4 = winter</td>
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<td>2 Seasons (0,1)</td>
<td>0 = summer/spring, 1 = fall/winter</td>
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ID# = YXX, where
Y=season (1=Spring, 2=Summer, 3=Fall, 4=Winter, 5=Jan/Feb)
XX=shell’s number.

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417
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<td>3</td>
</tr>
<tr>
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<td>0</td>
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</table>
Concholepas concholepas – Analysis of the modern shells

Table A1.2 Three tables series composed by the main table (Angle) and two working tables.

<table>
<thead>
<tr>
<th>Angle</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
<th>Winter</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downward Sloping</td>
<td>29</td>
<td>59</td>
<td>4</td>
<td>20</td>
<td>112</td>
</tr>
<tr>
<td>Expected Frequency</td>
<td>23.3</td>
<td>55.5</td>
<td>9.4</td>
<td>23.8</td>
<td>112</td>
</tr>
<tr>
<td>Upward Sloping</td>
<td>18</td>
<td>53</td>
<td>15</td>
<td>28</td>
<td>114</td>
</tr>
<tr>
<td>Expected Frequency</td>
<td>23.7</td>
<td>56.5</td>
<td>9.6</td>
<td>24.2</td>
<td>114</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>112</td>
<td>19</td>
<td>48</td>
<td>226</td>
</tr>
</tbody>
</table>

Pearson \( \chi^2(3) = 10.5808 \)  
Pr = 0.014  
likelihood-ratio \( \chi^2(3) = 11.0247 \)  
Pr = 0.012

Table A1.3

<table>
<thead>
<tr>
<th>Ordered logistic regression</th>
<th>Number of obs</th>
<th>226</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR ( \chi^2(1) )</td>
<td>6.88</td>
<td></td>
</tr>
<tr>
<td>Prob &gt; ( \chi^2 )</td>
<td>0.0087</td>
<td></td>
</tr>
</tbody>
</table>
Table A1.4

Logistic regression

<table>
<thead>
<tr>
<th></th>
<th>Number of obs</th>
<th>226</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LR chi2(1)</td>
<td>9.55</td>
</tr>
<tr>
<td></td>
<td>Prob &gt; chi2</td>
<td>0.002</td>
</tr>
<tr>
<td>Log likelihood = -151.86856</td>
<td>Pseudo R2</td>
<td>0.0305</td>
</tr>
</tbody>
</table>

| angleb | Coef.      | Std. Err. | z     | P>|z|  | [95% Conf. Interval] |
|--------|------------|-----------|-------|-----|----------------|---------------------|
| seasons4w | 39.97547 | 13.56296  | 2.95  | 0.003 | 13.39255 | 66.55839 |
| _cons  | -0.4141827| 0.1953058 | -2.12 | 0.034 | -0.7969749 | -0.0313904 |

Marginal effects after logit

y= Pr(angleb) (predict) 0.50700551

| variable | dy/dx | Std. | z     | P>|z| | [95% C.I.] | X |
|----------|-------|------|-------|-----|----------------|-----|
| seaso~4w | 3.38877 | 2.95 | 0.003 | 3.35004 | 16.6338 | 0.011062 |

Concholepas concholepas – Analysis of the modern shells

Table A1.5

Three tables series composed by the main table (Space between lines) and two working tables.

<table>
<thead>
<tr>
<th>Space between lines</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
<th>Winter</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressed</td>
<td>20</td>
<td>66</td>
<td>15</td>
<td>29</td>
<td>130</td>
</tr>
<tr>
<td>Expected Frequency</td>
<td>27</td>
<td>64.4</td>
<td>10.9</td>
<td>27.6</td>
<td>130</td>
</tr>
<tr>
<td>Dispersed</td>
<td>27</td>
<td>46</td>
<td>4</td>
<td>19</td>
<td>96</td>
</tr>
<tr>
<td>Expected Frequency</td>
<td>20</td>
<td>47.6</td>
<td>8.1</td>
<td>20.4</td>
<td>96</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>112</td>
<td>19</td>
<td>48</td>
<td>226</td>
</tr>
</tbody>
</table>

Pearson chi2(3) = 8.1348
Pr = 0.043
Likelihood-ratio chi2(3) = 8.3840 Pr = 0.039

Table A1.6

420
Ordered logistic regression

<table>
<thead>
<tr>
<th>Number of obs</th>
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</thead>
<tbody>
<tr>
<td>LR chi2(1)</td>
<td>4.7</td>
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<td>Prob &gt; chi2</td>
<td>0.0301</td>
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</table>

Log likelihood = -271.49837

Pseudo R2 = 0.0086

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<tr>
<th>seasons4</th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>z</th>
<th>P&gt;z</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>space</td>
<td>-0.554</td>
<td>0.257</td>
<td>-2.160</td>
<td>0.031</td>
<td>-1.058 - 0.050</td>
</tr>
<tr>
<td>/cut1</td>
<td>-2.143</td>
<td>0.413</td>
<td>-2.952</td>
<td>0.0032</td>
<td>-3.333 - -1.333</td>
</tr>
<tr>
<td>/cut2</td>
<td>0.103</td>
<td>0.379</td>
<td>-0.640</td>
<td>0.521</td>
<td>-0.845 - 0.045</td>
</tr>
<tr>
<td>/cut3</td>
<td>0.553</td>
<td>0.383</td>
<td>-0.198</td>
<td>0.845</td>
<td>1.304</td>
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</table>

Logistic regression

<table>
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</thead>
<tbody>
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<td>4.08</td>
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<tr>
<td>Prob &gt; chi2</td>
<td>0.0434</td>
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</table>

Log likelihood = -152.04496

Pseudo R2 = 0.0132

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<tr>
<th>spaceb</th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>z</th>
<th>P&gt;z</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>seasons4w</td>
<td>-26.24751</td>
<td>13.40834</td>
<td>-1.96</td>
<td>0.05</td>
<td>-52.52738 - 0.032351</td>
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<tr>
<td>_cons</td>
<td>-0.021313</td>
<td>0.1940154</td>
<td>-0.11</td>
<td>0.913</td>
<td>-0.4015763 - 0.3589502</td>
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</table>

Marginal effects after logit

y = Pr(angleb) (predict) 0.42270921

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<tr>
<th>variable</th>
<th>dy/dx</th>
<th>Std. Err.</th>
<th>z</th>
<th>P&gt;z</th>
<th>95% C.I.</th>
<th>X</th>
</tr>
</thead>
<tbody>
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<td>-6.405079</td>
<td>3.26513</td>
<td>-1.96</td>
<td>0.05</td>
<td>-12.8046 - 0.00538</td>
<td>0.011062</td>
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**Concholepas concholepas** – Analysis of the modern shells

Table A1.8

Three tables series composed by the main table (Space between lines) and two working tables.

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<tr>
<th>Number of Lines</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
<th>Winter</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>26</td>
<td>46</td>
<td>3</td>
<td>19</td>
<td>94</td>
</tr>
<tr>
<td>Expected Frequency</td>
<td>19.5</td>
<td>46.6</td>
<td>7.9</td>
<td>20</td>
<td>94</td>
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<tr>
<td>High</td>
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<td>66</td>
<td>16</td>
<td>29</td>
<td>132</td>
</tr>
<tr>
<td>Expected Frequency</td>
<td>27.5</td>
<td>65.4</td>
<td>11.1</td>
<td>28</td>
<td>132</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>112</td>
<td>19</td>
<td>48</td>
<td>226</td>
</tr>
</tbody>
</table>

Pearson chi2(3) = 8.9449  Pr = 0.030
likelihood-ratio chi2(3) = 9.5678  Pr = 0.023
Table A1.9

Ordered logistic regression

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<td>LR chi2(1)</td>
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<td>Prob &gt; chi2</td>
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Log likelihood =

<p>| | | |</p>
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</thead>
<tbody>
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</tbody>
</table>

seasons4

|                | Coef. | Std. Err. | z    | P>|z|   [95% Conf. Interval] |
|----------------|-------|-----------|------|-------|------------------------|
| linenumbers    | 0.538 | 0.258     | 2.090| 0.037 | 0.033 | 1.044               |
| /cut1          | -0.500| 0.429     | -1.341| 0.340 | 0.862 | 2.625               |
| /cut2          | 1.744 | 0.450     | 0.033 | 1.044 | 0.033 | 1.044               |
| /cut3          | 2.194 | 0.458     | 1.297| 3.092 | 1.297 | 3.092               |

Table A1.10

Logistic regression

<table>
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<th>Number of obs</th>
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<tbody>
<tr>
<td>LR chi2(1)</td>
<td>5.41</td>
<td></td>
</tr>
<tr>
<td>Prob &gt; chi2</td>
<td>0.02</td>
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</tr>
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</table>

Log likelihood = -150.73582

|                  | Coef. | Std. Err. | z     | P>|z|   [95% Conf. Interval] |
|------------------|-------|-----------|-------|-------|------------------------|
| linenumbersb     | 30.7375| 13.77282  | 2.23  | 0.026 | 3.743276 | 57.73172                  |
| _cons            | 0.0124415| 0.1951427 | 0.06  | 0.949 | -0.3700311 | 0.3949141                |

Marginal effects after logit

y = Pr(ys) (predict) 0.58721353

| variable     | dy/dx    | Std. Err. | z     | P>|z|   [95% C.I. ] | x   |
|--------------|----------|-----------|-------|-------|---------------|-----|
| seaso~4w     | 7.450579 | 3.32638   | 2.24  | 0.025 | 0.9309999 | 13.9702 | 0.011062 |

APPENDIX A2

SHELL DATA: *Concholepas concholepas*

APPENDIX – SHELL ANALYSES OF *Concholepas concholepas*: ARCHEOLOGICAL SAMPLES FROM CAMARONES SUR AND CAMARONES 14 SITES

Table A2.1: Camarones Sur – archaeological shells
Type (form of the shell tip in a cross cut section)
(1,2,3,4) 1 = hook, 2 = dividing, 3 = straight, 4 = curved

Line numbers (0,1)
0 = less lines on the edge 1 = more lines on the edge

Angle (0,1)
1 = upward sloping (high), 0 = downward sloping (low)

Space between lines (0,1)
1 = dispersed (lines formed more distant from each other) 0 = compressed (lines more close together)
n = undefined characteristic

Camarones Sur site
Shell's analyses  Concholepas concholepas

<p>| Layer 1 |
|---|---|---|---|---|
| Shell | ID # | Type | Angle | Space bw lines | Line numbers |
| 1 | 1 | 4 | 0 | 0 | 1 |
| 2 | 2 | 3 | 0 | 0 | 1 |
| 3 | 3 | 3 | 0 | 1 | 0 |
| 4 | 4 | 3 | 1 | 0 | 1 |
| 5 | 5 | 3/4 | 0 | 0 | 1 |
| 6 | 6 | 3 | 0 | 1 | 0 |
| 7 | 7 | 3 | 0 | 1 | 0 |
| 8 | 8 | 2 | 0 | 1 | 0 |
| 9 | 9 | 3 | 1 | 0 | 1 |
| 10 | 10 | 2 | 0 | 0 | 1 |
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### APPENDIX B – SHELL ANALYSES FROM HUACA PRIETA: MODERN AND ARCHAEOLOGICAL SAMPLES

**Semele** sp. Analysis of the modern shells

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APPENDIX C

Overexploitation

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Charts 1a, 1b, 2a, and 2b represent the linear regression result from Table 2. Horizontal axes are the representation of layers trend, where layer 3 is on the left side and layer 17 in the opposite extreme, that is, time progression is from more recent to oldest layers (from left to right). There is a slight trend indicating that the shells collected increased in size during time, that is, the opposite situation expected for overexploitation. The data, however, is not strong enough to allow a definitive conclusion.
Chart 2b

Log (width)

- Log (width)
- Linear (log (width))

Layer 3 - Layer 17
### Table 3

#### Descriptive Statistics

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Total shells analyzed: 140 100.00

Notes: first column (obs) refers to the number of observations (shells) in each “capa” (layer), while the third column (Cum.) has the cumulative proportions of shell.
### Table 4: Data for linear regression

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Charts 2a, 2b, 2c, and 2d represent the linear regression result from Table 4. Horizontal axes are the representation of layers trend, where layer 1 is on the left side and layer 13 in the opposite extreme, that is, time progression is from more recent to oldest layers (from left to right). Although there is a slight trend points to shells diminishing in size through time, the data is not strong enough to indicate overexploitation.
Table explanation:

- The first column contains the number of observations in each "capa" (layer).
- The second column contains the proportions of shells in relation to the total number of shells in each "capa" (layer).
- The third column shows the cumulative proportions of shells as "capas" (layers) are added.
- The fourth column shows the mean for length and width in each "capa" (layers).
- The sixth column contains the standard deviations for length and width in each "capa" (layer).
- The seventh column contains the minimum value for length and width for each "capa" (layer).
- The eighth column shows the maximum value for length and width for each "capa" (layer).
- Looking at the mean of the length there is no clear trend across "capas" (layers).
- The mean of the width increases slightly as increases the value of the "capas" (layers).
- There is a slight increase in the maximum value of the width as increases the value of the "capa" (layer).
APPENDIX D

Oxygen Isotopic Analysis - *Concholepas concholepas*

Table compiled from the analysis performed by Fred Andrus (Department of Geological Sciences at the University of Alabama)

Sample: Modern shell

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INTRODUCCIÓN

El sitio arqueológico Camarones 14 (CAM 14) se ubica en la terraza sur de la desembocadura del valle homónimo, específicamente en el margen oeste de una explanada completamente desértica que se proyecta hacia el oriente donde se emplaza la caleta actual. Hacia el mar y el fondo de valle la planicie cae de forma abrupta permitiendo una excelente visibilidad hacia estos espacios.

En términos generales, se trata de un espacio ecotonal, donde es posible acceder fácilmente a recursos diversos y complementarios, incluyendo especies de agua dulce y de playa. Así mismo, podría considerarse como un lugar estratégico en cuanto punto de inicio/terminal de una ruta natural a las tierras altas, ámbito desde donde provendrían los restos de camélido, vizcacha y algunas materias primas líticas que se asocian al conchal arcaico (Schiappacasse y Niemeyer 1984).

Como debió ser en el pasado, flora y fauna se concentran en el humedal del fondo de la quebrada. En el caso de las plantas, hoy es posible observar no más de cinco o seis especies nativas, fundamentalmente adaptadas a suelos salinos y desérticos. En este sentido, encontramos grandes cojines de kachiyuyo o piyaya (*Atriplex imbricata* y *Atriplex madariagae*), algunas concentraciones de pastos o grama salada (*Distichlis spicata*) y en menor medida brea o sorona (*Tessaria absintioides*). En el entorno del desagüe mismo, las especies anteriores disminuyen al tiempo que aparecen totorales (*Typha angustifolia*), juncos (*Scirpus sp.*) y cañaverales (*Phragmites australis*)

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1 Arqueóloga. manegarciab@yahoo.com
2 Observación personal 2008.
Es probable que los efectos de la agricultura colonial intensiva y el uso industrial de los suelos en el presente hayan determinado la configuración actual de la flora (variedad y distribución), provocando no sólo un repliegue total de las plantas acuáticas y su reemplazo por las especies desérticas, sino también la desaparición de especies que hoy habitan más al interior (molle, algarrobo) o incluso otras que se encuentran simplemente extintas (Belmonte com. pers. 2008). Es interesante señalar que sólo un recorrido superficial por el humedal costero nos permitió visualizar restos de plantas muertas que hoy no habitan en el lugar, como por ejemplo, recurrentes tallos de cola de caballo (*Equisetum giganteum*) y un tronco casi completo de algún árbol que no hemos podido identificar a simple vista. Así mismo, podemos considerar la alta frecuencia que adquieren ciertas especies en el conchal de CAM 14 que se manifiestan como especies de acceso cotidiano y que se encuentran actualmente ausentes en el curso bajo del valle (últimos 12 km, tramo Cuya-Caleta Camarones).

Un ámbito diferente y complementario lo contituyen los “oasis de niebla” que se definen como un tipo de vegetación baja que prolifera sobre las mesetas de la cordillera de la Costa debido a la influencia de la camanchaca. Corresponden a sitios de no más de 3 km de largo, en cerros de exposición SW que les permiten captar las neblinas. Esta formaciones, también denominadas “formación de lomas” o “praderas del desierto” (Muñoz et. al. 2001), representan verdaderos oasis, al constituirse como espacios verdes circunscritos en medio del desierto absoluto (op. cit.). En Camarones, la única referencia hallada la otorga Pinto (2005), quien describe estas formaciones en la ladera norponiente de la quebrada, en el cerro Ballenato a 18 km de la desembocadura, cubriendo un espacio aproximado de 3 km². Junto con éste son de importancia aquellos registrados en la quebrada Vitor y Suca (cuesta Chiza) (op. cit.).

La composición florística mayoritaria de estos oasis de niebla es de *Tillandsia landbeckii* y *Eulychnia iquiquiensis*, que son especies permanentes (Pinto 2005), no obstante, durante fenómenos ENSO (El Niño Oscilación Sur) se producen lluvias excepcionales que conllevan el florecimiento de una inusual variedad de especies (Muñoz et al 2001). En este

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3 Los estudios botánicos se enfocan principalmente a la costa Iquique.
sentido, aparentemente las semillas de estas últimas se encuentran en estado de latencia y germinan cuando se mejoran las condiciones de humedad, generando un aumento considerable de las familias vegetales presentes, entre las que cabe destacar Asteraceae (con 10 especies), Cactaceae (con cinco especies), Nolanaceae (con siete especies), Solanaceae (con siete especies), Portulacaceae (con cinco especies), Chenopodidaeae (con tres especies) y Tecophilaeaceae. Esta última de especial interés, por estar asociada al contexto arqueológico de CAM 14 (Zephyra elegans).

Considerando todo lo anterior, los restos vegetales de CAM 14 sustentan en cierta medida la riqueza que debió tener este espacio en el pasado. El amplio universo vegetal representado en el conchal a través de variados ecofactos (tallos, maderas, semillas, frutos, bulbos e inflorescencias) y artefactos, dan cuenta de un manejo integrado del entorno y un amplio conocimiento de las propiedades específicas de las plantas, principalmente en los ámbitos alimenticios y artesanales.

El presente trabajo da cuenta de los macrorrestos vegetales recuperados de las unidades A2 y A3 del sitio en cuestión, excavadas en el marco del proyecto Paleoecología y sedentarismo de cazadores-recolectores costeros en el norte de Chile a cargo de la (c)Dra. Teresa Franco. En términos generales, el universo vegetal analizado considera órganos vegetativos (tallos, hojas, raíces) y/o reproductivos (semillas, frutos, inflorescencias) de las distintas especies representadas, lo cual será considerado para aproximarnos a reconstruir los ámbitos de aprovisionamiento y los contextos de uso y descarte que motivaron su recolección y traslado hacia al área habitacional.
TRATAMIENTO DE LOS RESTOS

El material estudiado proviene las unidades A2 y A3, de 1 x 1m cada una, trazadas de manera colindante al interior del área doméstica del sitio CAM 14, en el cual también se ha registrado un sector de enterramientos vinculados a la tradición chinchorro (Schiappacasse y Niemeyer 1984).

El material vegetal fue obtenido de forma directa desde el harnero y a partir de muestras de balde y de sedimentos para flotación. El criterio de selección de éstas estuvo basado en las potencialidades que mostraron los distintos estratos o camadas, lo cual explicaría la ausencia de muestras para ciertas camadas que no se consideraron relevantes en términos vegetales y la disparidad en relación al volumen de cada muestra tomada (Tabla 1).

El total del material fue analizado en el laboratorio Lluta del Museo Arqueológico San Miguel de Azapa (MASMA). Las muestras de flotación fueron tratadas utilizando una máquina construida para este fin. La fracción pesada fue entregada íntegra a Teresa Franco. La fracción liviana fue analizada bajo lupa binocular (aumentos de 0,7 a 4,5X), donde se fueron clasificando restos de frutos, semillas, bulbos, inflorescencias, tallos, maderas y finalmente artefactos, proceso que luego se repitió con las muestras de balde y harnero.

El material fue determinado taxonómicamente en base al criterio de morfología comparada utilizando colecciones de referencia y manuales especializados de botánica. En la mayoría de los casos, este proceso requirió del uso de lupa binocular para observar y comparar los distintos elementos anatómicos de las plantas. Sin embargo, no siempre se logró una determinación positiva de los restos, debido principalmente a la ausencia de elementos diagnósticos que definan los distintos géneros y especies o, en otros casos, por el desconocimiento de los taxones. Tanto los carporrestos no determinados como el resto de las estructuras desconocidas fueron marginados del análisis.

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Agradecemos a Calogero Santoro por facilitar la infraestructura del laboratorio Lluta.

En términos generales, el material de referencia utilizado proviene del humedal de Lluta (desembocadura), valle de Azapa y playa y humedal de Camarones (transecta N-S).

Agradecemos a Eliana Belmonte (Universidad de Tarapacá), Gina Arancio (curadora Herbario Universidad La Serena) y Alejandra Vidal por sus valiosas contribuciones en el proceso de determinación del material.
Finalmente, las evidencias más diagnósticas se fotografiaron directamente utilizando una cámara Panasonic digital FZ-50 (lente Leica, zoom óptico 12X, macro 5.00cm – infinito).

El análisis consideró aspectos cuantitativos y cualitativos. Los primeros se orientaron a los elementos discretos (frutos, semillas, bulbos e inflorescencias), los cuales se consideraron como una unidad cuando estuvo presente más del 50% del elemento. En el caso de los bulbos, se contabilizó una unidad a partir de la presencia de los discos que se ubican en su base. Bajó este criterio se llevó a cabo una cuantificación general de los restos recuperados a nivel de sitio y una independiente considerando frecuencias absolutas y relativas por especie, de modo de comparar espacial y estratigráficamente elementos similares (Hastorf y Popper 1988; Buxó 1997). Por su parte, los tallos, maderas y fragmentos de hoja identificados se evaluaron en términos de presencia y ausencia.

Los problemas que derivan de la cuantificación de los restos vegetales han sido largamente reflexionados en arqueobotánica. En este sentido, la frecuencia y número de taxones

<table>
<thead>
<tr>
<th>CAMADA</th>
<th>UNIDAD</th>
<th>VOLUMEN FLOTADO (lts)</th>
<th>MATRIZ FRACCIÓN LIVIANA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1C</td>
<td>A2</td>
<td>0,7</td>
<td>vegetal: tallos, espículas carbón</td>
</tr>
<tr>
<td>2</td>
<td>A2</td>
<td>0,1</td>
<td>vegetal: tallos disminuyen espículas</td>
</tr>
<tr>
<td>6</td>
<td>A2</td>
<td>0,6</td>
<td>vegetal y crustáceos: tallos y conglomerados orgánicos (fibras limo)</td>
</tr>
<tr>
<td>rasgo 1</td>
<td>A2</td>
<td>0,6</td>
<td>vegetal y crustáceos: tallos y conglomerados orgánicos (fibras limo)</td>
</tr>
<tr>
<td>9C</td>
<td>A2</td>
<td>1,45</td>
<td>vegetal y crustáceos: tallos y conglomerados orgánicos (fibras limo)</td>
</tr>
<tr>
<td>12C</td>
<td>A2</td>
<td>0,5</td>
<td>vegetal y crustáceos: tallos y conglomerados orgánicos (fibras limo)</td>
</tr>
<tr>
<td>12C2</td>
<td>A2</td>
<td>1</td>
<td>vegetal y crustáceos: tallos y conglomerados orgánicos (fibras limo)</td>
</tr>
<tr>
<td>13C</td>
<td>A2</td>
<td>0,6</td>
<td>vegetal y aumentan crustáceos</td>
</tr>
<tr>
<td>13D</td>
<td>A2</td>
<td>0,5</td>
<td>vegetal y crustáceos</td>
</tr>
<tr>
<td>8C</td>
<td>A3</td>
<td>2,1</td>
<td>vegetal y crustáceos</td>
</tr>
<tr>
<td>9A</td>
<td>A3</td>
<td>0,9</td>
<td>vegetal y crustáceos</td>
</tr>
<tr>
<td>9C</td>
<td>A3</td>
<td>0,3</td>
<td>crustáceos y vegetal: tallos caña</td>
</tr>
<tr>
<td>12</td>
<td>A3</td>
<td>0,71</td>
<td>vegetal y crustáceos</td>
</tr>
<tr>
<td>12 ceniza</td>
<td>A3</td>
<td>2,9</td>
<td>vegetal y crustáceos, aumenta carbón</td>
</tr>
<tr>
<td>13</td>
<td>A3</td>
<td>0,2</td>
<td>vegetal sin carbón</td>
</tr>
<tr>
<td>13B</td>
<td>A3</td>
<td>0,7</td>
<td>vegetal</td>
</tr>
<tr>
<td>14</td>
<td>A3</td>
<td>0,6</td>
<td>vegetal</td>
</tr>
<tr>
<td>14 depresión</td>
<td>A3</td>
<td>0,1</td>
<td>vegetal</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>14,56</td>
<td></td>
</tr>
</tbody>
</table>

Tabla 1: volúmenes flotados en Camarones 14.
presentes en un sitio, puede llevar a interpretaciones sesgadas producto de la preservación diferencial de las especies, el grado de abundancia de una especie respecto a otra en una misma zona, la posibilidad de que una especie produzca una gran cantidad de semillas en relación a otras, el consumo más frecuente de unas especies sobre otras y el consumo de especies en que el fruto no es comestible pero sí las flores, raíces u hojas, entre otros (Buxó 1997). Además, es necesario considerar los problemas de preservación y tafonomía, clima y tipo de suelo en que los restos se encuentran depositados, todo lo cual podría afectar diametralmente la preservación diferencial de las especies y, en definitiva, las características propias del registro arqueológico (Dimbledy 1967; Miksicek 1987). Así mismo, debemos considerar, por una parte, que un segmento importante del universo vegetal está constituido por elementos no cuantificables como fragmentos de tallos y maderas, y por otra, que hay plantas que definitivamente no producen semillas, como la cola de caballo (*Equisetum giganteum*).

Junto con ello, se fue consignando el estado de conservación (deshidratación, carbonización, nivel de completitud-fragmentación) y otras observaciones específicas. Por su parte, los artefactos (elemento vegetal con modificación intencional) fueron descritos considerando principalmente morfología y materia prima, junto con medidas de longitud, ancho y espesor.

Los criterios cualitativos consideran la diversidad y distribución de los restos identificados (espacial y estratigráfico), enfatizando en el tipo de evidencia a través del cual las distintas especies se encuentran representadas (p.e., tallo, semilla), lo cual permitirá aproximarnos a los usos otorgados a estas plantas y, en definitiva, lo que motivó su recolección y transporte al sitio arqueológico.

Para el análisis hemos decidido integrar las evidencias provenientes de las distintas estrategias implementadas para la recuperación del material (harnero, balde y flotación) con el fin de facilitar el manejo y la comprensión de los datos.
RESULTADOS

En términos generales, las especies identificadas son de origen local y dan cuenta de un aprovechamiento integral del ecotono, encontrándose representadas especies propias del humedal y valle, la meseta costera (oasis de niebla) y la playa. Fundamentalmente, los restos están constituidos por fragmentos de tallos blandos y maderas y, en menor medida, restos de bulbos, inflorescencias, frutos y semillas, todos los cuales se encuentran en buen estado de conservación producto esencialmente de la deshidratación natural que han sufrido los restos al depositarse en un ambiente hiperárido.

Del universo total se lograron determinar un total de 13 taxones, de los cuales en siete casos se llegó a nivel específico (*Equisetum giganteum, Macrocystis integrifolia, Phragmites australis, Schinus molle, Tessaria absintioides, Typha angustifolia, Zephyra elegans*), en cuatro a nivel de género (*Leucocoryne* sp., *Lagenaria* sp., *Prosopis* sp., *Scirpus* sp.) y en dos casos a nivel de familia (*Asteraceae* y *Cactaceae*).

En relación a las evidencias, hay ciertas especies que aparecen representadas en el contexto arqueológico a partir de dos órganos diferentes, aunque la mayoría lo hace a partir de sólo uno. Así entre las especies arbóreas, el molle (*Schinus molle*) está presente a partir de sus drupas o frutos y fragmentos de hoja, mientras que el algarrobo (*Prosopis* sp.) sólo a partir de sus semillas (con y sin endocarpo). En relación a las plantas acuáticas o palustres, el junquillo (*Scirpus* sp.) se hace presente tanto a partir de sus semillas como de sus característicos tallos de sección triangular, el cañaveral (*Phragmites australis*) a partir de fragmentos de hoja, la totora (*Typha angustifolia*) a partir de sus tallos planos y esponjosos y, por último, la cola de caballo (*Equisetum giganteum*) a partir de sus ramificaciones secundarias.

Por otra parte, el arbusto conocido como brea o sorona (*Tessaria absintioides*) está presente a partir de sus inflorescencias, las hierbas flor de viuda (*Zephyra elegans*) y huille (*Leucocoryne* sp.) a través de restos de cormo (estructura subterránea que incluye un bulbo sólido probablemente comestible). Dentro de las especies cultivadas, la única evidencia
corresponde a un fragmento de pericarpio o cáscara del fruto de la calabaza (*Lagenaria* sp.). Finalmente, las algas marinas están presentes a partir de un fragmento de aerociste de huiro (*Macrocystis integrifolia*) y un rollito elaborado con las frondas de esta misma especie.

Junto con lo anterior, se han determinado inflorescencias diferentes a la brea (*Tessaria absintioides*) también correspondientes a la familia de las asteráceas. Por último, dos espinas, una de ellas con incisiones, correspondientes a una misma especie de la familia de cactáceas.

Es importante señalar que un gran número de elementos quedaron sin determinar, principalmente fragmentos de tallos blandos y lignificados (maderas) los cuales podrían eventualmente corresponder a las especies ya determinadas a través de otros órganos. Así, por ejemplo, hay maderas que podrían corresponder a algarrobo (*Prosopis* sp.) o molle (*Schinus molle*), mientras que ciertos tallos arbustivos con textura interior esponjosa podrían corresponder a brea (*Tessaria absintioides*). Una determinación positiva de este tipo de restos requiere de análisis macroscópicos específicos.


1. TALLOS BLANDOS
Los tallos blandos se refieren a tallos no lignificados cuya función en términos amplios es la de sostener la planta, uniendo las raíces con los órganos vegetativos y reproductivos. De acuerdo a ello, una parte significativa de la muestra está constituida por estos elementos, los cuales en general se encuentran muy fragmentados, tanto longitudinal como transversalmente, dificultando en gran medida una determinación taxonómica positiva. Sin embargo, hay tallos que presentan rasgos diagnósticos que permiten su identificación a través de la comparación macroscópica con material de referencia, como las especies de
junquillo (*Scirpus* sp.), totora (*Typha angustifolia*) y cola de caballo (*Equisetum giganteum*).

Los unquillos o junquillos (*Scirpus* sp.) son plantas palustres asociadas a ambientes húmedos. Sus tallos varían en morfología y tamaño según la especie, destacando para su reconocimiento su característica sección transversal de forma circular, triangular o cuadrangular. Diversas especies de juncos son reconocidas por las sociedades andinas tradicionales por su valor artesanal, quienes utilizan estos tallos como materia prima para la elaboración de esteras, tejidos y canastos (Villagrán y Castro 2004). Junto con ello, hay múltiples referencias en torno a la importancia alimenticia de los rizomas tiernos, la base de los tallos y los brotes que apenas emergen del suelo (Pardo y Pizarro 2005). En relación a la especie *Scirpus californicus*, sus tallos no solamente podrían ser comidos crudos o cocidos, sino también pueden ser asados, secados y molidos como harina (op. cit.).

En la muestra arqueológica hemos detectado con relativa abundancia la presencia de tallos blandos finos de color café rojizo y sección triangular que podrían pertenecer a la familia de las juncáceas o cyperáceas (ambos conocidos comúnmente como juncos), sin embargo, su frecuente asociación con semillas del género *Scirpus* (F. Cyperaceae) y la comparación con tallos actuales de este último género, permiten señalar que semillas y tallos pertenecen a la misma especie. En el contexto arqueológico, los tallos se distribuyen en ambas unidades excavadas aunque con mayor frecuencia en A3, preferentemente asociados a los niveles medios de la ocupación (camadas 3 a 8) (FIGURA 1 y 2). En el contexto de CAM 14, es probable que estas plantas hallan sido recolectadas como alimento y por sus propiedades artesanales, siendo este último manifestado de manera elocuente en el área funeraria adyacente donde se registraron fardos y esteras tejidas con esta materia prima (Niemeyer y Schiappacasse 1984).

Como en el caso anterior, la totora (*Typha angustifolia*) es una planta palustre asociada a cursos de agua dulce. Morfológicamente, sus tallos se caracterizan por ser planos y esponjosos, con grosores variables aparentemente según la etapa de crecimiento. Como en
el caso anterior, esta especie ha sido etnográficamente documentada para la confección de cestos, esteras y techumbres (Villagrán y Castro 2004).

En el contexto arqueológico, los tallos de totora están presentes en ambas unidades, aunque con mayor énfasis en A2. Estratigráficamente, la mayor concentración la encontramos en los niveles medios de la ocupación, es decir entre las camadas 5 y 9 (FIGURAS 3 y 4). Es probable que la totora halla sido recolectada para elaborar esteras y tejidos, lo cual, como en el caso de los juncos, se encuentra evidenciado en los fardos funerarios del área adyacente (Niemeyer y Schiappacasse 1984).

Por último, la cola de caballo o qosqosa (*Equisetum giganteum*) es una planta muy común en los valles de Arica y de Tarapacá, de tallos huecos y articulados ramificados en los nudos, completamente recubierta de sílice lo cual le otorga una textura áspera característica. Se reconoce como una de las especies más “primitivas” entre la flora actual al reproducirse por esporas y no por semillas, demostrando así un enorme éxito adaptativo hacia estos ambientes. Etnográficamente, esta planta ha sido documentada por su valor medicinal, principalmente para la vesícula, pulmonías y mal de orines (Villagrán y Castro 2004). Arqueológicamente ha sido documentada formando parte del material de construcción de los túmulos Alto Ramírez (Belmonte com. pers. 2008). Así mismo, me han sugerido que la cubierta sílicea de la planta contribuye a la absorción de líquidos y, en este sentido, se constituye como un excelente material para llevar a cabo la técnica de momificación artificial practicada por los chinchorro (Arancio com. pers 2009).

En el contexto de CAM 14, los restos de qosqosa se refieren a fragmentos de las ramificaciones secundarias que se desprenden de los nudos, los cuales han sido reconocidos fundamentalmente por su textura. Estos restos se asocian únicamente a la camada 8C de la unidad A3 (Tabla 2).
2. HOJAS Y ESPINAS

Las hojas halladas se refieren en todos los casos a unidades incompletas o fragmentos. Es muy probable que su presencia en el contexto no responda a la utilidad práctica de ellas mismas, sino de los tallos o ramificaciones donde éstas vienen adheridas. Específicamente se han logrado determinar hojas de molle (*Schinus molle*) en A2 y A3 y caña (*Phragmites australis*) en A3 (FIGURA 5). En ambas unidades los restos se presentan como fragmentos únicos y aislados (Tabla 3).

<table>
<thead>
<tr>
<th>UNIDAD A2</th>
<th>Scirpus sp.</th>
<th><em>Typha angustifolia</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5 decap. 2</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5 decap. 3</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5 decap. 4</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>12C2</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>13C</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>13D</td>
<td>X</td>
<td>X</td>
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</table>

<table>
<thead>
<tr>
<th>UNIDAD A3</th>
<th><em>Equisetum giganteum</em></th>
<th>Scirpus sp.</th>
<th><em>Typha angustifolia</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1D</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3A</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5 decap. 1</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>8C</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>9A</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>12C (ceniza)</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>13 C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tabla 2: Distribución espacial y estratigráfica de los tallos blandos identificados

<table>
<thead>
<tr>
<th>Unidad A2</th>
<th><em>Schinus molle</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>13C</td>
<td>X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unidad A3</th>
<th><em>Schinus molle</em></th>
<th><em>Phragmites australis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8B</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>8C</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Tabla 3: Distribución espacial y estratigráfica de las hojas identificadas.

También incluimos dentro de este ítem los restos de huiro (*Macrocystis integrifolia*), los cuales corresponden a un fragmento proximal de aerociste (estructura adherida a las frondas que permite que éstas floten) y un ovillo hecho de frondas. Esta última clase de evidencia la hemos registrado en la costa sur de Iquique (sitio Pabellón de Pica), donde el huiro se manifiesta como una materia prima importante para la elaboración de lienzas (Vidal y García 2009). Estos restos se asocian a la unidad A2, camada 5 decapado 3 (FIGURA 6 y 7).
En relación a las espinas, encontramos dos ejemplares (largos 45,5 y 55,5 mm), uno de ellos con incisiones en el extremo proximal. Es probable que estas espinas pertenezcan a la especie *Eulychnia iquiquensis* (copao de Iquique), un cacto arbóreo hoy en peligro, que parece ser la única especie costera que otorga espinas similares a las evidencias (tamaño, color, textura), considerando que *Eulychnia aricensis* (copao de Arica) arroja espinas de longitud entre 20 y 40 mm (Hoffmann 1989). No obstante, la determinación de estos restos queda sólo a nivel de familia (“cactáceas”), mientras no se profundicemos los estudios con una buena colección de referencia (FIGURA 8).

3. INFLORESCENCIAS
Como en el caso de las hojas, las flores halladas también debieron ingresar al contexto arqueológico adheridas a sus tallos, los cuales podrían estar presentes en la muestra aunque no sea posible por ahora identificarlo con técnicas macroscópicas. En la unidad A2 encontramos dos inflorescencias correspondientes a una misma especie de asterácea. En A3, en cambio, aumenta notablemente la abundancia cuantitativa y cualitativa de este tipo de restos al estar representadas al menos tres especies: *Tessaria absinthioides* y dos especies no determinadas de la familia ya señalada, una de ellas análoga a los restos de A2 (Tabla 4) (FIGURA 9 y 10).

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</thead>
<tbody>
<tr>
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</tr>
<tr>
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<table>
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<td>12</td>
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</tr>
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Tabla 4: Distribución espacial y estratigráfica de las inflorescencias identificadas.
4. CARPORRESTOS Y BULBOS

Frutos, semillas y bulbos están presentes en ambas unidades excavadas. Se han identificado tres taxones representados a partir de sus semillas (*Prosopis* sp., *Scirpus* sp. y F. cactaceae), un taxón a partir de sus frutos completos (*Schinus molle*), otro a partir de restos de él (*Lagenaria* sp.) y, finalmente, dos a partir de evidencias de cormos (*Leucocoryne* sp. y *Zephira elegans*).

El algarrobo (*Prosopis* sp.) es un árbol frecuente en las quebradas del Norte Grande, muy importante para las sociedades andinas tradicionales. Está ampliamente documentado el uso completo de la vaina tanto para su consumo fresco -hoy poco común- como para la preparación de harina (*añapa*) y chicha (*aloja*). Del mismo modo, se documenta el uso de sus flores para la preparación de miel, el de la resina como tintura y el de su madera como un buen material de construcción y un excelente combustible (Villagrán et al. 1999; Villagrán y Castro 2004).

Se registraron un total de 13 semillas, las cuales se hallaron, excepto un ejemplar, aún con su envoltura endocárpica característica por su forma cuadrangular a subcircular. Es altamente probable que esta condición indique la presencia de las vainas ya que, es prácticamente imposible separar ambos elementos en estado fresco. En cuanto su distribución espacial y estratigráfica, éstas se concentran fundamentalmente en los niveles superficiales de A3 (camadas superficial, 1 y 1C), hallándose sólo dos ejemplares en la camada 5B de la unidad A2. Lo anterior representa una tendencia opuesta con respecto a las otras evidencias, las cuales se concentran principalmente en los niveles medios de la ocupación (FIGURA 11 y 12).

Por su parte, las semillas de junquillo (*Scirpus* sp.), cuyas atribuciones botánicas y etnobotánicas ya han sido referidas al dar cuenta de sus tallos, suman un total de 100 unidades y se distribuyen de manera homogénea en ambas unidades excavadas. Es altamente probable que hallan ingresado con las flores y éstas adheridas a los tallos, los cuales fueron transportados al sitio como alimento o materia prima para elaborar artesanías. En la unidad A2 la encontramos distribuida principalmente desde la
camada 12C hasta el inicio de la ocupación, con una importante concentración de 32 unidades en la camada 12C2. Como en A2, la distribución estratigráfica en A3 marca una clara tendencia hacia los niveles medios e iniciales, con una concentración de 13 semillas en la camada 8C (FIIGURA 13).

En relación a la semilla de la familia de las cactáceas, esta se caracteriza por su color negro brillante, textura punteada y forma de gorro. Esta clase de semillas son comunes en diferentes especies de cactus que poseen frutos esféricos a veces comestibles (Hoffmann 1989). En este sentido, si bien no es posible realizar una determinación específica, podemos señalar que cumple aparentemente con la morfología de las semillas del copao (*Eulychnia* sp.) y, en este sentido, podría corresponder a la misma especie que las espinas ya reseñadas. La semilla se registró en la unidad A3, asociada a la camada 9A.

Por otra parte, el molle (*Schinus molle*) es un árbol inerme (sin espinas) de 10 a 20 m de altura, un tronco de hasta un metro de diámetro, excepcionalmente hasta 1,5 m, corteza rugosa pardo oscura hasta marrón, follaje resistente, verde amarillento; hojas compuestas, frutos como drupas globosas, primero verdes y al madurar moradas, de 5-7 mm de diámetro, con una semilla cada uno (Digilio y Legname 1966).

Etnográficamente, manifiesta múltiples usos: medicinalmente, se utiliza en sahumerio para el reumatismo, dolor de muelas y dolor de cabeza. Además, la infusión de la hoja con limón es un remedio apreciado para el dolor de estómago, cólicos, enfriamientos, mareos y como purgante. Al mismo tiempo, sus frutos poseen cualidades tintóreas, medicinales y alimenticias; se consume en ayunas para el dolor de pulmón y vesícula. Como alimento, se consume con azúcar y se prepara chicha. Otros usos hacen referencia a la buena calidad de su madera como combustible. Finalmente, es un árbol muy valorado por su belleza y la frescura de su sombra (Villagrán y Castro 2004).
Junto con los restos de hojas antes mencionadas, el molle (*Schinus molle*) está presente en el contexto arqueológico a partir de 49 frutos o drupas, los cuales se distribuyen principalmente en la unidad A3, estando presente en toda la ocupación aunque con una concentración importante en la camada 8C que arroja 13 unidades. En A2, en cambio, se contabilizaron nueve de estos frutos distribuidos entre los niveles superficiales y medios (camadas 1C a 9D), concordante con el patrón distribucional de la unidad A3 (Tabla 5) (FIGURA 14 y 15).

La calabaza (*Lagenaria* sp.) es uno de los cultígenos andinos de mayor antigüedad. Probablemente su temprana y amplia distribución esté dada por la buena adaptación a ambientes tropicales, subtropicales y temperados, que dan cuenta de una gran versatilidad ambiental para su producción (Timothy 1993). En CAM 14 se ha registrado un fragmento de pericarpio o cáscara de esta especie, cuyo tamaño aunque muy reducido (aprox. 4 x 9 mm) es diagnóstico por su superficie cóncava y textura rugosa. Se asocia a la camada 13C de la unidad A2, es decir a los inicios de la ocupación (FIGURA 16). Pese a lo reducido de la muestra, ésta representaría una evidencia de temprana incorporación de un cultígeno cuya data más antigua hasta ahora se vincula a contextos costeros del arcaico tardío, como Camarones 15 (aprox. 4000 AP) también ubicado en la desembocadura homónima. Se trata de un contexto transicional al periodo Formativo con presencia de cestería y calabaza pirograbada con motivos similares a los registrados en las representaciones rupestres de Cueva La Capilla (Rivera et al. 1974; Muñoz 1982). Es probable que su importancia se deba a su uso alimenticio y artesanal como contenedor.

Finalmente, se encuentran representadas dos hierbas monocotiledóneas a través de los discos que constituyen la base de los bulbos, probablemente comestibles. Tanto el huille (*Leucocoryne* sp., familia Alliaceae) como Flor de la Viuda (*Zephira elegans*, familia Tecophilaeaceae) proliferan en las mesetas de la cordillera de la Costa alimentadas por la camanchaca. Estas plantas bulbosas se caracterizan entre otros aspectos por tener un cormo sólido (raíz que da origen a la parte aérea de la planta) desde el cual creemos se puede estar extrayendo un bulbo comestible.
<table>
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<th>Schinus molle</th>
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Tabla 5: Distribución espacial y estratigráfica de los carporrestos identificados.

Las referencias en torno al consumo alimenticio de estos bulbos son escasas y están documentados principalmente para los sitios arqueológicos de la costa de Iquique. Por una parte, en Alto Patache se registraron evidencias identificadas como *Leucocoryne, Zephyra y/o Fortunatia* spp., en un contexto de cazadores recolectores marinos (acerámico y con rasgos tecnológicos que permiten vincularlo con la
tradición chinchorro), donde aparecen restos de bulbos o bulbos secos en cantidades 
apreciables (Larraín et al. 2004). Al mismo tiempo, Núñez y Moraga (1977) señalan 
que es un hallazgo habitual entre los sitios costeros, probablemente porque en ellos 
encuentran una fuente importante de hidratos de carbono que vendría a complementar 
la dieta esencialmente marina (proteica) de sus habitantes (op. cit.). En complemento, 
evidencias de cormos de Zephira elegans hemos registrado recientemente en la 
misma costa, específicamente en los sitios Los Verdes 9, Sarmentia, Pabellón de Pica, 
Chomache 1 y Punta Blanca, todos ellos aparentemente vinculados al periodo 
Formativo. A diferencia del registro de CAM 14, los contextos anteriores incluyen 
además de los discos, fragmentos de fibras o el corno completo, aunque siempre 
ausente el bulbo interior (Vidal y García 2009).

Los restos han sido reconocidos indistintamente como Leucocoryne sp./Zephira 
elegans, ya que su diferenciación es altamente dificultosa si consideramos su alto 
nivel de fragmentación. Es altamente probable que algunos de ellos correspondan a la 
especie Leucocoryne appendiculata, cuestión que deberá ser corroborada a futuro 
(Arancio com. pers. 2009). Se contaron un mínimo de 41 discos distribuidos en 
ambas unidades. En A3 donde se contabilizaron un total de 27 unidades, los cuales se 
distribuyen de forma homogénea, destacando una concentración de 18 de ellos en la 
camada 1C. En la unidad A2 se contabilizaron 14 unidades y como en el caso anterior 
se encuentran distribuidos a lo largo de la estratigrafía, destacando la camada 3 con 6 
ejemplares (FIGURA 17).

5. ARTEFACTOS
Por último, se han registrado un total de cinco artefactos entre los cuales 
reconocemos tres tipos: dos de ellos representados por un ejemplar cada uno y un 
tercer tipo representado por tres ejemplares.

El tipo 1 corresponde a un pequeño fragmento de madera con punta aguzada. Está 
representado por un sólo ejemplar registrado en la unidad A2, camada 1D (artefacto
1). La evidencia se encuentra fracturada, posee un largo de 25 mm y un diámetro de 6 mm (FIGURA 18).

El tipo 2 corresponde a una vara con punta roma y quemada, elaborado en madera arbórea y también representado por un sólo ejemplar (artefacto 2). Se registró en la unidad A3, camada 8C. Posee un largo 46,9 mm y anchos de 14,2 mm la base y 8 mm en la punta.

El tipo 3 corresponde a artefactos elaborados en maderas arbustivas (*Tessaria absinthioides* o similar) con muesca y evidencia de carbonización. Se registraron tres ejemplares de este tipo (artefacto 3, 4 y 5). El artefacto 3 corresponde a un fragmento de madera con muesca y quema por ambos lados (largo 46,8 mm; ancho 73 mm). Tiene huellas de desgaste en ambos extremos, quizás pudo servir como carrete para alguna fibra fina. Se rescató de la unidad A3 camada 13 (FIGURA 19). El artefacto 4 evidencia combustión en el borde, posee un extremo con terminación diagonal y el otro con una muesca o medio círculo. Se registró en la unidad A2 camada 13C (largo 77 mm; ancho 7 mm; espesor de un lado 4 mm). Artefacto 5 corresponde a un fragmento de madera con un extremo con muesca y quemado, y fracturado en el otro extremo (largo 22,3 mm; ancho 9 mm). Es similar al de camada 13, se registró en la unidad A3 camada 11 (FIGURA 20).
DISCUSION Y CONCLUSIONES

En términos generales, los usos representados a través del material vegetal se vinculan a alimentación y artesanía. El primer ámbito se encuentra representado por evidencias positivas y negativas, reconociéndose entre las primeras las semillas de algarrobos (*Prosopis* sp.), drupas de molle (*Schinus molle*) y frondas de huiro (*Macrocystis integrifolia*) y, entre las segundas, restos de cormos de plantas bulbosas (*Leucocoryne* sp. y *Zephira elegans*), cáscara de calabaza (*Lagenaria* sp.) y tallos de totora (*Typha angustifolia*) y juncos (*Scirpus* sp.). De esta manera, los ámbitos de aprovisionamiento de estos “alimentos” son relativamente inmediatos, comprendiendo la playa, el humedal, el valle y los denominados “oasis de niebla”.

Algunas de las especies anteriores poseen también un valor artesanal, el cual se encuentra representado principalmente por medio de una destacable abundancia de tallos pertenecientes a plantas acuáticas, como totora (*Typha angustifolia*), juncos (*Scirpus* sp.) y cañaveral (*Phragmites australis*) que podrían constituir desechos de manufactura de, por ejemplo, las esteras que se encuentran en el área funeraria adyacente. Así mismo podemos mencionar el fragmento de calabaza (*Lagenaria* sp.) anterior, el cual además podría comprender un uso como contenedor, aunque no hemos registrado evidencias de tratamiento exterior ni huellas de ningún tipo. Del mismo modo, el huiro (*Macrocystis integrifolia*) al evidenciarse el uso de sus frondas como fibra para elaborar lienzas (ovillito). Por último, se incluyen las inflorescencias y probables tallos y artefactos de brea (*Tessaria absinthioides*) de uso desconocido que ya han sido descritos anteriormente por Schiappacasse y Niemeyer en 1984 (Cuadro 1).

En relación al uso artesanal de las fibras provenientes de las plantas palustres, existe una amplia documentación de la utilización de estas familias en contextos Chinchorro, en los cuales se mencionan las “fibras vegetales” como ítem predominante en la manufactura de cordeles (Núñez 1969). Este autor precisamente hace referencia al empleo de “totora” en este rubro, nombre genérico con el cual se
denominan a las especies que crecen cerca de cursos de agua, pudiendo comprender géneros tan variados como *Typha* o *Scirpus*. A su vez, en Camarones 8 (sitio arcaico también cercano a la desembocadura), Belmonte y colaboradores (1995) analizan un conjunto de fibras en el cual se determinó el uso de *Scirpus americanus* (juncos), *Typha* (totoras) y *Distichlis* (grama salada) como materias primas para la manufacturación de cordelería.

Espacialmente podemos observar que ambos usos se encuentran representados en las dos unidades excavadas aunque con diferencias cualitativas y cuantitativas importantes. En A3 están presentes todas las especies identificadas, a excepción del huillo (*Macrocystis integrifolia*) que está presente sólo en A2 junto a restos de molle (*Schinus molle*), totora (*Typha* sp.) y junquillo (*Scirpus* sp.). En este sentido, podemos reconocer sectores de mayor y menor intensidad en el uso de estas plantas dentro de un mismo espacio doméstico.

<table>
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</tr>
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<td>alimenticio</td>
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</table>

Cuadro 1: restos vegetales identificados de las unidades A2 y A3 de Camarones 14. El uso se deriva del tipo de evidencia y la documentación etnobotánica.

En relación a la distribución estratigráfica, vemos que existe una clara tendencia de los restos de agruparse en los estratos intermedios, es decir entre las camadas 5 y 9. Analíticamente podemos dividir la columna estratigráfica en tres grandes segmentos que podrían relacionarse con distintos momentos ocupacionales. Así, la ocupación inicial se vincularía a los niveles inferiores o más profundos, desde la camada 10 a 14; los intermedios corresponden a las camadas 5 a la 9; y finalmente, los niveles superiores comprenden la camada 4 hasta la superficie.
De esta manera, a los niveles intermedios se asocian prácticamente el total de las plantas reconocidas en algún nivel: *Equisetum giganteum*, *Leucocoryne* sp. *Macrocystis integrifolia*, *Phragmites australis*, *Prosopis* sp., *Schinus molle*, *Scirpus* sp., *Tessaria absinthioides*, *Typha angustifolia*, *Zephira elegans* y los restos de las Familias Asteraceae y Cactaceae. Esta abundancia cualitativa y cuantitativa en contraste con los niveles inferiores y sobre todo superiores podrían asociarse a los momentos de mayor intensidad en la ocupación del sitio.

Si bien la tendencia anterior es elocuente en la presencia/ausencia de los restos no cuantificados (tallos, hojas), la evaluación de los carporrestos cuantificables sugieren una tendencia algo diferente. Por una parte, los frutos de molle (*Schinus molle*) replican lo anterior, encontrándose un 53% de ellos en los niveles destacados, mientras que el resto se divide en partes relativamente equitativas entre los niveles superiores e inferiores. Por otra parte, los juncos (*Scirpus* sp.) destacan principalmente en los niveles inferiores o iniciales de la ocupación, donde se concentra el 76% de la semillas contabilizadas, estando completamente ausentes en los niveles superiores. Ello podría implicar un manejo y uso de los juncos desde los inicios de la ocupación, antes que otras especies como el algarrobo (*Prosopis* sp.).

El algarrobo sigue una tendencia completamente opuesta, en la medida que sus semillas se concentran en los niveles superficiales (84,51%) y en los inicios de los niveles medios (15,49%). Siguiendo el criterio estratigráfico, lo anterior sugiere que el procesamiento de vainas de *Prosopis* se vincula a las ocupaciones más tardías del sitio, donde, además, el registro vegetal es notoriamente menos diverso y parece enfocarse a las especies del valle, como algarrobo y molle. De todas maneras, lo anterior debe ser discutido y reevaluado en relación al material de otros contextos arqueológicos (Cuadro 2).

Una situación destacable es el hallazgo de un fragmento muy pequeño –menos de 1 cm- de cáscara de fruto de calabaza (*Lagenaria* sp.) asociada a los niveles inferiores (camada 13C) que apoya la idea ya planteado por otros autores en cuanto al temprano
<table>
<thead>
<tr>
<th>Equisetum giganteum</th>
<th>Lagenaria sp.</th>
<th>Macro cystis integrifolius</th>
<th>Phragmites australis</th>
<th>Prospis sp.</th>
<th>Schinus molle</th>
<th>Scirpus sp.</th>
<th>Tessaria absinthioides</th>
<th>Typha angustifolia</th>
<th>Leucocoryne sp./Zephira elegans</th>
<th>F. Asteraceae</th>
</tr>
</thead>
<tbody>
<tr>
<td>(camadas sup a 4)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>NIVELES MEDIOS</td>
<td>NIVELES SUPERIORES</td>
<td>NIVELES INFERIORES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(camadas 5 a 9)</td>
<td>(camadas 10 a 14)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cuadro 2: Presencia estratigráfica de los restos vegetales identificados en las unidades A2 y A3.

manejo de este tipo de cultígenos por parte de los pescadores desde el arcaico (Núñez 1986).

La diversidad de las especies representadas en el área doméstica de CAM 14 alude a un aprovechamiento amplio del espacio y un conocimiento específico de las propiedades prácticas de las plantas. De ello ya se ha dado cuenta en el ámbito funerario, donde más allá de los diferentes estilos y periodos, la larga tradición de momificación artifical evidencia una continuidad en el uso de ciertas materias primas vegetales para fines específicos (Belmonte et al. 2001).

De esta manera, lo anterior podría entenderse como una manifestación de permanencia o sentido de pertenencia del lugar, apoyando la idea ya planteada del carácter semisedentario de los pescadores chinchorro (Schiappacasse y Niemeyer 1984). En este sentido, los restos vegetales recuperados nos permiten pensar en una relativa autosuficiencia por parte de los habitantes de la desembocadura de la quebrada de Camarones, quienes están obteniendo de manera directa recursos diversos y complementarios provenientes de, al menos, tres ámbitos de aprovisionamiento de recursos: playa, humedal/valle y oasis de niebla. En este sentido, los pescadores no sólo debieron desarrollar mecanismos dinámicos de asentamiento, recolección y desplazamiento, sino también poner en práctica formas muy específicas de conocimiento heredado en relación a los ciclos de vida de la flora y fauna y los ciclos climáticos propios del litoral.
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Villagrán, C., V. Castro, G. Sánchez, F. Hinojosa y C. Latorre

Villagrán, C. y V. Castro
ANEXO: FIGURAS

FIG. 5: hoja de caña (*Phragmites australis*).

FIG. 3 y 4: tallo de totora (*Typha angustifolia*). Anverso y reverso.

FIG. 1 y 2: tallos de juncos (Cyperaceas), probablemente *Scirpus* sp. Detalle sección triangular de los tallos.
FIG. 6 y 7: fragmento de aerociste y rollito elaborado en frondas de huiró (*Macrocystis integrifolia*).

FIG. 8: espinas de cactácea, probablemente copao (*Eulychnia* sp.).

FIG. 9: inflorescencias pertenecientes a la familia Asteraceae.

FIG 10: inflorescencias pertenecientes a brea (*Tessaria absintioides*).

FIG. 11 y 12: semillas de algarrobo (*Prosopis* sp.).
FIG. 13: semillas de junco (*Scirpus* sp.).

FIG. 14 y 15: frutos de molle (*Schinus molle*).

FIG. 16: fragmento de calabaza (*Lagenaria* sp.).

FIG. 17: discos correspondientes a hierbas bulbosas conocidas como flor de viuda (*Leucocoryne* sp./*Zephyra elegans*).
FIG. 18: artefacto 1. Unidad A2 camada 1D.


FIG. 20: artefacto 5. Unidad A3 camada 11.
APPENDIX F

POLLEN ANALYSIS OF SEDIMENT SAMPLES FROM THE CAMARONES 14 SITE, NORTHERN CHILE

Linda Scott Cummings and Melissa K. Logan with Assistance from R.A. Varney
Paleo Research Institute (Golden, Colorado)

Paleo Research Institute Technical Report 09-92
POLLEN ANALYSIS OF SEDIMENT SAMPLES FROM THE CAMARONES 14 SITE, NORTHERN CHILE

By

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and

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Golden, Colorado

Paleo Research Institute Technical Report 09-92

Prepared For

Vanderbilt University
Anthropology Department
Nashville, Tennessee

April 2010
INTRODUCTION

Three sediment samples from the excavated profile of the Camarones 14 site in northern Chile were submitted for pollen analysis. The site is believed to represent a middle Holocene occupation associated with the Chinchorro Tradition. These three samples were examined in an effort to provide subsistence information.

METHODS

Pollen

A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for the removal of the pollen from the large volume of sand, silt, and clay with which they are mixed. This particular process was developed for extraction of pollen from soils where preservation has been less than ideal and pollen density is lower than in peat.

Hydrochloric acid (10%) is used to remove calcium carbonates present in the soil, after which the samples are screened through 150 micron mesh. The samples are rinsed until neutral by adding water, letting the samples stand for 2 hours, then pouring off the supernatant. A small quantity of sodium hexametaphosphate is added to each sample once it reaches neutrality, then the samples are allowed to settle according to Stoke’s Law in settling columns. This process is repeated with ethylenediaminetetraacetic acid (EDTA). These steps remove clay prior to heavy liquid separation. The samples are then freeze dried. Sodium polytungstate (SPT), with a density 1.8, is used for the flotation process. The samples are mixed with SPT and centrifuged at 1500 rpm for 10 minutes to separate organic from inorganic remains. The supernatant containing pollen and organic remains is decanted. Sodium polytungstate is again added to the inorganic fraction to repeat the separation process. The supernatant is decanted into the same tube as the supernatant from the first separation. This supernatant is then centrifuged at 1500 rpm for 10 minutes to allow any silica remaining to be separated from the organics. Following this, the supernatant is decanted into a 50 ml conical tube and diluted with distilled water. These samples are centrifuged at 3000 rpm to concentrate the organic fraction in the bottom of the tube. After rinsing the pollen-rich organic fraction obtained by this separation, all samples receive a short (20-30 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples are then acetalated for 3-5 minutes to remove any extraneous organic matter.

A light microscope is used to count the pollen to a total of approximately 100 to 200 pollen grains at a magnification of 500x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen diagrams are produced using Tilia, which was developed by Dr. Eric Grimm of the Illinois State Museum. Total pollen concentrations are calculated in Tilia using the quantity of sample processed in cubic centimeters (cc), the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted and expressed as pollen per cc of sediment.
Unidentified pollen, such as that reported as TC/TCP, includes pollen grains that are folded, mutilated, and otherwise distorted. These grains are included in the total pollen count since they are part of the pollen record. The microscopic charcoal frequency registers the relationship between pollen and charcoal. The total number of microscopic charcoal fragments was divided by the pollen sum, resulting in a charcoal frequency that reflects the quantity of microscopic charcoal fragments observed, normalized per 100 pollen grains.

DISCUSSION

The Camarones 14 site is located in the Atacama desert along the coast of the Camarones River in northern Chile. The site, which lies on a marine terrace approximately 35 meters above mean sea level (amsl), is boarded on the north by the Camarones River valley; on the south by sand-covered slopes; on the east by mountains; and on the west by the beach and ocean. The site is believed to represent a middle Holocene occupation associated with the Chinchorro Tradition. The river valley to the north supports vegetation, which includes Atriplex imbricata (kachiyuyo or piyaya), Atriplex madariagae (kachiyuyo or piyaya), Distichlis spicata (grama salada), and Tessaria absintioides (brea o sorona). Wetlands near the lagoon and river support Typha angustifolia (totora), Scirpus (juncos), and Phragmites (caña).

The pollen record from these three sediment samples is similar in the lower two samples (2 and 1) and quite different in the uppermost sample (Table 1). The lowest sample (sample 1 from Layer A) is heavily dominated by Typha angustifolia-type charcoal, representing local growth of totora in the wetlands and perhaps an expanded wetland community relative to that of today (Table 2, Figure 1). Cyperaceae pollen was the second dominant type, probably representing Scirpus (juncos), which grows in the area today. This sample also contained a moderate quantity of Nothofagus pollen, representing southern beech trees growing in the area when this sample accumulated. Only small quantities of Poaceae and an unidentified pollen (TC/TCP) that was too crushed to be able to discern whether it was tricolpate (TC) or tricolporate (TCP), representing local grasses, as well as other plants. A total pollen concentration of approximately 2800 pollen per cubic centimeter (cc) of sediment is a rather large amount for a sandy sediment matrix. The fact that few pollen were crumpled to the point that they could not be identified or described indicates very good preservation. This sample contained a significant quantity of microscopic charcoal and undoubtedly represents a period of occupation at the site, which is consistent with the recovery of botanical remains, mollusk shells, crustaceans, and fish bones.

Sample 2, representing Layer C, also contained large quantities of Typha angustifolia and Cyperaceae pollen, representing the wetland plants totora and juncos. The Poaceae pollen frequency was slightly elevated in this sample, suggesting that the population of grasses was at least slightly larger. Small quantities of Cheno-am, Sida, and Nothofagus pollen were noted, indicating that the local vegetation also included Atriplex, a member of the mallow family, and only a small quantity of southern beech trees, the latter of which was becoming more rare on the landscape. This sample contained approximately 2100 pollen per cc of sediment, which is also excellent. In addition, it contained nearly double the quantity of microscopic charcoal when compared with the lower sample, indicating intense economic activity involving burning or cooking in the area where this sample was collected.

Sample 3, representing Layer F, yielded a much different pollen signature. Dominance of this pollen record by High-spine Asteraceae pollen indicates that the wetland had dried up at
least partially. Recovery of moderately large quantities of Cyperaceae and Poaceae pollen indicate that sedges and grasses also grew in the area. Only a very small amount of *Typha angustifolia*-type pollen was observed, suggesting that the wetland had dried considerably. *Nothofagus* pollen has disappeared from the record, suggesting that southern beech trees were no longer growing in the area. Total pollen concentration was similar to that in the other samples, as it was calculated at slightly less than 2100 pollen per cc of sediment. The microscopic charcoal was much less abundant in this sample than either of the lower samples.

**SUMMARY AND CONCLUSIONS**

Pollen analysis of three samples from Camarones 14, Chile indicates that the wetland that was visible in the samples from Layers A and C, the wetland was drying by the time that sediments accumulated in Layer F. This is consistent with the recovery of fish bones in the sediments from Layers A and C and not in Layer F. The transition from a wetland to drier conditions was already under way by the time sediments represented by sample 2 (Layer C) accumulated, although the change recorded was one from clear dominance by cattails (*Typha*) with a smaller quantity of sedges (Cyperaceae) to co-dominance by *Typha* and Cyperaceae. Local *Nothofagus* trees were declining in frequency along the drainages or beside the wetlands, as well. Finally, as the wetlands dried the area supported sedges (Cyperaceae), grasses (Poaceae), and members of the sunflower family (Asteraceae).
<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Layer</th>
<th>Depth (mbs)</th>
<th>Provenience/Description</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>F</td>
<td>0.55-0.6</td>
<td>Sand with organic material, mainly botanical fragments.</td>
<td>Pollen</td>
</tr>
<tr>
<td>2</td>
<td>C</td>
<td>.9</td>
<td>Sand mixed with botanical remains, mollusk fragments, and fish bones.</td>
<td>Pollen</td>
</tr>
<tr>
<td>1</td>
<td>A</td>
<td>1.15</td>
<td>Sand mixed with botanical remains, small fragments of mollusk shells, crustaceans, and fish bones.</td>
<td>Pollen</td>
</tr>
</tbody>
</table>
### TABLE 2
POLLEN TYPES OBSERVED IN SAMPLES FROM THE CAMARONES 14 SITE

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ARBOREAL POLLEN:</strong></td>
<td></td>
</tr>
<tr>
<td>Nothofagus</td>
<td>Beech</td>
</tr>
<tr>
<td><strong>NON-ARBOREAL POLLEN:</strong></td>
<td></td>
</tr>
<tr>
<td>Asteraceae:</td>
<td>Sunflower family</td>
</tr>
<tr>
<td>High-spine</td>
<td>Includes aster, rabbitbrush, snakeweeds, sunflower, etc.</td>
</tr>
<tr>
<td>Cheno-am</td>
<td>Includes the goosefoot family and amaranth</td>
</tr>
<tr>
<td>Cyperaceae</td>
<td>Sedge family</td>
</tr>
<tr>
<td>Ephedra torreyana-type (includes E. torreyana, E. trifurca, and E. antisyphilitica)</td>
<td>Ephedra, Jointfir, Mormon tea</td>
</tr>
<tr>
<td>Poaceae</td>
<td>Grass family</td>
</tr>
<tr>
<td>Sida</td>
<td>similar to Sida, Mallow</td>
</tr>
<tr>
<td>Typha angustifolia-type</td>
<td>Cattail</td>
</tr>
<tr>
<td>TC/TCP</td>
<td>Includes pollen grains that are folded, mutilated, and otherwise distorted and unidentifiable</td>
</tr>
<tr>
<td>Charcoal</td>
<td>Microscopic charcoal</td>
</tr>
<tr>
<td>Total pollen concentration</td>
<td>Quantity of pollen per cubic centimeter (cc) of sediment</td>
</tr>
</tbody>
</table>
FIGURE 1. POLLEN DIAGRAM FOR CAMARONES 14, CHILE.
APPENDIX G

PHYTOLITH ANALYSIS OF SITE CAMARONES 14

José Iriarte and Jennifer Watling
Laboratory of Archaeobotany and Paleoecology
Department of Archaeology, HuSS, University of Exeter
Materials and methods

This preliminary report presents a summary of the phytolith analysis of 6 samples from excavations in the context of the “Proyecto Paleoecológico y Sedentarismo de Cazadores-Recolectores Costeros en el Norte de Chile, Region de Taparaca” directed by Teresa Franco (Table 1).

Table 1. List and provenience of the archaeological sediments analysed

<table>
<thead>
<tr>
<th>Site</th>
<th>Excavation Unit</th>
<th>Strata</th>
<th>Lab. no</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camarones</td>
<td>A2</td>
<td>9/C</td>
<td>CM 1</td>
</tr>
<tr>
<td>Camarones Sur</td>
<td>Perfile Leste</td>
<td>C</td>
<td>CM 2</td>
</tr>
<tr>
<td>Camarones 14</td>
<td>Perfil Leste</td>
<td>C</td>
<td>CM 3</td>
</tr>
<tr>
<td>Camarones 14</td>
<td>Perfil Leste</td>
<td>B</td>
<td>CM 4</td>
</tr>
<tr>
<td>Camarones 14</td>
<td>Perfil Leste</td>
<td>B</td>
<td>CM 5</td>
</tr>
<tr>
<td>Camarones 14</td>
<td>F</td>
<td></td>
<td>CM 6</td>
</tr>
</tbody>
</table>

Samples were processed, identified, and counted at the University of Exeter Archaeobotany Laboratory. Phytolith extractions from the archaeological sediments followed standard procedures. Sediment samples were deflocculated in a shaker with Calgon for 24 hours. Clays were washed by gravitational sedimentation, carbonates where removed using Hydrochloric acid, and organic matter was removed with Nitric acid and Potassium chlorate when necessary. Samples were floated in a Zinc bromide solution at a specific density of 2.3 g/ml,
dried in acetone, and mounted in Permount. The lithic tool was sonicated for half and hour, the sediment residue collected, centrifuged, treated with Nitric acid and phytolith floated with Zinc Bromide. More details of this procedure can be found in Piperno (2006: 119-129). In order to maximize the recovery of important phytoliths of different size classes, such as those that derive from the rinds of *Cucurbita* fruits and leaves and cobs of maize (*Zea mays* L.), archaeological sediments were separated by wet-sieving into fine silt (fraction A, 2-25 µm), coarse silt (fraction B, 25-50 µm) and sand (fraction C, 50-2000 µm) fractions. The entire extract recovered from the sand fraction was scanned in search for *Cucurbita* phytoliths and other large arboreal and economic plant forms. Extended counts of the fine silt fraction were carried out in order to search for cross-shaped phytoliths in order to detect the presence of maize leaf phytoliths (Iriarte 2003; Pearsall 2000; Piperno 2006). Similarly, since wavy-top maize rondel types constitute a minor part of the prolific rondel assemblages produced by maize cobs, and may be absent in some maize races (Mulholland 1993; Piperno and Pearsall 1993; Pearsall et al. 2003), the samples were also subjected to an intensive search for these types. Phytoliths were identified under the light Zeiss Axioskope 40 microscope at 500 x magnifications. Identification of Poaceae phytoliths was based on a morphological classification first proposed by Twiss et al. (1969), and later modified or refined by various researchers by taking into account criteria based on three-dimensional morphology and other micro-morphological features (Brown 1984; Fredlund and Tiezen 1994; Mulholland 1989; Twiss 1992); neotropical grasses (De Campos and Labouriau 1969; Pearsall 2000; Piperno 2006; Piperno and Pearsall 1998b; Sendulsky and Labouriau 1966; Sondahl and Labouriau, 1970; Teixeira da Silva and Labouriau 1970); and the Rio de la Plata Grasslands (Bertoli de Pomar 1971; Zucol 1996, 1998, 1999). The phytolith diagram was made using C2 software (Juggins 2003). Horizontal bars represent percentages; crosses correspond to presence/absence of plant taxa/phytolith morphotypes lower than 1% in abundance.
Results

All samples had good preservation of phytoliths. We did not find phytolith morphotypes diagnostic of plant of economic importance in the six samples analysed. In addition, despite complete and intensive scanning of all C-fraction slides (slides containing phytoliths >50 µm) no squash (*Cucurbita* sp.) scalloped sphere phytoliths were found.

A large proportion of the phytolith assemblages, in some samples comprising up to 50%, fall into an unidentified category. This underscores the need to create phytolith reference collection of modern plants and vegetation formations from the desert coast of Chile to identify undeterminable phytolith morphotypes. These unidentified morphotypes are irregular bodies displaying psilate (smooth) sculpting lacking surface decoration and bearing projections that usually terminate in concave ends. Some of the projections are pronounced while others can be much shorter and wider. They can appear forming aggregates or isolated (Figure 1: j-l).

**CM1: Lithic artefact**

The sample corresponds to the phytolith residue extracted from a flake. This sample is the only one that is dominated by arboreal-type phytoliths, largely globular granulate phytoliths (Figure 1:i) and small numbers of globular psilate phytoliths and faceted elongates. A few Asteraceae opaque perforated platelets were present and trace amounts of cross-shaped Panicoideae short cells were also observed. The dominance of woody-dicot phytolith suggests that this lithic tool may have been used to work wood.
CM2:

Sample CM2 has a large percentage of unidentified phytoliths totalling up to 48% of all forms observed. These are followed by globular granulate phytoliths, an minor percentage of Poaceae (grass) short cells and Cyperaceae sedges (Figure 1:h). The grass phytolith assemblage contains Panicoid (crosses and bilobates) (Figure 1:a), Chloroid (saddles), and the Pooid circular/oblong (Figure 1: b), rectangular/square and wavy trapezoids (Figure 1:c) morphotypes in minor amounts.

CM3:

The assemblage CM3 is very comparable to that in CM2, except that substantially more Cyperaceae hat-shaped bodies are present. Cyperaceae sedges in general thrive in wet areas, like wetlands or wet prairies. The sample is also characterised by a slight increase in grass phytoliths. The number of unidentified phytoliths is comparable to CM2.

Figure 2. Phytolith percentage diagram.
CM4:

CM4 has also a large number of the unidentified morphotypes. These are followed by a high percentage of Cyperaceae sedges, totalling around 35%, representing the highest percentage of all the samples. Globular granulate phytoliths are less well represented that in other samples. The sample also contains trace amounts of ridged saddles from *Phragmites*, a brackish water reed that possibly grows in the vicinity of the site. Panicoid and Chloridoid grasses are still a background presence, whilst rondels and spiky towers are both only present in trace amounts.

CM5:

The phytolith assemblage from CM5 is very similar to CM4. Cyperaceae hat-shaped bodies and globular granulate phytoliths are equally abundant. The same grasses are present as are described above but the unidentified phytoliths have also dropped in relative abundance by around 15%.

CM6:

CM6 sample exhibit smaller numbers of all morphotypes of phytolith described in previous samples, but “spiked towers” that are far more abundant than in any of the other samples, reaching 43%. Higher numbers of rondels are also present suggesting a positive correlation between the two types. Spiked towers are thick, narrow rondels exhibiting two or three spikes in one end (Figure 1: f-g). These phytolith morphotypes have been generally called “towers” or “spools” in the Old World (e.g., Kondo et al. 1994; Boyd et al. 1998). In the New World, this type of phytolith have been reported from the Pampa grass *Cortaderia* sp. (Danthoniidae) (Zucol 1999), in the seashore saltgrass *Distichlis spicata* (Chloridoideae), and from some bamboos like *Guada* sp. (Bambusoideae) (Pearsall 2000: 452-453). Given the proximity of Camarones to the seashore, it is likely these “spiked towers” represent the background vegetation, possibly seashore saltgrass or *Cortadeira*. The rest of the grass phytolith assemblage
contains Panicoid (crosses and bilobates) (Figure 1:a), Chloroid (saddles), and Pooid (circular) phytoliths (Figure 1: b) in minor amounts.

Phytolith preservation was very good and other non-diagnostic phytoliths in the samples included: bulliform cells, tracheid elements, Poaceae (grass) long cells, silicified epidermal sheets containing long and short cells, silicified sclerenchyma cells, silicified epidermal hair cells, dicotyledonous polyhedral and jig-saw puzzle epidermal cells. A phytolith reference collection from modern plants of the northern coast of Chile is needed to identify these unknown phytoliths.

**Preliminary conclusions**

- No phytoliths from plants of economic importance have been found in the samples
- A large percentage of the phytolith assemblages is comprised of unidentified phytolith stressing the need to carry out phytolith reference collections from modern plants and vegetation formations in the north coast of Chile desert to ID these indeterminable morphotypes
- The flake tool (CM1) is dominated by phytoliths mainly produced by arboreal phytolith suggesting that it may have been used to process wood
- The samples contain phytoliths from Cyperaceae sedges, *Phragmites* reeds and grasses that appear to represent background vegetation or plant brought to the site as construction material such as thatched roofs (reeds, sedges) or bedding such as grass mats
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APPENDIX H

PARASITOLOGICAL ANALYSIS: COPROLITES FROM CAMARONES 14

Adauto Araujo and Mônica Vieira.
Escola Nacional de Saúde Pública,
Fundação Oswaldo Cruz - Rio de Janeiro, Brasil.

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<td>2185 A</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>fitólito drusa</td>
<td>1 foto fitólito drusa (FitólitoDrusa) / 1 foto fitólito (Fitólito1)</td>
<td></td>
</tr>
<tr>
<td>2185 A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
<td>1 foto amido milho (Amido 3)</td>
<td></td>
</tr>
<tr>
<td>2185 B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
<td>2 fotos amido polarizada (16) (11) / 1 foto amido juntos (24) / 1 foto amido (5)</td>
<td></td>
</tr>
<tr>
<td>2185 B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>muito pólen e fitólito</td>
<td>1 foto fitólitos muito frequente</td>
<td></td>
</tr>
<tr>
<td>2185 C</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
<td>1 foto amido (6) / 1 foto amido cozido (2) / Amidos polarizada (1)</td>
<td></td>
</tr>
<tr>
<td>2185 D</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1 foto amido (8)</td>
<td></td>
</tr>
<tr>
<td>2185 E</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2186</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2187</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

555
APPENDIX J: Soil sample analysis from Camarones 14. Report sent by Dr. Mario Piño

Informe Análisis de sedimentos Perfil Norte Camarones 14
Proyecto: Paleoecología y Sedentarismo de Cazadores - Recolectores Costeros en el Norte de Chile (Teresa Franco)

1) Las muestras de sedimentos EA₂, CA₂, CA₃, EA₃ y D, fueron sometidas a inspección bajo lupa con el objeto de describir su contenido biológico.

Muestra EA₂: Sedimento arenoso de color gris oscuro, con intenso olor a pescado. Gran cantidad de fragmentos de conchas, crustáceos y huesos pequeños. Llama la atención un pequeño fragmento con dientes, que probablemente corresponda a parte del proceso mandibular de un pez. Son numerosos los restos vegetales como, ramillas, carbones y algunas semillas. Presentes también, aunque escasos, pelos y fibras vegetales de color amarillo y blanco.

***Debido al estado de compactación, las muestras EA₃ y D fueron primero disgregadas en agua y luego separadas en sus tres clases texturales (grava, arena y fango) con tamices de 2 mm y 63 µm. Las fracciones se secaron en estufa a 40º C y las dos fracciones mayores fueron observadas bajo lupa.

Muestra EA₃: Sedimento cementado pardo rojizo, de olor úrico, el material de cementación corresponde a una especie de resina pardo rojiza. Estos sedimentos presentan gran cantidad de fragmentos de conchas (Choromytilus). Abundantes son también las fibras vegetales (rojas y amarillas), pequeños fragmentos óseos y cartilaginosos. Restos vegetales escasos, solo se observan pocos, pequeños y altamente fragmentados.
La muestra presenta el mayor porcentaje de Materia orgánica (9,6%)

Muestra D: Sedimento arenoso de color pardo-amarillo, cementado, de olor úrico característico. Prácticamente estéril en restos orgánicos reconocibles, aun cuando son abundantes pequeños fragmentos de conchas. Otros fragmentos de aspecto cartilaginoso y óseo de color amarillento de mayor tamaño son frecuentes.
La arena de esta muestra presenta gran cantidad de pequeños clastos de ~1.5 mm. El porcentaje de esta fracción es el menor de todas las muestras (68%).
La muestra presenta también la abundancia relativa más alta de grava (~20%), carbonatos (13%) y el menor porcentaje de materia orgánica (3%).

Muestra CA₂: Sedimento arenoso, pardo rojizo con abundante biotita. También son numerosos los restos vegetales (carbones, ramitas y algunas semillas). Relativamente frecuentes también espinas de erizos de mar y pequeñas estructuras cónicas con coloración en bandas que probablemente corresponden a dientes de ictiofauna (menos abundantes que en muestra CA₃).
Esta muestra presenta el mayor porcentaje relativo de arena (~93%) y el menor para mat. orgánica (~2,6)%, fango (~4,8%) y grava (~2%).

556
Muestra CA₃: Sedimento gris oscuro con gran cantidad de material vegetal carbonizado (espinas, semillas y pequeños fragmentos de tallos vegetales). Abundantes restos de crustáceos (patas y restos de carapazón) carbonizados, vértebras de peces y fragmentos de conchas de color azul que probablemente correspondan a la especie Choromytilus. Al igual que en muestra CA₂ están presentes estructuras cónicas con coloración en bandas (dientes de ictiofauna??). También presentes pelos y fibras vegetales de color blanco. Presenta el mayor porcentaje de carbonatos (21%).

2) Para el análisis de sedimentos las muestras fueron separadas en sus tres fracciones principales (grava, arena y fango) mediante tamizaje húmedo, con tamiz de 2mm y 63 µm. Las fracciones correspondientes a arena y fango de cada una de las muestras, fueron tratadas con HCl al 15% con el fin de cuantificar el porcentaje de carbonatos presentes. Luego dichas fracciones fueron incineradas en mufla a 550º por espacio de 2 horas para determinar el contenido de materia orgánica presente en cada muestras. A continuación se detallan los porcentajes obtenidos:

<table>
<thead>
<tr>
<th>%Fracciones</th>
<th>EA₂</th>
<th>EA₃</th>
<th>D</th>
<th>CA₂</th>
<th>CA₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grava</td>
<td>8,65</td>
<td>7,98</td>
<td>20,30</td>
<td>1,95</td>
<td>9,79</td>
</tr>
<tr>
<td>Arena</td>
<td>82,62</td>
<td>81,02</td>
<td>68,22</td>
<td>92,76</td>
<td>78,07</td>
</tr>
<tr>
<td>Fango</td>
<td>10,57</td>
<td>9,68</td>
<td>9,16</td>
<td>4,80</td>
<td>10,99</td>
</tr>
<tr>
<td>Carbonato*</td>
<td>16,67</td>
<td>14,35</td>
<td>13,14</td>
<td>16,57</td>
<td>21,01</td>
</tr>
<tr>
<td>Mat. org.*</td>
<td>3,66</td>
<td>9,57</td>
<td>3,07</td>
<td>2,55</td>
<td>4,52</td>
</tr>
</tbody>
</table>

*Porcentaje de carbonatos y mat. orgánica expresados como suma de porcentajes de la fracción arena y fango.

3) La fracción arena de cada una de las muestras fue analizada en tubo de sedimentación. Se efectuaron tres réplicas por muestra y los valores obtenidos fueron analizados mediante el programa GRANPLOTS (Versión 4.0), obteniéndose los siguientes estadígrafos por muestra:

<table>
<thead>
<tr>
<th></th>
<th>EA₂</th>
<th>EA₃</th>
<th>D</th>
<th>CA₂</th>
<th>CA₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media φ</td>
<td>2,7756</td>
<td>2,5978</td>
<td>2,4307</td>
<td>2,8984</td>
<td>2,7448</td>
</tr>
<tr>
<td>D. estándar φ</td>
<td>0,8723</td>
<td>0,9576</td>
<td>1,0798</td>
<td>0,7273</td>
<td>0,8923</td>
</tr>
<tr>
<td>Asimetria</td>
<td>-0,8200</td>
<td>-0,6670</td>
<td>-0,5860</td>
<td>-0,5387</td>
<td>-0,7803</td>
</tr>
<tr>
<td>Curtosis</td>
<td>3,2372</td>
<td>2,8949</td>
<td>2,5246</td>
<td>2,5389</td>
<td>3,1181</td>
</tr>
</tbody>
</table>

**Resultados expresados como promedio de tres réplicas.
APPENDIX J: Soil sample analysis from Camarones 14. Report sent by Dr. Mario Piño

Para caracterizar las muestras de arena en base a los parámetros estadísticos obtenidos, se utilizó la descripción establecida por Folk, 1974.

<table>
<thead>
<tr>
<th>Muestra</th>
<th>Selección $\phi$</th>
<th>Asimetría</th>
<th>Curtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA$_2$</td>
<td>Moderadamente seleccionada (0,71 $\phi$ a 1,0 $\phi$)</td>
<td>Alto exceso de granos gruesos (-0,3 a -1,0)</td>
<td>Extremadamente leptocúrtica (&gt;3,00)</td>
</tr>
<tr>
<td>EA$_3$</td>
<td>Moderadamente seleccionada</td>
<td>Alto exceso de granos gruesos</td>
<td>Muy leptocúrtica (1,50 a 3,00)</td>
</tr>
<tr>
<td>D</td>
<td>Mal seleccionada (1,00 $\phi$ a 2,00 $\phi$)</td>
<td>Alto exceso de granos gruesos</td>
<td>Muy leptocúrtica</td>
</tr>
<tr>
<td>CA$_2$</td>
<td>Moderadamente seleccionada</td>
<td>Alto exceso de granos gruesos</td>
<td>Muy leptocúrtica</td>
</tr>
<tr>
<td>CA$_3$</td>
<td>Moderadamente seleccionada</td>
<td>Alto exceso de granos gruesos</td>
<td>Extremadamente leptocúrtica</td>
</tr>
</tbody>
</table>
APPENDIX K

The Topographic Plan of Camarones 14

Topography and Digitalization: Raul Rocha U.
Departmento de Antropologia
Universidad de Tarapacá, Arica)