[Supplementary material]

Vaquerías ceramics: a techno-stylistic study of the earliest polychrome pottery in the Argentine Northwest

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Methodology

Morphological aspects were analysed taking the identification of the shape repertoires as a base, using the standards defined by the Convención Nacional de Antropología (1966) and Balfet *et al*. (1983). In this sense, we analysed the characteristics of the sherds surfaces and the treatments that were applied using variables such as coloration, firing atmosphere and surface finishing. The use of techniques such as smoothing, polishing and burnishing, the application of slip, painting, incisions and modelling appliqué, were taken into consideration. Iconographic analysis was performed via the identification of formal design elements, this is, design field, composition and motifs. Following a non-hierarchical analysis mode, we proceeded with the observations of recurrent representations (patterns) for the definition of design units, spatial orderings, reading planes and symmetry patterns. From there, we identified the compositional structure of this style (Cremonte & Bugliani 2006–2009; Bugliani 2008).

The description of the pastes was performed through a petrographic study. Thin sections were examined using a petrographic or polarized light microscope (Leica model DME-P). Photomicrographs were obtained with a Canon Rebel EO5 camera, and captured with the 5×/0.12 objective and crossed polars, which allows an optimal image of the thin section. First, the analysis consisted in the classification of the structures of the pastes background (Courtois 1976). Secondly, we identified inclusions above 15µm. Petrographic identification was based on the optical properties of the minerals (Kerr 1965). Furthermore, we identified other elements present within the clay matrix, such as volcanic glass, opaque minerals and grog. The mineral inclusions were classified according to their granulometry and shapes. In this sense, we used the Wentworth's granulometric classification scale (taken from Adams *et al*. 1997 [1984]) and sedimentology charts for determining the sphericity and angularity degree. Finally, we described the cavities considering the shapes and sizes observed. During the descriptive process, we quantify a minimum of 300 points per thin section (Cremonte 1996). For the point-counting analysis, we used the “multiple intercept” method (Quinn 2013), which allowed us to obtain a percentage distribution of the registered elements. Afterwards, these data were subjected to a cluster analysis through the PAST 2.17 software (Hammer *et al*. 2001). Thirteen quantitative variables were considered for each one of the samples, corresponding to percentages of matrix (Mz), voids (Vd), quartz (Qtz), potassium feldspar (Kfs), plagioclases (Pl), biotite (Bt), muscovite (Ms), amphiboles and pyroxene (Am–Px), opaque minerals (Op), granitic stones (Gr), sandstone (Sd), slate and phyllite (Sl–Ph) and grog (Gg). Other variables such as volcanic stones (Vs), volcanic glass (Vg), shale (Sh), claystone (Cs), quartzite (Qt), carbonate (Cb), tourmaline (Tur), garnet (Grt) and microcline (Mc) were not considered since they have an occasional and scarce presence in some samples.

The cluster analysis was conducted using the algorithm of paired groups with measure of Euclidean distance (Shennan 1992 [1988]). From this test, we obtained a cophenetic correlation coefficient of 0.9373, resulting in a dendrogram depicting a reliable representation of the distance matrix (see Figure S1). The groupings were subsequently combined with the data regarding shape and design, registering the way in which the fragments within each petrographic group behaved at a stylistic level.

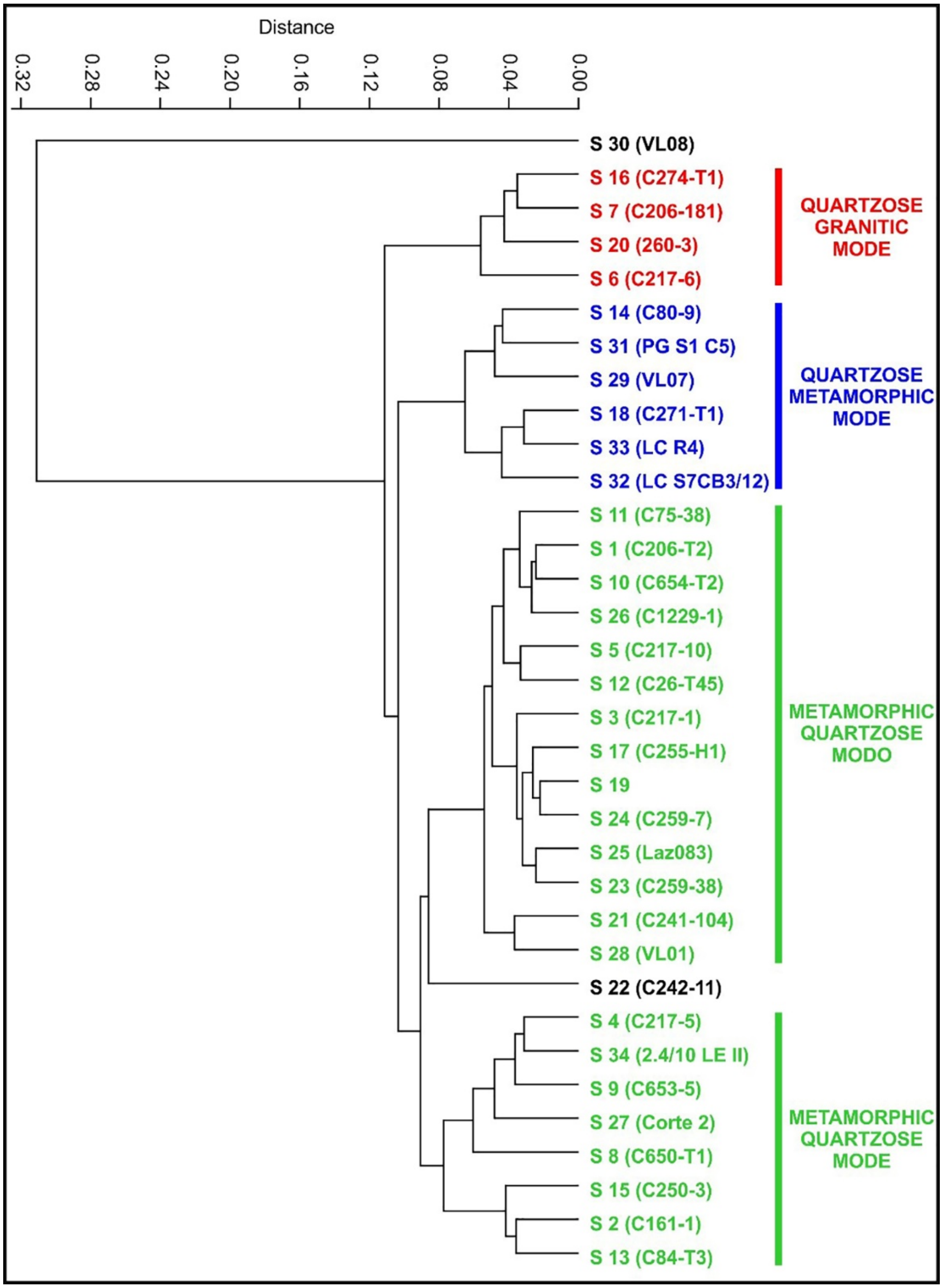

Figure S1. Cluster analysis dendrogram of the 34 thin sections analysed. Software: PAST version 2.17 (Hammer et al*. 2001).*

Petrographic description

Metamorphic-Quartzose Medium Mode

This cluster comprises samples characterised by the addition of low-grade metamorphic rocks (e.g. slate and phyllite: 2.4–12.8%), sandstone (0.8–4%), quartz (4.2–10.3%), and grog (1–8.8%). Other recorded tempers are Kfs (≤1.6%), Pg (0.1–0.7%), Mc (≤0.2%), Bt (≤0.5%), Ms (≤0.9%), Am–Px (≤0.4%), Cb (≤ 0.2%), Cs (≤ 0.7%), Gr (≤0.5%), Vg (≤0.8%), and Op (≤0.7%). The density of inclusions fluctuates between 17.3 and 26.3%. The inclusions are sub-angular and sub-rounded. Most of them have sizes between 125 and 2000μm (fine sand–very coarse sand). The voids represent between 1.6 and 5.6%. The matrix represents between 69.6 and 80.5%. The fabrics are compact and have textures crypto-phyllitic, crypto-phyllitic something micro-granular, pseudo-lepidoblastic something micro-granular, and micro-granular something pseudo-lepidoblastic. The analysed pieces were cooked in an oxidising atmosphere (Figure 3; Figure S1 & Table S1).

Table S1. Synthesis of the morphological, stylistic and petrographic analysis of the selected samples. Sl-Ph (slate and phyllite); Qtz (quartz); Sd (sandstone); Gg (grog); Pl (plagioclases); Gr (granitic stones); Vs (volcanic stones); Vg (volcanic glass); Kfs (potassium feldspar); Bt (biotite); Op (opaque minerals).

Sample	Area	Fragment	Shape	Design fields	Design elements	Colours	Structure	Inclusions			Voids	
								%	Predominant inclusions	Predominant granulometry (µm)	Shape	Size (µm)
1	Cajón Valley	C206-T2 (V19) Bordo Marcial	Closed?	External surface	Triangles	2.5YR 2.5/0 10R 3/6 7.5YR 6/4	Crypto-phyllitic something micro-granular	23	Qtz, Sl-Ph, Sd, Gg	Medium sand and coarse sand (250–1000)	Elongated and irregular	400
2		C161-1 (V20) Bordo Marcial	Open. Bowl with composed outline	Internal and external surface	Triangles and parallel lines	7.5YR 3/1 7.5YR 6/4	Crypto-phyllitic something micro-granular	23	Sl-Ph, Sd, Qtz	Coarse sand and very coarse sand (500–2000)	Elongated and irregular	400
3		C217-1 (V22) Bordo Marcial	Closed?	External surface	Rows of triangle	5R 3/4. 5YR N2.5/1 7.5YR 5/4	Crypto-phyllitic something micro-granular	18	Sl-Ph, Qtz, Gg	Medium sand and coarse sand (250–1000)	Elongated and irregular	400

4		C217-5 (V23) Bordo Marcial	Closed?	External surface	Parallel lines	10R 3/6 7.5YR 6/4	Crypto-phyllitic something micro-granular	26	Gg, Sl-Ph, Sd, Qtz	Coarse sand and very coarse sand (500–2000)	Elongated and irregular	400
5		C217-10 (V24) Bordo Marcial	Closed?	External surface	Parallel lines and staggered figure	7.5YR 3/1 7.5YR 6/4	Crypto-phyllitic	21	Qtz, Sl-Ph , Sd, Gg	Medium sand and coarse sand (250–1000)	Elongated and irregular	400
6		C217-6 (V25) Bordo Marcial	Open	Internal and external Surface	Parallel lines and geometrical solid figures	7.5R 3/2 10R 3/3 5YR 5/6	Pseudo-lepidoblastic	19	Qtz, Gs, Bt, Vg, Pl	Medium sand and coarse sand (250–1000)	Elongated and irregular	400
7		C206-181 (V39) Bordo Marcial	Closed with modelling appliqué on rim	External surface	Lines and geometrical solid figures	10R 4/2 5YR 2.5/1 7.5YR 6/4	Pseudo-lepidoblastic	21	Qtz, Gs, Bt, VV, Fk	Medium sand and coarse sand (250–1000)	Elongated and irregular	400
8		C650-T1 (V40) Bordo Marcial	Closed?	External surface	Lines in V-shape and triangle	10R 4/2 5R2.5/2 7.5YR 6/4	Crypto-phyllitic	25	Gg, Qtz, Sl-Ph, Sd	Coarse sand and very coarse sand (500–2000)	Elongated and irregular	400

9		C653-5 (V41) Bordo Marcial	Open?	Internal surface	Parallel lines	5Y 2.5/1 7.5YR 7/4	Crypto-phyllitic	26	Sl-Ph, Qtz, Gg, Sd	Coarse sand and very coarse sand (500–2000)	Elongated and irregular	600
10		C654-T2 (V42) Bordo Marcial	Open	Internal surface	Lines in V shape and rows of triangles	5R 2.5/1 7.5YR 6/3	Pseudo-lepidoblastic something micro-granular	22	Qtz, Sl-Ph, Sd, Gg	Medium sand, course sand, and very coarse sand (250–2000)	Elongated and irregular	600
11		C75-38 (V5) Cardonal	Open	Internal and external Surface	Parallel lines and triangle	7.5R 4/4 5YR 2.5/1 7.5 YR 6/4	Crypto-phyllitic	24	Qtz, Sl-Ph, Gg, Sd	Coarse sand and very coarse sand (500–2000)	Elongated and irregular	500
12		C26-T45 (V9) Cardonal	Open. Bowl with thickened rim	Internal and external Surface	Rectangles and lines	7.5R 3/6 5YR N2.5/1 7.5YR 5/4	Crypto-phyllitic	21	Sl-Ph, Sd, Qtz	Coarse sand and very coarse sand (500–2000)	Elongated and irregular	400
13		C84-T3 (V10) Cardonal	Open?	External surface	Triangles	10R 3/2 7.5YR 6/4	Crypto-phyllitic	25	Sl-Ph, Sd, Qtz, Gg	Coarse sand and very coarse sand (500–2000)	Elongated and irregular	500
14		C80-9 (V14) Cardonal	Open	Internal surface	Staggered shape	5Y 2.5/1 10R 3/4 7.5YR 7/4	Crypto-phyllitic something	27	Qtz, Sl-P , Gg, Sd	Fine sand, medium sand, and coarse sand	Elongated and irregular	300

							micro-granular			(125–1000)		
15		C250-3 (V15) Cardonal	Closed?	External surface	Diamonds and rows of triangles	7.5YR 3/2 7.5YR 4/3 10R 6/3	Crypto-phyllitic something micro-granular	24	Sl-Ph, Sd, Qtz	Coarse sand (500–1000)	Elongated and irregular	400
16		C274-T1 (V17) Cardonal	Open	Internal and external Surface	Parallel lines	5R 3/3 10R 2.5/1 7.5YR 5/4	Crypto-phyllitic	21	Qtz, Gs, Bt, Vg, Kfs	Medium sand and coarse sand (250–1000)	Elongated and irregular	800
17		C255-H1 (V28) Cardonal	Closed?	External surface	Diamonds and solid diamonds	10R 2.5/2 7.5YR 3/4 7.5YR 6/6	Crypto-phyllitic	20	Sl-Ph, Qtz, Gg, Sd	Coarse sand and very coarse sand (500–2000)	Elongated and irregular	400
18		C271-T1 (V29) Cardonal	Closed	External surface	Diamonds and solid diamonds	7.5R 3/2 5YR 2.5/1 7.5YR 5/3	Pseudo-lepidoblastic	25	Qtz, Gg, Sl-Ph, Sd	Medium sand and coarse sand (250–1000)	Elongated and irregular	300
19		Sin número (V31) Cardonal	Open?	External surface	Geometrical figures and lines	10R 3/4 2.5YR N2.5/1 10 YR 7/3	Crypto-phyllitic	20	Qtz, Sl-Ph, Gg, Sd	Medium sand and coarse sand (250–1000)	Elongated and irregular	600

20		C260-3 (V32) Cardonal	Open	Internal and external Surface	Parallel lines and unidentified geometrical figures	7.5R 3/4 5YR 5/4	Crypto-phyllitic something pseudo-lepidoblastic	21	Qtz, Gs, Bt, Vs, Pl, KFs, Op	Medium sand and coarse sand (250–1000)	Elongated and irregular	600
21		C241-104 (V33) Cardonal	Closed	External surface	Parallel lines and unidentified geometrical figures	10R 3/3 2.5YR 2.5/1 7.5YR 7/4	Crypto-phyllitic something micro-granular	21	Qtz, Gg, Sl-Ph	Fine sand and medium sand (125–500)	Elongated and irregular	300
22		C242-11 (V34) Cardonal	Closed	External surface	Parallel lines	10R 2.5/1 7.5YR 6/4	Pseudo-lepidoblastic	20	Gg, Qtz, KFs	Medium sand, coarse sand, and very coarse sand (250–2000)	Elongated and irregular	600
23		C259-38 (V35) Cardonal	Open	Internal and external Surface	Triangles	7.5YR 3/2 7.5YR 5/6	Crypto-phyllitic	17	Qtz, Sl-Ph, Gg, Sd	Fine sand, medium sand, and coarse sand (125–1000)	Elongated and irregular	400
24		C259-7 (V38) Cardonal	Closed	External surface	Parallel lines	7.5YR 3/4 5Y 2.5/1 7.5YR 6/4	Crypto-phyllitic	20	Qtz, Sl-Ph, Gg	Medium sand and coarse sand (250–1000)	Elongated and irregular	500

25		Laz083 (V51) Cardonal	Open	Internal surface	Parallel lines	7.5YR 3/1 7.5YR 6/4	Micro-granular something pseudo-lepidoblastic	19	Qtz, Gg, Sl-Ph, Sd	Fine sand and medium sand (125–500)	Elongated and irregular	600
26		C1229-1 (V45) Sajrapampa	Circular fragment of clay artefact	One side	Parallel lines	5R 3/3 5Y 2.5/1	Crypto-phyllitic	21	Qtz, Sl-Ph, Gg, Sd	Medium sand and coarse sand (250–1000)	Elongated and irregular	400
27	Santa María Valley	Corte 2 [56-45] Tolombón	Open	Internal and external Surface	Triangles and parallel lines	5YR 2.5/1 7.5R 3/6 7.5YR 6/4	Crypto-phyllitic	25	Sl-Ph, Sd, Gg, Qtz	Coarse sand (500–1000)	Elongated, irregular, and rounded	400
28	Lerma Valley	VL01 Sillisque Tilian 2	Beaker	External surface	Lines and rows of triangles	7.5YR 4/2 10R 4/4 10YR 6/2	Crypto-phyllitic	19	Qtz, Gg, Sl-Ph, Sd	Fine sand and medium sand (125–500)	Elongated and irregular	300
29		VL07 Sillisque Tilian 2	Open	Internal and external surface	Parallel lines and rows of triangles	7.5YR 4/2 10R 4/4 10YR 6/2	Pseudo-lepidoblastic	25	Qtz, Sl-Ph, Gg	Fine sand, medium sand, and coarse sand (125–1000)	Elongated and irregular	300
30		VL8 Sillisque Tilian 2	Closed	External surface	Parallel lines an rows of triangles	7.5YR 3/4 5Y 2.5/1 7.5YR 6/4	Pseudo-lepidoblastic something	42	Gg, Qtz, Sl-Ph, Gs	Between medium silt and very coarse sand	Elongated and irregular	1000

							micro-granular			(15–2000)		
31	Quebrada del Toro	PG S1 C5 Potrero Grande	Open. Flat base	External surface	Staggered lines and unidentified solid figures	5YR 4/3 5YR 3/2 10YR 7/3	Crypto-phyllitic something micro-granular	24	Qtz, Sl-Ph, Sd, Gg	Fine sand, medium sand, and coarse sand (125–1000)	Elongated and irregular	400
32		LC S7/CB 3/12 Las Cuevas	Sub-globular jar with short neck and vertical handle attached	External surface	Parallel lines and unidentified solid figures	5YR 4/3 7.5 YR 3/2 10YR 6/3	Crypto-phyllitic something micro-granular	22	Qtz, Gg	Fine sand and medium sand (125–500)	Elongated and irregular	400
33		LC R4 (0,40-0,60) Las Cuevas	Open	Internal and external surface	Rows of triangles, vertical and zig zag lines	5YR 4/4 10YR 3/2 10YR 6/3	Crypto-phyllitic	25	Qtz, Gg, Sl-Ph	Fine sand and medium sand (125–500)	Elongated and irregular	300
34		2.4/10 La Encrucijada II	Closed	External surface	Parallel lines and unidentified solid figures	10YR 3/2 10R 4/4 7.5YR 6/4	Crypto-phyllitic	25	Sl-Ph, Gg, Qtz	Medium sand and coarse sand (250–1000)	Elongated and irregular	500

Quartzose-Metamorphic Medium Mode

This cluster is characterised by the appearance of quartz (11.8–14.5%) in greater relative abundance compared to metamorphic rocks (0.7–6.4%) and grog (1.6–8.6%). Other recorded tempers are Sd (0.2– 2%), Kfs (0.2–1.1%), Pl (0.1–0.7%), Mc (≤0.4%), Bt (≤0.5%), Ms (≤0.2%), Tur (≤0.4%), Am–Px (0.1–0.4%), Gr (≤0.7%). Sh (≤0.2%), Vg (≤0.6%), and Op (0.1–0.9%). The density of inclusions fluctuates between 21.7 and 26.8%. The inclusions are sub-angular and sub-rounded. Most of them have sizes between 125 and 1000µm (fine sand–coarse sand). The voids represent between 3.2 and 5%. The matrix represents between 69.9 and 73.6%. The fabrics are compact and have textures pseudo-lepidoblastic, crypto-phyllitic something micro-granular, and pseudo-lepidoblastic. The analysed pieces were cooked in an oxidising atmosphere (Figure 4; see Figure S1 & Table S1).

Quartzose-Granitic Medium Mode

This cluster comprises fabrics characterised by different proportions of quartz (7–10.4%), granitic lithoclast (2.6–5.6%), biotite (0.6–2.3%), plagioclase (0.7–1.8%) and potassium feldspar (0.9–1.5%) inclusions. Other recorded tempers are Mc (≤0.2%), Ms (0.3–0.6%). Grt (≤0.7%), Am–Px (0.2–0.9%); Vs (≤2.4%), Vg (≤1.7%), and Op (0.2–1.2%). The density of inclusions fluctuates between 18.9 and 21.3%. The inclusions are sub-angular and sub-rounded. Most of them have sizes between 250 and 1000µm (medium sand–coarse sand). The voids represent between 2.8 and 4%. The matrix represents between 74.6 and 77.8%. The fabrics are compact and have textures pseudo-lepidoblastic, crypto-phyllitic, and crypto-phyllitic something pseudo-lepidoblastic. The analysed pieces were cooked in an oxidizing atmosphere (Figure 5; see also Figure S1 & Table S1).

Samples 22 and 30

Two samples do not fit in the three clusters defined above. Sample 22 from the Cajón Valley contains grog (8.4%), quartz (7.1%) and potassium feldspar (Kfs 1%) inclusions. Other recorded tempers are Gr (0.8%), Pl (0.4%), Mc (0.2%), Bt (1.2%), Ms (0.2%), Am–Px (0.2%), Cs (0.6%), and Op (0.2%). The density of inclusions is 20.3%. The inclusions are sub-angular and sub-rounded and most of them have sizes between 250 and 2000 µm (medium sand–very coarse sand). The voids represent 4.1%. The matrix corresponds to 75.6%. The fabric is compact and has texture pseudo-lepidoblastic. The piece was fired in an oxidising atmosphere (Figure 6; see also Figure S1 & Table S1). Sample 30 from the Lerma Valley has a fabric made predominantly of grog (17.6%), along with quartz (14.1%), metamorphic lithoclasts (slate and phyllite 4.4%) and granite (2.4%). Other recorded tempers are Kfs (0.6%), Pl (0.3%), Mc (0.2%), Ms (0.2%), Tur (0.2%), Am–Px (0.2%), Cb (0.2%), Cs (0.2%), Qt (0.2%), Sd (0.5%); and Op (0.5%). The density of inclusions is 41.8%. The inclusions are sub-angular and sub-rounded and have sizes between 15 and 2000 µm (medium silt–very coarse sand). The voids represent 9.5%. The matrix corresponds to 48.7%. The fabric is compact and has texture pseudo-lepidoblastic something micro-granular. The piece was fired in an oxidising atmosphere (Figure 6; see also Figure S1 & Table S1).

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Table S2. Radiocarbon dates from the contexts of the analysed Vaquerías ceramic samples. Dates modelled in Calib Radiocarbon Calibration program 7.04, using SHCal13 calibration curve (Hogg *et al*. 2013).

Site	Area	References	Material	Radiocarbon age	Calibrated date (1σ)	Calibrated date (2σ)	Code
Las Cuevas Mound S Midden	Quebrada del Toro	Cigliano *et al*. (1976)	Charcoal	2150±80 BP	350–304 cal BC (*p*. 0.15) 228–220 cal BC (*p*. 0.03) 213–50 cal BC (*p*. 0.82)	367 cal BC–33 cal AD (*p*. 1)	CSIC 121
Las Cuevas Mound N Enclosure 5		Cigliano *et al*. (1976)	Charcoal	2070±50 BP	99 cal BC–26 cal AD (*p*. 1)	198–176 cal BC (*p*. 0.02) 161 cal BC–74 cal AD (*p*. 0.97) 105–105 cal AD (*p*. 0.01)	CSIC 122
Las Cuevas Inter Mound		De Feo & Mari (2017)	Animal bone	1810 ±80 BP	94–96 cal AD (*p*. 0.01) 125–262 cal AD (*p*. 0.75) 276–329 cal AD (*p*. 0.24)	32–36 cal AD (*p*. 0.01) 51–397 cal AD (*p*. 0.99)	LP 2938
Las Cuevas Mound S Midden		Cigliano *et al*. (1976)	Animal bone	1695±50 BP	259–271 cal AD (*p*. 0.04) 339–467 cal AD (*p*. 0.95)	249306 cal AD (*p*. 0.14) 321–529 cal AD (*p*. 0.86)	GRN53 99
Potrero Grande Midden		Raffino (1977)	Charcoal	1710±50 BP	256–298 cal AD (*p*. 0.34) 319–392 cal AD (*p*. 0.66)	174–192 cal AD (*p*. 0.005) 211–428 cal AD (*p*. 0.99) 500–501 cal AD (*p*. 0.005)	CSIC 126
Cerro El Dique Patio Patio 4		Raffino (1977)	Charco al	1690±50 BP	340–477 cal AD (*p*. 0.99) 512–516 cal AD (*p*. 0.01)	250–303 cal AD (*p*. 0.12) 323–533 cal AD (*p*. 0.88)	CSIC 123

Site	Area	References	Material	Radiocarbon age	Calibrated date (1σ)	Calibrated date (2σ)	Code
Bordo Marcial Structure 18	Cajón Valley	Scattolin (2010)	Charcoal	1869±38 BP	131–184 cal AD (*p*. 0.59) 197–234 cal AD (*p*. 0.41)	79–99 cal AD (*p*. 0.03) 110–251 cal AD (*p*. 0.93) 298–331 cal AD (*p*. 0.04)	AA 87294
Cardonal Structure 1		Scattolin *et al*. (2009)	Charcoal	1841±35 BP	140–180 cal AD (*p*. 0.31) 201–249 cal AD (*p*. 0.59) 307–320 cal AD (*p*. 0.10)	124–259 cal AD (*p*. 0.79) 270–271 cal AD (*p*. 0.01) 275–339 cal AD (*p*. 0.2)	AA 82262
Cardonal Structure 2		Scattolin *et al*. (2009)	Charcoal	1878±57 BP	114–245 cal AD (*p*. 1)	53–339 cal AD (*p*. 1)	AA 67778
Cardonal Structure 3		Scattolin *et al*. (2009)	Charcoal	1831±35 BP	150–151 cal AD (*p*. 0.01) 65–178 cal AD (*p*. 0.09) 202–253 cal AD (*p*. 0.58) 295–334 cal AD (*p*. 0.32)	129–187 cal AD (*p*. 0.21) 195–343 cal AD (*p*. 0.79)	AA 82258
Cardonal Structure 5	Cajón Valley	Scattolin *et al*. (2009)	Charcoal	1932±35BP	65–138 cal AD (*p*. 0.81) 181–200 cal AD (*p*. 0.19)	36–213 cal AD (*p*. 1)	AA 82260