

Data Tables for Archaeoastronomy on Inca Sites in the Argentine Northwest

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The values of azimuth and height were determined by three observations of the Sun, using a theodolite and GPS, including values of the geographical position and local time.

Parallax calculation: $h = (h_{teo} - r) + p$

h = corrected height horizon; h_{teo} = height measured with theodolite; r = atmospheric refraction; p = parallax (57')

Legend

λ	geographic longitude
φ	geographic latitude
TU	universal time (GPS)
TT	terrestrial dynamical time
ET	equation of time*
δ	declination
HA	hour angle
LHA	local hour angle
masl	meters above sea level
h_{\odot}	Sun height above the horizon
A_{\odot}	Sun azimuth
Aube	object azimuth
r	atmospheric refraction correction
obs.	obs: observed
calc.	calc: calculated
v	theodolite measurement on the vertical plane
h	theodolite measurement on the horizontal plane

Acronyms

P-DSSR	pre-December solstices sunrise
DSSR	December solstice sunrise
P-DSSS	pre-December solstice sunset
DSSS	December solstice sunset
P-JSSR	pre-June solstice sunrise
JSSR	June solstice sunrise
P-JSSS	pre-June solstice sunset
JSSS	June solstice sunset
P-EQSR	pre-equinox sunrise
EQSR	equinox sunrise
P-EQSS	pre-equinox sunset
EQSS	equinox sunset
NMMR	northern major standstill moonrise
NMMS	northern major standstill moonset
SMMR	southern major standstill moonrise
SMMS	southern major standstill moonset
NmMR	northern minor standstill moonrise
NmMS	northern minor standstill moonset

* This is the difference between apparent solar time and mean solar time. In the Almanac it is the reference point for when the sun passes through the 90° W meridian.

Guitián

Lat.: S 25°11'14.3" **Time Zone:** GMT -3 **LHA:** -59.088744
Lon.: W 66°11'38.2" **TT:** 12.335277 **h[☉]calc.:** 28.042086
Elev.: 2288 masl **ET obs:** 11.861447 **A[☉]calc.:** 76.916388
Date: 29 Sept. 2012 **δ obs:** -0.712418

No.	Name	Vertical (v)	Horizontal (h)	Declination (δ)	Solar Date	Parallax Corrected (δ)	Lunar Date	Comment
2	Meléndez	07°09'21.11"	325°37'59"	43°28'54.73"	-	-	-	-
3	Peñón Blanco	07°19'28.72"	323°30'59"	41°51'56.01"	-	-	-	-
4	Hoygaard	06°38'58.26"	329°40'59"	46°36'18.11"	-	-	-	-
5	-	02°03'31.22"	98°14'59"	-08°20'24.00"	24 Feb. / 14 Oct.	-	-	-
6	-	02°17'11.97"	201°59'59"	-58°47'50.34"	-	-	-	-
7	-	09°50'47.16"	257°35'59"	-15°19'17.83"	8 Feb. / 4 Nov.	-	-	-
8	-	11°21'20.59"	262°28'59"	-11°31'43.16"	20 Feb. / 22 Oct.	-	-	-
10	-	04°14'19.85"	338°14'59"	53°46'43.43"	-	-	-	-
11	-	05°27'53.98"	352°45'59"	58°33'04.43"	-	-	-	-
12	-	05°48'14.54"	20°50'59"	52°58'01.97"	-	-	-	-

Cortaderas

Lat.: S 24°53'34.1" **Time Zone:** GMT -3 **LHA:** -66.646803
Lon.: W 66°02'08.1" **TT:** 11.74 **h^ocalc.:** 24.694761
Elev.: 2802 masl **ET obs:** 11.762137 **A^ocalc.:** 88.202393
Date: 16 Oct. 2011 **δ obs:** -8.491731

No.	Name	Vertical (v)	Horizontal (h)	Declination (δ)	Solar Date	Parallax Corrected (δ)	Lunar Date	Comment
3	Meléndez	05°14'03.8"	254°04'08.62"	-16°40'33.97"	3 Feb. / 9 Nov.	-	-	-
4	Hoygaard	05°26'18.84"	259°48'08.61"	-11°31'23.58"	19 Feb. / 24 Oct.	-	-	-
5	Libertador	05°22'13.83"	262°53'08.61"	-08°41'56.44"	27 Feb. / 16 Oct.	-	-	-
6	s/n	04°27'08.56"	278°20'08.61"	05°38'55.78"	4 Apr. / 9 Sept.	-	-	-
1	Palermo	04°49'38.01"	279°54'08.61"	06°53'35.52"	8 Apr. / 5 Sept.	-	-	-
2	Peñón Blanco	04°22'01.62"	246°12'08.61"	-23°23'28.34"	19 Dec. / 26 Dec.	-23°47'38.29"	15 Jun.	DSSS
22	De Pasco and Pelicelli	04°52'40.59"	251°43'08.62"	-18°37'13.06"	27 Jan / 16 Nov	-19°01'10.87"	27 Jan.	SmMS solar anular eclipse (23 Jan., 1460)
7	Palermo Norte	04°28'14.37"	283°10'08.62"	09°58'26.34"	16 Apr. / 28 Aug.	-	-	-
8	-	04°04'36.4"	284°32'08.61"	11°22'16.41"	20 Apr. / 24 Aug.	-	-	-
9	Cortaderas Alto	16°57'40.74"	316°04'08.62"	30°08'10.74"	-	29°28'56.36"	-	ca. NIMMS
10	-	02°27'23.7"	09°45'8.61"	61°03'34.33"	-	-	-	-
11	-	04°11'47.22"	14°57'08.61"	57°28'58.42"	-	-	-	-
12	-	05°17'08.1"	25°11'08.61"	51°07'55.28"	-	-	-	-
13	-	04°22'01.62"	31°56'08.61"	47°21'02.09"	-	-	-	-
14	-	04°55'44.46"	50°32'08.61"	32°33'52.03"	-	-	-	-
15	-	03°51'15.91"	69°53'08.61"	16°26'09.57"	6 May / 7 Aug.	-	-	-
16	Cumbre Alta	08°13'18.47"	92°24'08.61"	-05°36'49.97"	7 Mar. / 8 Oct.	-06°00'20.64"	-	P-EQSR
17	-	07°21'49.82"	107°07'08.62"	-18°35'15.97"	27 Jan. / 16 Nov.	-18°58'10.68"	SmMR	SmMR
18	-	05°56'47.49"	123°29'08.61"	-32°46'40.7"	-	-	-	-
19	-	04°07'41.41"	138°32'08.61"	-45°05'43.68"	-	-	-	-
20	-	01°34'41.8"	178°51'08.61"	-66°36'42.79"	-	-	-	-
21	-	00°08'17.8"	186°20'08.61"	-64°29'51.24"	-	-	-	-
23	El Apunao	04°43'	249°52'08.62"	-	-	-	-	-

El Apunao

Lat.: S 24°59'04.1" **Time Zone:** GMT -3 **LHA:** -71.358422
Lon.: W 67°10'42.9" **TT:** 11.538888 **h^ocalc.:** 16.778527
Elev.: 4753 masl **ET obs:** 11.874806 **A^ocalc.:** 82.532314
Date: 23 Sept. 2009 **δ obs:** 0.143743

No.	Name	Vertical (v)	Horizontal (h)	Declination (δ)	Solar Date	Parallax Corrected (δ)	Lunar Date	Comment
1	-	10°01'54.3"	51°19'56.33"	28°57'12.92"	-	28°23'31.34"	-	NMIMR
2	-	01°29'10.14"	74°21'56.33"	13°29'16.65"	26 Apr./ 17 Aug	-	-	-
4	-	-00°20'46.17"	81°39'56.33"	07°32'58.06"	9 Apr. / 3 Sept.	-	-	P-EQSR
6	-	-01°20'05.87"	99°22'56.33"	-07°55'131.52"	28 Feb. / 14 Oct.	-	-	-
7	-	-00°04'51.79"	102°53'56.3"	-11°38'20.05"	18 Feb. / 24 Nov.	-	-	-
19	-	26°51'51.85"	282°49'56.3"	-00°38'45.27"	19 Mar. / 24 Sept.	-	-	EQSS
20	-	26°33'52.42"	286°40'46.58"	02°30'46.58"	27 Mar. / 17 Sept.	-	-	-
23	-	21°49'35.95"	310°29'56.3"	22°55'07.19"	9 Jun. / 4 Jul.	-	-	P-JSSS

Uña Tambo

Lat.: S 24°59'25.4" **Time Zone:** GMT -3 **LHA:** -62.335502
Lon.: W 66°19'17.5" **TT:** 12.133055 **h₀calc.:** 25.03811
Elev.: 4716 masl **ET obs:** 11.86717 **A₀calc:** 78.98717 (Starcalc = 78.22)
Date: 24 Sept. 2012 **δ obs:** -0.326146

No.	Name	Vertical (v)	Horizontal (h)	Declination (δ)	Solar Date	Parallax Corrected (δ)	Lunar Date	Comment
1	C. La Uña	16°06'03.07"	27°32'12"	40°55'14.02"	-	-	-	-
2	-	18°18'17.56"	330°50'12"	38°13'28.1"	-	-	-	-
3	Pilar de las Pailas	21°03'31.59"	339°38'12"	39°52'47.25"	-	-	-	-
4	-	17°21'11.91"	354°11'12"	47°16'45.01"	-	-	-	-
5	-	13°45'43.11"	23°31'12"	44°58'6.62"	-	-	-	-
6	-	02°12'06.79"	43°43'12"	39°40'6.94"	-	-	-	-
7	-	-01°05'36.42"	71°47'12"	17°50'7.11"	1 Aug. / 11 May	-	-	-
8	-	-01°01'14.28"	92°51'12"	-02°09'14.7"	15 Mar. / 28 Sept.	-	-	P-EQSR
9	-	-01°22'48.07"	98°03'12"	-06°42'19.99"	3 Mar. / 10 Oct.	-	-	-
10	-	-01°43'12.2"	111°32'12"	-18°39'24.11"	27 Jan. / 16 Nov.	(-)19°05'16.59"	-	SmMR
11	C. El Negro	-00°03'56.28"	101°31'12"	-10°24'1.86"	22 Feb. / 20 Oct.	-	-	-