

Sub-tropical astronomy in the southern Andes: the ceque system in Socaire, Atacama, northern Chile†

Ricardo Moyano

Escuela Nacional de Antropología e Historia, Periférico Sur y Calle Zapote s/n,
Isidro Fabela, México, D.F., Mexico
email: mundosubteraneo2@yahoo.es

Abstract. Sky observation in sub-tropical Andean areas, part of ancient Collasuyu, during the Inca empire (ca. 1470 A.D.) was characterized by the combined use of geographical, social, psychological and natural elements of the *entorno* (environment or landscape). From a phenomenological perspective, it would be understood as: the place (point of observation), the path (line or relation), the horizon (calendrical marker) and the zenith/anti-zenith (vertical projection) as an expression of ‘dwelling or living in the world’. I present results obtained from a spatio-temporal analysis of mountain worship which took place at the Atacama Indian community of Socaire, northern Chile (23° 35′ 28″S, 67° 52′ 36″W, 3274m AMSL). These indicate the existence of an animistic relationship between astronomical observations, the worship of mountains, and agricultural practices. The psychological phenomena of pareidolia, apophenia and hierophany also contribute to explain the mimetolith of the ‘Hand of God’ (formed by the Tumisa, Lausa, Chiliques, Ipira and Miñiques mountains) and the social categories of space and time in Socaire: ‘above, here, and down’; ‘right and left’; ‘female and male’; ‘noon and midnight’; ‘north and south’; and ‘visible and invisible’ (as complementary opposites or *yanantin*).

Keywords. sub-Tropical astronomy, Collasuyu, phenomenology, PAH triad, northern Chile

1. Introduction

Socaire is an *atacameña* or *Lican Antay* Indian community located to the southeast of the Atacama Salar, at 3274m AMSL, in Antofagasta Region, Loa Province, San Pedro de Atacama County, northern Chile (23° 35′ 28.68″ S/ 67° 52′ 36.10″ W). Socaire’s geographical position, approximately 16 km south of the Tropic of Capricorn, means that zenith sun passages occur every summer solstice (December 21–24) and anti-zenith passages occur every winter solstice (June 21–24). The Tropic of Capricorn in 1500 A.D. was around latitude 23° 30′ S. This situation may be important considering the knowledge that the Incas had of the sun’s movements in different parts of their Empire (Fig. 1).

From a comparative perspective, the geographical latitude has been a topic of discord among Mesoamerican researchers. Broda (2004) gives a solid background to understanding the use of the solar zenith passage as an expression of a system that counts days based on the architectural orientation of Teotihuacan and zenith passages at latitude 15° N. In the southern Andes, zenith passages of the moon could determine the location of the Inca *ushnus*, especially those located between 23.5° S and 28.5° S. An example is the platform of Viña del Cerro in the Copiapo river valley in northern Chile, probably related to the southern major lunar standstill every 18.61 years (Ianiszewski 2010; Moyano 2010a).

† Invited student keynote lecture

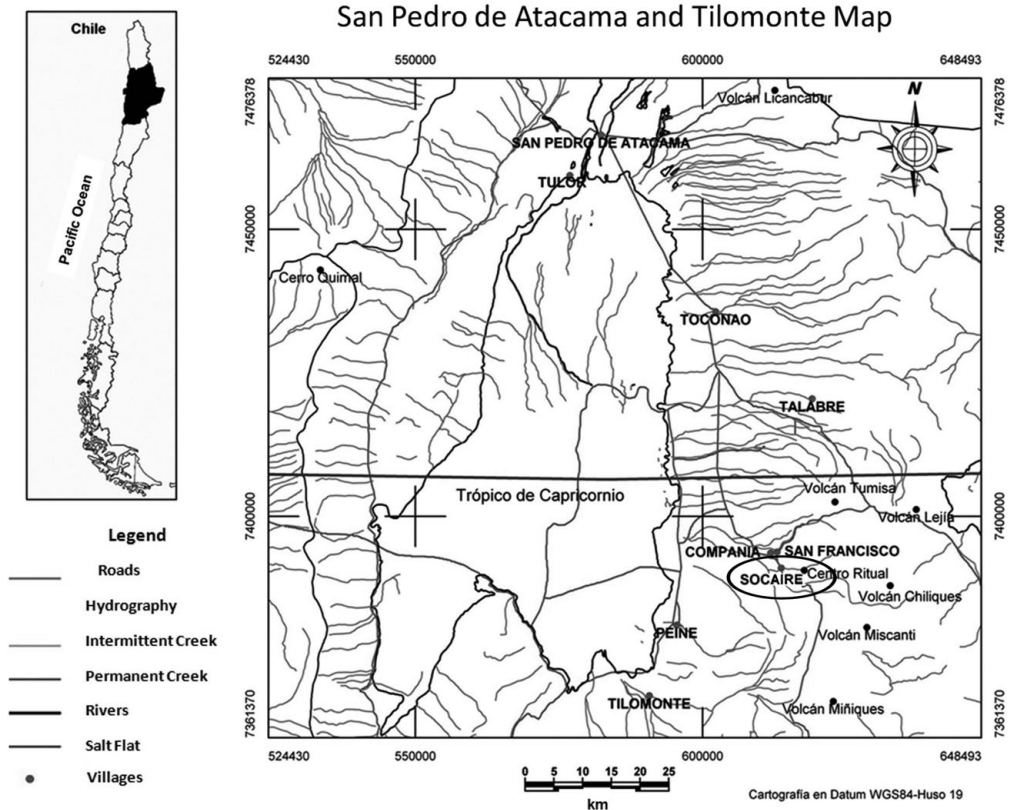


Figure 1. Map of the general location.

The Atacama region is characterized by a lack of rain (except during the Bolivian winter) and high mountains and volcanoes, reaching more than 5000m AMSL. In Inca times (1470–1536 A.D.) this region and Socaire were part of the agricultural and livestock system that supplied the *Qhapaq Ñan* and Tambo Peine in this section of Collasuyu (Núñez 1991). Until 1980, Socaire had a radial system of organization composed of seven sectors, two halves and one center (Hidalgo 1992: 28, 69, 224). Today, it has approximately 300 inhabitants, subsisting mainly from tourism and mining activities (Moyano 2010b).

Social life in Socaire is mainly governed by the irrigation system, which determines the ‘sistema de cargos’ (civil religious hierarchy), communal work or ‘minga’, planting and harvesting, livestock and major religious holidays. The general structure of the calendar includes dates with Pre-hispanic and Christian importance: August 1 (first planting), August 24 (St. Bartholomew), September 30–October 1 (water judges), October 24–26 (cleaning the irrigation canal), December 4 (St. Barbara), February–March (Carnival), March 31–April 1 (water distributor), May 1 (ending of irrigation year), May 3 (Holy Cross), and June 24 (St. Juan, livestock market, and winter solstice) (Fig. 2) (Barthel 1986 [1957]; Hidalgo 1992; Moyano 2010b).

The most important date is the cleansing of the channel during late October, when the *socaireños* invoke the mountains from the ceremonial center near the water source in the Nacimiento ravine. On that occasion, each mountain is represented by a circle of bottles of *aloja* (algarrobo alcohol) as a local representation of the landscape. Also worthy of note are the distribution of stones in the ceremonial center, the *talatur* dance, the cosmivision, and the direction of the local irrigation system, which follow the sun’s

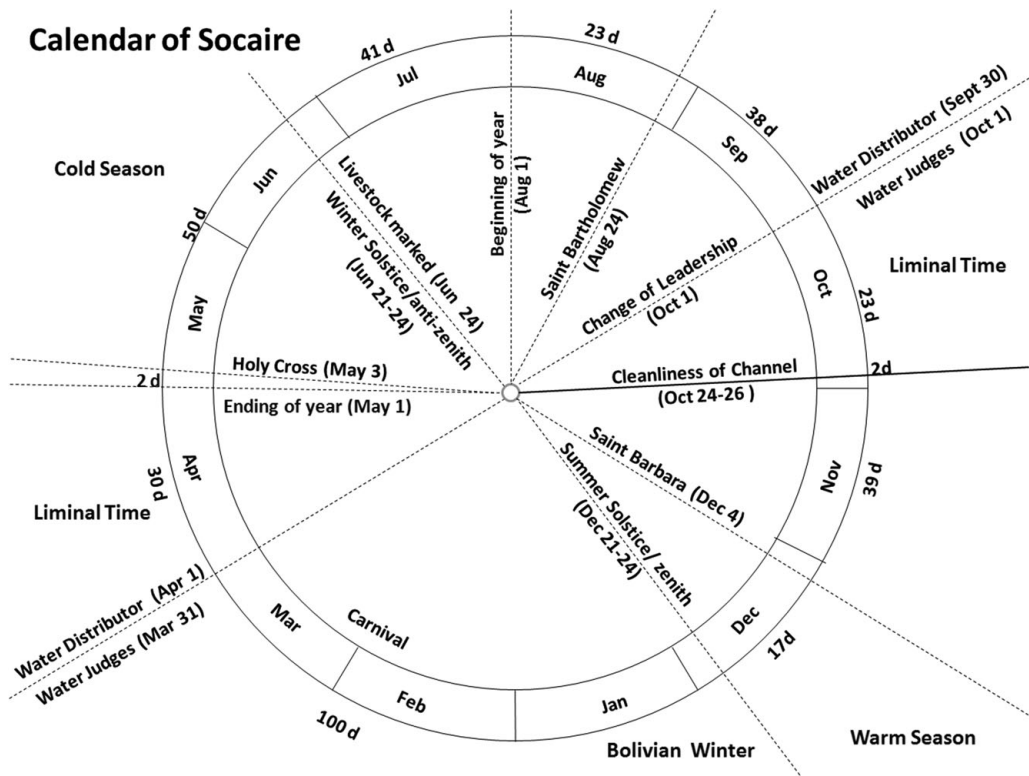


Figure 2. The calendar of Socaire.

daily movement (Barthel 1986; Grebe 1996; Grebe & Hidalgo 1988; Núñez 1993; Moyano 2010b; Valenzuela 2000).

For Andean people it was common to identify human and animal forms in topographic and sky elements. In the city of Cuzco, the shape of a puma and the motif of a llama (*Lama glama*) were perceived in the Milky Way close to α and β Centauri (Bastien 1989; 1996; Elorrieta & Elorrieta 1996; Sullivan 1999 [1996]).

According to Bustamante (2008a; 2008b) the perception of the environment in different cultures around the world is related to the psychological phenomena of pareidolia (the tendency to see images), apophenia (the tendency to perceive meaning in random stimuli) and hierophany (sacred manifestation); these three phenomena are known as the PAH triad. In Socaire, this relationship is expressed through five visible mountains on the eastern horizon—Tumisa, Lausa, Chiliques, Ipira and Miñiques—known ethnographically as a giant human left hand in the landscape (measuring 40×30 km). In order to explain these psychological phenomena, I utilize Maradona's parody ('The Hand of God') from Mexico's 1986 Football World Cup and the image of the pulsar PSR B1509-58 (NASA, April 2009, <http://chandra.harvard.edu/photo/2009/b1509/>).

In the Andean context the human body is the physical and mental structure of the human being. Anatomically it consists of the head, trunk, and extremities (upper and lower). It is the intermediary between the subject and the world and is defined as a filter, a tool and reference frame for the construction of sensory experience. The human body, as an instrument, determines our position in the world and gives us the necessary analogies for understanding the environment. Phenomenological experience, in other words, is a combined result of the instrument, the psychology, the cultural context and the collective

capacity of representation (Moyano 2010b: 68–126). In the Andean world, the earth is named *pachamama* (Mother Earth).

“There is a universal tendency among mankind to conceive all beings like themselves and to transfer to every object those qualities, with which they are familiarly acquainted, and of which they are intimately conscious. We find human faces in the moon, armies in the clouds: and by a natural propensity, if not corrected by experience and reflection, ascribe malice or good-will to everything that hurts or pleases us. Hence the frequency and beauty of the prosopopeia in poetry; where trees, mountains and streams are personified, and the inanimated parts of nature acquire sentiment and passion.” (Hume 1757: 7).

Animism (from the Latin *anima*, soul), is the belief that every object, whether commonplace or ritual, in fact all things in the world—mountains, rivers, earth, rocks, plants, trees, and so on—have a soul or life, and are therefore worthy of adoration or worship. This contrasts absolutely with the Cartesian division between object and subject that is fundamental to ‘Western’ perceptions (cf. Hornborg 2006; Latour 1993; Viveiros de Castro 1999).

The socaireños, like other cultures, ascribe cultural significance to their surroundings. For them, the sky constitutes part of social experience and reflects spatio-temporal conceptions of the world. In this sense, cultural astronomy studies the mechanisms by which people come to understand astronomical phenomena. It analyzes their systems of conceptualization and representation and correlates social connections, social processes and sets of ideas about social life (Iwaniszewski 2009).

2. Method of analysis

The fieldwork involved the observation and registration of astronomical phenomena visible to the naked eye, using a digital camera (Nikon Coolpix L11, 6.0 Megapixels), a Berger ST-1 transit (precision = 1), a GPS (Garmin LEGEND, WGS 84 datum), aerial photographs (Landsat), topographic maps, and satellite images from Google Earth. The archaeological survey included the horizon area identified by the sun’s annual movement and important elements of the local landscape. The azimuth calculation, the solar, lunar and stellar declinations and the date were obtained with the horizon system of reference (GMT–4). The MonteroCalc2003 program <http://www.montero.org.mx/calculadora.htm> was used to calculate the difference in days between two dates in the Gregorian calendar. The planetary software Starcalc 5.72 was also used. The graphical analysis was conducted with a representation of the sun’s annual trajectory (Stuven 1972) and with 360° panoramic photographs taken from the ceremonial center and Church of Socaire using the photoshop image editor.

This article includes aspects related to phenomenology and landscape, as well as a brief description of the ceremony of the cleansing of the water canal in Socaire as an example of a radial organization system in the southern Andes.

3. Phenomenology and landscape

Each society perceives the world in which they live through their senses; in other words they create their own worldview (point of view of things). Iwaniszewski (2007: 12) defines ‘dwelling or living in the world’ as a result of ‘being there’ (*Dasein*); a mutually subjective relationship between humans with the world around them, following the ideas of Heidegger (1999). In this context, perception is defined as a psychic function that allows human beings through the use of their senses to learn, develop and interpret stimuli from their physical, social and symbolic surroundings. This could depend on the instrument (the human eye and brain), on psychology, on the cultural context and also on the capacity of (collective or individual) representation.

From this point of view, the human body is the measure of all things. In this sense, object and subject, nature and conscience are understood as a result of 'dwelling or living in the world' expressed in the following categories: place, path, horizon and zenith/anti-zenith.

- The place (point of observation) is defined as a center of human significance, a point of reference and meaning, and a reservoir of memories (Tilley 1994: 14–15, 26). It provides ontological security; in other words, it is a starting point for the definition of concepts such as place–instant, itself–other, causality and relation. Astronomically, this could be related to the concept of point of observation, somewhere a sky observer is occupied for a long time, aligning himself to certain marks on the horizon as they relate to celestial objects in the sky. The social practice of skywatching allows the determination of cultural events such as solstices, planting and harvesting, equinoxes and so on (Hardman and Hardman 1992: 155).

- Paths connect different places, by means a relationship between two significant points or lines projected in the landscape. They are physical or imaginary, straight or curved, continuous or discontinuous (Tilley 1994: 31). In Atacama, northern Chile, they are recognized as 'lines of offering to mountains' and are linked to rituals, the *pachamama* (mother earth) and *mayllkus* (ancestors that live in mountains).

- The horizon is defined astronomically as the great circle centered on the observer and tangential to the earth's surface at that point; or, as the line that separates the sky from the earth (Aveni 2005: 139). I postulate that it should be understood as a complex of features related to calendrical landmarks, related specifically to the movement of the sun, defining the intersection place or boundary with visible land (cf. Iwaniszewski 2001: 222–223 for a different Indian community). This concept has been widely utilized in the study of Hopi and Inca calendars (Parsons 1936, in Aveni 2005: 64; Bauer & Dearborn 1998; Zuidema 1989; 2009). An irregular horizon with peaks and valleys offers natural markers, as opposed to flat areas such as Cahokia or the Maya landscape, where the horizon was constructed by pyramids, platforms, temples and stelae (Hardman and Hardman 1992: 154).

- The zenith/anti-zenith is defined as the vertical projection of the observer's head and its opposite at 180°, and relates to the zenith passage of the sun, the culmination of stars, the meridian passage of the moon, and the observation of constellations and dark areas of the Milky Way. Within Inca astronomy, the categories of horizon and zenith were integrated into the *ceque* system (328 *huacas* and 41 *ceques*), related to various categories of kinship, political hierarchies, tribute conditions and calendrical dates within a luni-solar system. In Quechua, the zenith is related to the word *sayhua*, defined as the 'mojón' (landmark) or 'lindero' (boundary) of lands and roads. It is synonymous with *ticnu* 'the zenith or higher point in the sky', the time of day when the sun passes overhead (midday) (Santo Tomás 1951 [1560]; González Holguín 1952, in Sanhueza 2005: 61). In this work, the zenith includes all objects and social categories projected into the sky.

Recent studies indicate the probable influences of the psychological phenomena of pareidolia, apophenia and hierophany (the PAH triad) in the sacralization of landscape elements (or mimetolith) in diverse cultures around the world (Dietrich 1989; Bustamante 2008a; 2008b; Moyano and Bustamante 2010a; 2010b):

- Pareidolia is a psychological phenomenon where a vague and random stimulus (often an image or sound) is perceived as significant. Common examples include seeing images of animals or faces in clouds, the rabbit in the moon and hearing hidden messages on records played backwards. It is used in psychological explorations such as the Rorschach test.

- Apophenia is the experience of seeing patterns or connections in random or meaningless data associated with the distortion of reality. It has been related to psychosis, but in mentally healthy people it permits random sensory information to be interpreted in a coherent way.

- Hierophany is a psychological phenomenon generally associated with the physical manifestation of sacred and religious experiences.

- A mimetolith is a natural topographic feature such as a rock outcrop or mountain that possesses shapes similar to a person or animal or parts thereof.

The experience of ‘dwelling in the world’ is a multi-sensory experience dependent upon human perception, including the skill to walk, smell, hear and feel the landscape (Tilley 2008: 272).

4. The October ceremony

The cleansing of irrigation channels takes place between October 24 and 26, or the weekend nearest to these dates. For this, the *socaireños* choose a ‘capitán’ (captain) and a ‘capitana’ (woman captain), both men. As a symbol of status they use the *clarin* (a type of trumpet) and the *putu* (bull horn) to invoke the “sound of water that comes from the mountains” (Barthel 1986: 152). It is part of the *minga* or system of communal work in which each family becomes responsible for a part in relation to the lands they own (*ibid.*: 151).

At this time of year the temperature has risen to an average of 15°C. The melting of snow in the high mountains begins to provide a source of water for the irrigation channels. This continues until April, when temperatures are decreasing again.

Petitioning for water takes place in the ceremonial center of Socaire (CCS). This is located 5.25 km from Socaire and 200 m from the water intake in the Nacimiento Ravine. The CCS consists of: 1) a plane surface surrounded by a circle of rocks (5.5 × 4.3 m) called the *merendadero*; 2) a vertical rock known as Cerro Grande, located to the north of the *merendadero*; 3) a 1.0 × 1.5 m rock that symbolizes the Chiliques volcano; 4) an area called the *covero*, to the southwest of the *merendadero*, where burnt offerings such as wood, coca leaves, and flamingo feathers are made; and 5) a system of seats (Barthel 1986; Hidalgo 1992).

The ritual activities are performed by a master and his assistant, called *cantales* (those that sing), beginning early in the morning when the sun rises at the horizon, in the direction of the Chiliques volcano (east). Each Socaire family offers a bottle of *aloja* (algarrobo alcohol) to some mountain in the local topography, decorated with flamingo feathers that symbolize each member of the group. The feathers are representative of age and gender categories: for example black feathers are associated with adult males, pink and red feathers with adult females, and small and white feathers with children (Barthel 1986: 156–157).

In the *merendadero*, the ‘cantales’ offer food and alcohol to the local mountains, recognizing them as *mayllkus* or ancestors. According to Mariscotti de Görlitz (1978: 79–80), the master begins with the southern mountains, always with Litinque. His assistant will do the same with the northern group, beginning always with Lausa. For the northern group, the hierarchical order always starts in the east and runs counter-clockwise. For the southern group, on the other hand, the hierarchical order starts in the east and runs clockwise. Both the northerly and southerly directions form part of the *talatur* (the Kunza word for jump) and partly symbolize the sun’s daily movement (east-north-west-south) (Fig. 3).

Mariscotti de Görlitz (1978: 83), drawing an analogy with the ceque system presented by Zuidema (1995 [1964]), notes that the three groups of ceques of Chinchaysuyu and

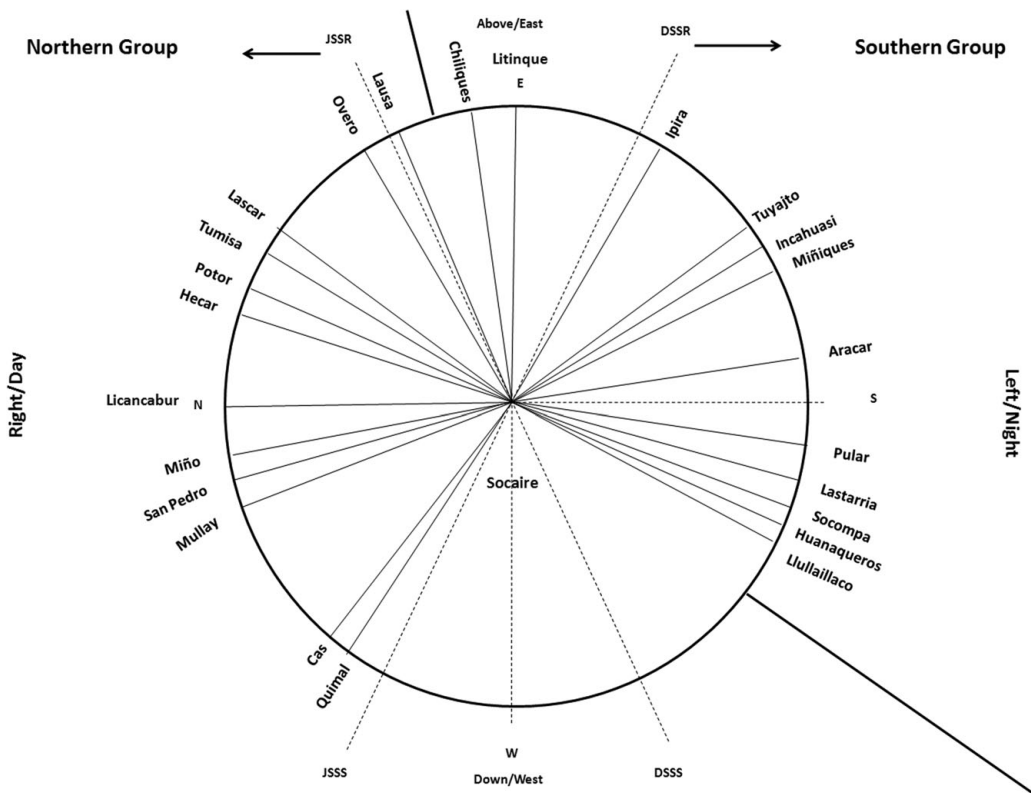


Figure 3. Socaire's system of mountains.

Antisuyu, i.e. the north or Hana Cuzco, appear in the sequence Collana, Payan, Cayao, i.e. in a clockwise direction. At the same time the groups of Collasuyu and Cuntisuyu, i.e. the south or Hurin Cuzco, are listed in the same order, but in a counter-clockwise direction. That is to say, the whole system is in the reverse direction to Socaire's system.

An important component is the existence of ceremonial archaeological sites (1470–1536 A.D.) on many of the mountains invoked in the Socaire ritual, the only exceptions being Lascar, Overo, Potor and Hecar in the northern group and Talus and Lastarria in the southern group (Beorchia 2001; Reinhard 1983). The reason could be volcanic activity or the minor importance of these shrines in prehispanic times.

Tichy (1983) suggests that a possible radial organization system (ceques) based on natural landmarks and related to the solstices and equinoxes existed in Socaire. Later, Zuidema (1989: 464–466), proposed analogies between ritual activities in Socaire and the ceremony of Citua (lunar month of September) in Cuzco, because of: 1) the importance of local mountains as water providers; 2) the existence of visual lines and a huaca that symbolize the Chiliques volcano, which concentrates the rainfall of other shrines; 3) the relationship between land, social division, and sections of irrigation channels; and 4) the mythical relationship between mountains (as locations of water sources), ancestors and social order.

With respect to the number of directions or sightlines, there are different versions. Barthel (1986 [1957]) describes 27 lines, 15 in the southern group and 12 in the northern group. Mariscotti de Görlitz (1978) gives only gives 22 directions, with 12 mountains to the south and 10 mountains to the north. Tichy (1983) lists a total of 27 directions,

with 16 sightline targets in the southern group including Peine and Tilomonte towns and the mountain Capur, not previously named. His northern group has 11 directions that include 15 mountains. Reinhard (1983) only lists 15 points, and does not distinguish between north and south. Zuidema (1989; 1990), based on Barthel's work, specifies 27 lines (15 to the south and 12 to the north). Grebe and Hidalgo (1988) carried out some arduous fieldwork, and were able to identify a total of 30 locations, with 14 mountains in the southern group and 16 in the northern group. Finally, Hidalgo (1992) gives a total of 40 directions with 20 in each half, close to the total number of ceques identified at Cuzco (41 or 42 lines) (Zuidema 1995).

In this sense, a ceque system (or its variant) is defined by the existence of a center (point of observation), lines of sight (towards visible and non-visible elements), and the existence of huacas (sacred places), in a radial spatial system of organization. It follows that the existence of a ceque system in Socaire should be reflected in social organization, the division of territory, and the structure of the calendar. These should be determined by principles of duality, tripartition, quadripartition, quinquepartition and the animistic conceptualization of landscape.

5. Fieldwork data

My field research between December 2008 and October 2009 included the identification of landscape ethno-categories—the *entorno* (environment) of which 50% is the ground and 50% is the sky—the measurement and calculation of the visible horizon, the determination of architectural orientations (a 16th-century church and the ceremonial center), and an archaeological survey of Chiliques, Pular, Salin and Miñiques volcanoes.

Socaire's division into halves, each with three neighbors and one center, could have been established as the left and right directions when oriented towards the volcano Litinque, close to due east. Turning clockwise, this division determines the hierarchy of the mountain group in the southern direction, related to midnight and male. By contrast, the northern mountain group is hierarchically arranged counter-clockwise and is associated with noon and female (*yanantin*) (Núñez del Prado 2008).

This duality is also present in the agricultural calendar which divides the seasonal year into two periods of six months each (October–March and April–September) with different people responsible for the water. The system incorporates sub-periods of 23, 38, 23(+2), 39, 17, 100, 30(+2), 50 and 41 days. The sacred volcano of Miñiques (5927 m AMSL) appears to have been the reference point for Socaire's 16th-century church, built on the site of an old Indian cemetery.

The Miñiques volcano is located adjacent to the Miñiques and Miscanti lagoons (Beorchia 1985). Although higher than Chiliques, it is markedly less important in Socaire's ceque system. On the northern ascent route was found a corral for livestock near the Miñiques lake (4166 m AMSL), and timber and a projectile point were found between 4600 m and 5200 m. A rectangular platform exists in a rocky promontory at 5701 m, surrounded by wood and a low circular wall. At the summit are a couple of simple structures made of stone, with an excellent view of the Ipira, Chiliques, Pili and Quimal prehispanic huacas (Moyano 2010b).

The irrigation canal was conceptualized as a line projected in the landscape. It connects the village of Socaire and the Nacimiento Ravine (the water intake, 5.25 km away). The channel could have been understood as a ceque in the sense of a ceremonial path that the *socaireños* constructed during the October water ceremony: it included a directionality and times when people were responsible for maintaining it within the *minga* (communal work) system.

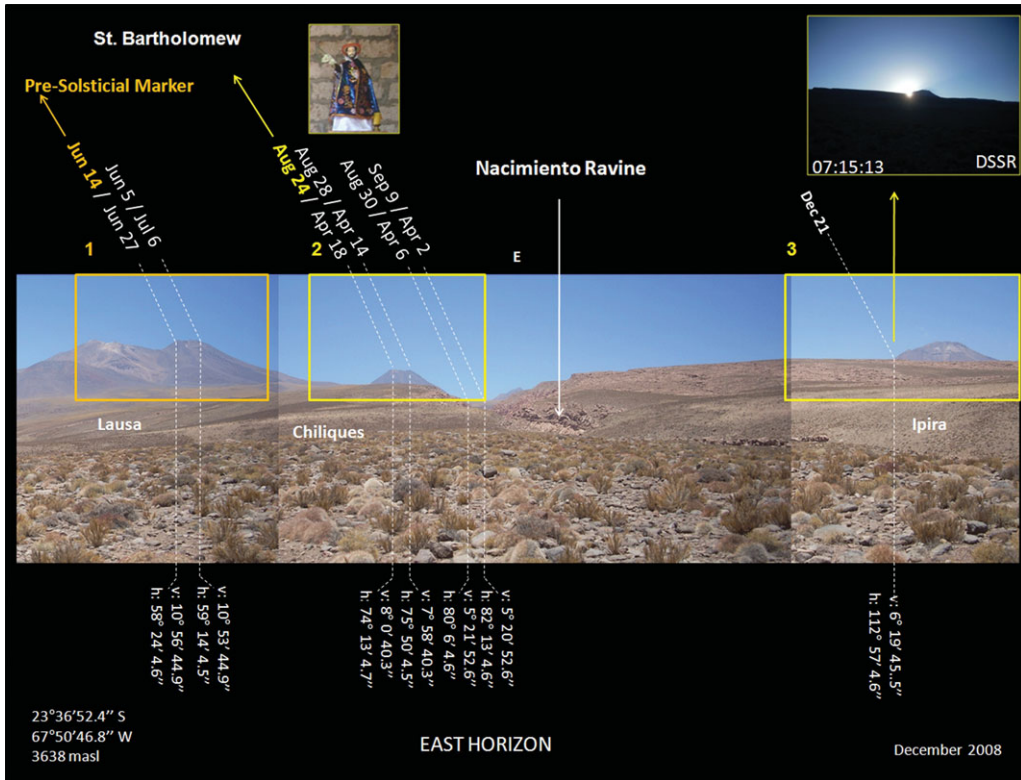


Figure 4. The eastern horizon from within 90m of the ceremonial center of Socaire (CCS).

Naked-eye solar observations made in December 2008 close to (90 m north of) the CCS revealed the existence of a possible landscape feature marking the summer solstice, between the near horizon and the Ipira volcano (az. 112° 57'). More significant, however, is the calculated sunrise on August 24 (St. Bartholomew), which coincides with the northern summit of Chiliques volcano (5770 m) (az. 74° 13') (Fig. 4).

The archaeological evidence from the summit of Chiliques includes an elliptical structure 8m in diameter (N–S) opening to the east, a small room 2.4 × 2.0 m, and pottery. There are two rectangular platforms, 6 × 5 m in size and oriented east–west, at 5727 m; nine rooms containing wood and pottery on the surface at 5680 m; a complex of simple structures at 5315 m; an Inca tambo with 53 units at 4500 m; and a stretch of *Qhapaq Ñan* (Inca trail) in the north-south direction (Beorchia 2001: 288; Reinhard 1983, 1993; Moyano & Uribe 2010). This suggests the existence of an Inca huaca in this part of the Atacama Desert, surpassed only by the Lullaillaco, Quimal and Licancabur shrines.

Although the feast of St. Bartholomew was introduced in the 1950s from Bolivia, I would propose a possible prehispanic substratum, because of the existence of the archaeological evidence on the Chiliques volcano and the ethnographic relationship between this mountain and agricultural activities during the month of August, coinciding with the first planting (2 or 2.5 lunations after the June solstice).

Another solar phenomenon is manifested in a pre-solstitial marker (June 14) at the southern summit of Lausa volcano. This date, seven days before the winter solstice (St. John and livestock marking feasts), coincides with the local perceptions that are implicit in the saying ‘que los dias chicos se hacen grandes’ (short days become longer), referring to the significant increase in light during late June.

A second point of observation was defined in the center of the plaza or *cancha* of the church in Socaire. The cancha is trapezoidal, 192 m² in area, and built in stone and mud from 0.5 up to 1.2 m height. This place has an excellent view of Lausa volcano to the east, where the sun rises in April and September, as well as of Pular and Miñiques volcanoes, to the southeast but outside the solar arc.

The Sun rises on April 1 in a notch between the near horizon and the southern face of Lausa (az. 81° 21'). This date marks the changeover of who is responsible for the water (March 31–April 1). One of the most prominent peaks to the north marks the day before the feast of St. Bartholomew (az. 72° 34'). Another notch between the northern and the southern summit marks sunrise on August 4, first planting (az. 66° 57'). Apparently the June solstice does not have a visible marker. However, from this position, it would be possible to observe maximum northerly moonrise every 18.61 years; this phenomenon occurs in a notch between the near horizon and the northern slope of Lausa volcano (az. 54° 38').

Other aspects of Socaire's sky observation system are related to the lunar cycle (planting, harvesting, and irrigation), which divides the month into four parts, and to appearances of the planet Venus as morning or evening star. The heliacal rise of the Pleiades in June is identified as 'cuadrillas de la mañana'. The Magellanic Clouds are linked to muddy places where llamas wallow. The *suri* (Andean ostrich) is represented in the sky projected onto the Milky Way and the Southern Cross is 'Río Jordan'. The shape of the *suri* is identified in the sky both in the Bolivian Chaco (Pereira 2004) and among Australian aboriginal communities (Cairns & Harney 2003).

6. Conclusions

In Inca times, sky observation in sub-tropical areas was apparently characterized by the coordinated use of different elements of the local surroundings or *entorno*. This integrated geographical, psychological, natural and social variables as part of a particular way of being in the world. From a phenomenological perspective, it can be defined by the place, the paths, the horizon and the zenith–antzenith.

In Socaire, the concept of 'dwelling or living in the world' means an animistic relationship between people and their landscape. The mountains, in particular, functioned as part of local, radial way of organization—apparently a ceque system. As in Cuzco, its organization was based on imaginary lines projected out from one or more different places of observation.

This study has corroborated the existence of at least two different centers, one located near the ceremonial center in the Nacimiento Ravine and the other in the cancha of the 16th-century church. Ethnographic and archaeoastronomical data suggest a close relationship between agricultural activities, luni-solar observations, and local mountains used as landmarks.

Astronomically, I have confirmed a cultural continuity between indigenous and modern practices, specifically those related to agricultural cycles. This emphasizes the feast of St. Bartholomew (August 24) and the Chiliques volcano as responsible for the local water resource.

The PAH triad helps us to contextualize the imaginary projection of a human left hand in the visible horizon composed by the Tumisa, Lausa, Chiliques, Ipira and Miñiques mountains. This mimetolith has been interpreted as 'The Hand of God'. In Socaire, this concept ultimately connects all the spatio-temporal variables in the local worldview: up and down (zenith and anti-zenith), left and right, night and day, male and female, and south and north. These can be explained by the concept of *yanantin* (complementary

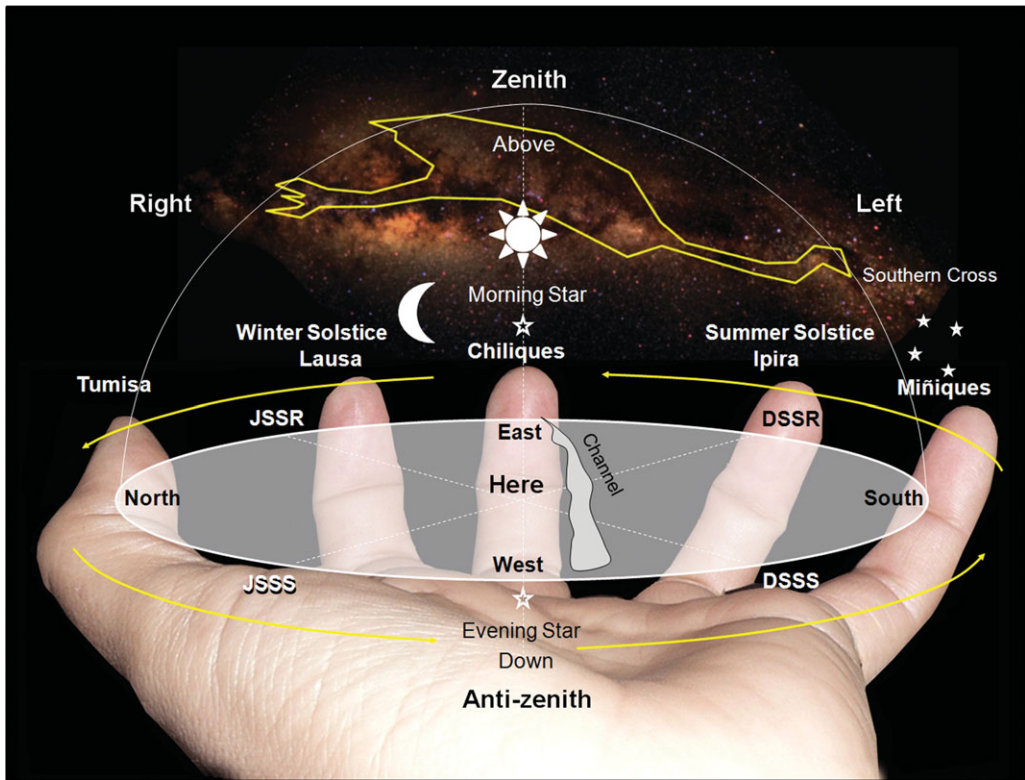


Figure 5. The human left hand and cosmological representation at Socaire.

opposites). Meanwhile, the set of *convidos* ('lines of offering') provides a specific territorial scheme that expresses a local ceque system (Fig. 5).

This study verifies the existence of complex relationships between humans and their environment, both in general terms and in the particular context of psychosocial aspects related to the observation and perception of the ground and sky in Inca times in northern Chile. It also demonstrates the existence of a local system of ceques and its use for calendrical and agricultural purposes in a radial pattern of Andean space-time organization.

References

- Aveni, A. F. 2005, *Observadores del Cielo en el México Antiguo*, Fondo de Cultura Económica, San Diego.
- Barthel, T. 1986 [1957], El Agua y el festival de primavera entre los atacameños. *Allpanchis* 28 (año XVIII), 147–184.
- Bastien, J. 1989, A shamanistic curing ritual of the Bolivian Aymara. *Journal of Latin American Lore* 15(1), 73–94.
- Bastien, J. 1996, *La Montaña y el Cóndor: Metáfora y Ritual en un Ayllu Andino*, Hisbol, La Paz.
- Bauer, B. & Dearborn, D. 1998, *Astronomía e Imperio en los Andes*, translated by J. Flores, Centro de Estudios Regionales Andinos Bartolomé Las Casas, Cuzco.
- Beorchia, A. 1985, *El Enigma de los Santuarios Indígenas de Alta Montaña*, Centro de Investigaciones Arqueológicas de Alta Montaña, San Juan (Argentina).
- Beorchia, A. 2001, Inventario de los objetos descubiertos en los adoratorios indígenas de altura. *Revista del CIADAM* 6, 281–314.

- Broda, J. 2004, La percepción de la latitud geográfica: otra dimensión de los estudios sobre calendarios mesoamericanos y arqueoastronomía. In J. B. M. Boccas, J. Broda & G. Pereira (eds), *Etno y Arqueo-Astronomía en las Américas. Memorias del Simposio ARQ-13: Etno y Arqueo-astronomía en las Américas, 51° Congreso Internacional de Americanistas*, Santiago de Chile, pp. 77–96.
- Bustamante, P. 2008a, ¿Qué parece? como pregunta orientadora en el estudio de la topografía sagrada en la cultura Azteca. <http://www.rupestreweb.info/queparece.html>, accessed March 25, 2010.
- Bustamante, P. 2008b, Posible ubicuidad espacio-temporal de la triada pareidolia-apofenia-hierofanía, como probable origen de la sacralización de algunos elementos del paisaje. <http://www.rupestreweb.info/triada.html>, accessed March 25, 2010.
- Cairns, H. & Harney, B. Y. 2003, *Dark Sparklers. Yidumduma's Aboriginal Astronomy*, Merimbula, Australia.
- Dietrich, R. 1989, Imagine: another mimetolith, *Rocks & Minerals* 64, 149–152.
- Elorrieta, F. & Elorrieta, E. 1996, *El Valle Sagrado de los Incas, Mitos y Símbolos*, Sociedad Pacaritanpu Hatha, Cusco.
- Grebe, M. E. 1996, Patrones de continuidad en el mundo surandino: creencias y cultos vinculados a los astros y espíritus de la naturaleza. In *Cosmovisión Andina*, Centro de Cultura, Arquitectura y Arte Taipinquiri, La Paz, pp. 205–220.
- Grebe, M. E. & Hidalgo, B. 1988, Simbolismo atacameño: un aporte etnológico a la comprensión de significados culturales. *Revista Chilena de Antropología* 7, 75–97.
- Hardman, C. Jr & Hardman, M.H. 1992, Linear solar observatory theory: the development of concepts of time and calendar. *North American Archaeologist* 13(2), 149–172.
- Heidegger, M. 1999, *El Ser y el Tiempo*, Fondo de Cultura Económica, México D.F.
- Hidalgo, B. 1992, *Organización Social, Tradición y Aculturación en Socaire. Una Aldea Atacameña*, Undergraduate thesis, University of Chile.
- Hume, D. 1757, *The Natural History of Religion*. <http://www.cchla.ufrn.br/conte/hume-nhr1.pdf>, accessed March 19, 2010.
- Hornborg, A. 2006, Animism, fetishism, and objectivism as strategies for knowing (or not knowing) the world. *Ethnos* 71(1), 21–32.
- Ianiszewski, J. 2010, *Guía a los Cielos Australes*, Editorial Mitra y Cuarto Propio, Santiago.
- Iwaniszewski, S. 2001, Astronomía, materialidad y paisaje: reflexiones en torno a los conceptos de medio ambiente y de horizonte. *Boletín de Antropología Americana* 37, 217–240.
- Iwaniszewski, S. 2007, La arqueología de alta montaña frente al paisaje montañoso en México central: problemas, interpretaciones, perspectivas epistemológicas. In M. Loera Chávez y Peniche, S. Iwaniszewski & R. Cabrera (eds), *Páginas en la Nieve, Estudios Sobre la Montaña en México*, INAH, México, pp. 9–28.
- Iwaniszewski, S. 2009, Por una astronomía cultural renovada. *Complutum* 20, 23–37.
- Latour, B. 1993, *We Have Never Been Modern*, transl. C. Porter, Harvard University Press, Cambridge MA.
- Mariscotti de Görlitz, A. M. 1978, *Pachamama Santa Tierra*, Gebr. Mann Verlag, Berlin.
- Moyano, R. 2010a, Astronomical observation on Inca ushnus in southern Andes: an approximation from the archaeology of landscape. Paper presented at *Inca Ushnus: Landscape, Site and Symbol in the Andes*, British Museum 2010, London, England.
- Moyano, R. 2010b, *La Mano de Dios en Socaire: Estudio de un Calendario Agrícola en Atacama, Norte de Chile*, MA Thesis, ENAH, Mexico City.
- Moyano, R. & Bustamante, P. 2010a, Socaires entorno (surroundings), northern Chile: a four-dimensional interpretation of Andean World View. Paper presented at 38th Annual Midwest Conference on Andean and Amazonian Archaeology and Ethnohistory, Indiana University, Purdue University Fort Wayne, USA.
- Moyano, R. & Bustamante, P. 2010b, Fenómenos psico-Sociales asociados a la percepción del entorno: la mano de Dios en Socaire. Paper presented at XVII Congreso Nacional de Arqueología Argentina, Mendoza.
- Moyano, R. & Uribe, C. 2010, *El Volcán Chilikues y el 'Morar en el Mundo' de una Comunidad Atacameña del Norte de Chile*. Manuscript.

- Núñez, P. 1991, Sobre economía prehispánica de Socaire, Norte de Chile. In *Actas del XI Congreso de Arqueología Chilena*, Museo Nacional de Historia Natural, Sociedad Chilena de Arqueología, Santiago de Chile, pp. 201–210.
- Núñez, P. 1993, Un canal de regadío incaico: Socaire—salar de Atacama. In *Actas del XII Congreso Nacional de Arqueología Chilena*, Boletín 4, Museo de la Araucanía, pp. 145–149.
- Núñez del Prado, D. 2008, Yanantin y masintin: la cosmovisión andina. *Yachay* 1, 130–136.
- Pereira, G. 2004, Persistencia y renovación: la Vía Láctea entre los guaraníes del Chaco boliviano. In J. B. M. Boccas, J. Broda & G. Pereira (eds), *Etno y Arqueo-Astronomía en las Américas. Memorias del Simposio ARQ-13: Etno y Arqueoastronomía en las Américas, 51° Congreso Internacional de Americanistas*, Santiago de Chile, pp. 299–314.
- Reinhard, J. 1983, Las montañas sagradas: un estudio etnoarqueológico de ruinas en las altas cumbres andinas. *Cuadernos de Historia* 3, 27–62.
- Reinhard, J. 1993, *Chiliques: a Report an Inca Mountain Ceremonial Center in Northern Chile*. Unpublished manuscript.
- Sanhueza, C. 2005, Espacio y tiempo en los límites del mundo, los incas en el despoblado de Atacama, *Boletín del Museo Chileno de Arte Precolombino* 10(2), 51–77.
- Santo Tomás, D. 1951 [1560], *Lexicón, Edición Facsimilar*, Universidad Nacional de San Marcos, Lima.
- Stuven, H. 1972, *42 Gráficos Solares para Ciudades de Chile y Argentina*, Facultad de Arquitectura, Universidad de Chile, Santiago.
- Sullivan, W. 1999 [1996], *El Secreto de los Incas*, transl. J. Pomares, GRIJALBO Mondadori S.A., Barcelona.
- Tichy, F. 1983, El patrón de asentamientos con sistema radial en la meseta central de México: ¿Sistemas Ceque en Mesoamérica? *Jahrbuch für Geschichte von Staat, Wirtschaft und Gesellschaft Lateinamerikas* 20, 61–84.
- Tilley, C. 1994, *A Phenomenology of Landscape: Places, Paths and Monuments*, Berg, Oxford.
- Tilley, C. 2008, Phenomenological approaches to landscape archaeology. In B. David & J. Thomas (eds), *Handbook of Landscape Archaeology*, World Archaeological Congress Research Handbooks in Archaeology, Left Coast Press, Walnut Creek CA, pp. 271–276.
- Valenzuela, A. 2000, *Socaire: Contexto, Problemas y Transformaciones en la Agricultura de un Pueblo Atacameño*. Unpublished manuscript.
- Viveiros de Castro, E. 1999, The transformation of objects into subjects in Amerindian ontologies. Paper presented at the *98th Annual Meeting of the American Anthropological Association*, Chicago.
- Zuidema, R. T. 1989, *Reyes y Guerreros: Ensayos de la Cultura Andina*, Grandes Estudios Andinos, Fomciencias, Lima.
- Zuidema, R. T. 1990, Ceques and chapas: an Andean pattern of land partition in the modern valley of Cuzco. In B. Illius & M. Laubscher (eds), *Circumpacifica Festschrift für Thomas S. Barthel*, Peter Lang, Frankfurt, pp. 627–643.
- Zuidema, R. T. 1995 [1964], *El Sistema de Ceques del Cuzco*, translated by E. Salazar, Pontificia Universidad Católica del Perú, Lima.
- Zuidema, R. T. 2009, *El Calendario Inca: Tiempo y Espacio en la Organización Ritual del Cuzco; La Idea del Pasado*, Fondo Editorial del Congreso del Perú y Pontificia Universidad Católica del Perú, Lima.