So far we have looked at what made the Second Age unique from the perspective of its monumental architecture, but have gleaned little in terms of what made its mysteries unique. The first element was offered by the language of the U-shaped mounds that indicate a cult of water and mountains, a continuation of the veneration of the Great Spirit, as it survived from Atlantean times in a similar way to what we find in North America. There is, however, another way to characterize Andean cosmology previous to the time of the Dawning and understand the nature of some of its ritual elements. It is found in the function of the sunken courts. We will turn to this in combining the information that astronomy offers to us in relation to architecture, through the new science of archaeoastronomy.

It is now well known that ancient and so-called primitive civilizations—particularly their initiate priesthood—had a far more advanced and subtle understanding and knowledge of the movements of the sun, planets, and stars than has been commonly assumed. We also know of a very common and as yet little understood and explored pervasive symbolism of the Andes: the so-called Andean Cross. The origin of the symbol is to be found in an important constellation of the southern hemisphere—the Southern Cross—a constellation that plays the equivalent role of Ursa Major in the northern hemisphere. It is this cross that is used as the pointer to the Southern Pole, that place that remains stationary in relation to all other circling stars. The line that goes from the upper (superior) star to the lower one (inferior) perpetually indicates the location of the southern pole in a similar way that that Polaris indicates the northern pole. At its superior culmination, when the cross's major axis is oriented vertically at the zenith, the four stars almost point to the cardinal directions.

The Southern Cross—called *chakana* in the Andes—is still an important constellation for the indigenous people at the present time. This may be what is represented as "the eye of god"—built with sticks in the form of a cross and held together with interlaced cotton threads—that archaeologists have found in the site of Caral and elsewhere.[25]

In *Spiritual Turning Points of North American History*, we have pointed out that in Mesoamerica, Ursa Major—pointing to North Pole—played an important part in the symbolism of Vucub Caquix (7 Macaw) and everything that points to the First and Second Ages in the *Popol Vuh*. The reference to this mythological image finds at least strong supporting

evidence in the realm of archaeology. As Popenoe Hatch elaborates, it would offer a plausible hypothesis about the central astronomical observations performed in the major Olmec centers.[26]

The strength of Popenoe Hatch's hypothesis lies in being able to explain the enigmatic abandonment of the ceremonial centers of the Olmecs, particularly La Venta. The researcher argues that at the time of the abandonment of the ceremonial centers, Ursa Major had significantly changed position in the heavens due to the precession of the equinoxes. This meant that a time came when it was no longer constantly observable on the horizon, at all times of the night and of the year, as it had been previously. This hypothesis finds confirmation in the images of the *Popol Vuh* in what is called the "Fall of 7 Macaw," who is identified with the constellation of Ursa Major in Mayan spirituality. The sacred book describes in great imaginations the dethroning of the demise of the god of a whole age.

It seems that the phenomenon of the building of structures that orient themselves to the heavens and then lose their function once the heavenly geography changes is also present in South America in the sunken courts. This may have led to their dismissal in the present era, although isolated examples remained even up to the fifth century AD and, in the case of Wari civilization, even later.

It lies beyond doubt that the Southern Cross played a central cosmological role in Andean culture. The old Andean agricultural calendars were tied to the superior culmination of the Southern Cross (May 3), which marked their beginning. Even today the date marks the beginning of the agricultural calendar and coincides with the Christian festival of the Holy Cross—a festival that was and is used to supersede a cult that had deep roots within Andean culture. In a manner typical to Native American history, the Spaniards' attempt to eradicate ancient tradition was only partially successful. It gave rise to a diffuse syncretism in which Christian names were used to cover the surviving use of ancient traditions or blend them with the new worldview.

The Southern Cross is the celestial axis of the southern hemisphere. The constellation has four stars, not exactly perpendicular. The relationship between the two arms is such that the minor arm is to the major as the side of a square is to its diagonal. This is the basis of the "sacred proportion," concludes Carlos Milla Villena after analyzing an astrophoto and measuring the rapport between major and minor axis of the constellation.[27] The reasoning behind this thought finds strong supporting evidence in the layout of the observatory of Salinas del Chao that we will look at in full detail shortly.

The Southern Cross is located in the Milky Way, close to the Coal Sack, one of the so-called dark cloud constellations of the Milky Way. By *dark cloud constellations* are meant the dark outlines formed by the surrounding thick clusters of stars of the Milky Way (figure 2.4).
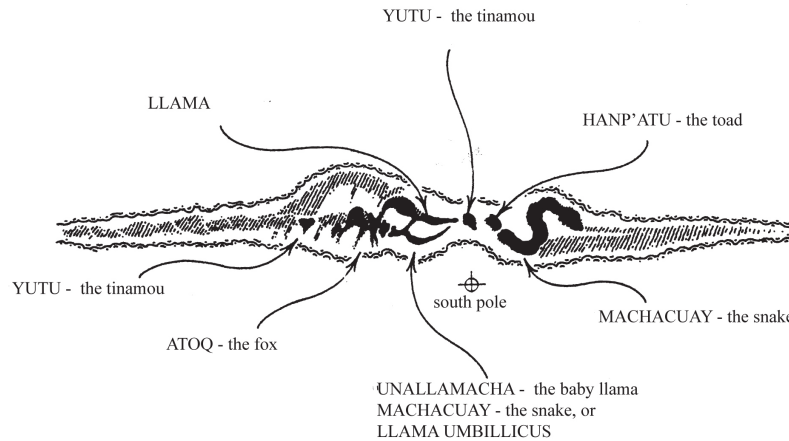
YUTU - the tinamou

LLAMA

HANP'ATU - the toad

YUTU - the tinamou

south pole

MACHACUAY - the snake

ATOQ - the fox

UNALLAMACHA - the baby llama
MACHACUAY - the snake, or
LLAMA UMBILLICUS

Figure 2.4: Dark cloud constellations

The Southern Cross also lies in immediate proximity to another central constellation of South America, the dark cloud constellation of the Sacred Llama. Two of the stars of the Llama—Alpha and Beta Centauri (*Llama ñawi*, the "eyes of the llama")—are some of the most brilliant stars of the firmament. Their heliacal rise and setting can be used to calculate the exact location of the geographic Southern Pole. To the immediate south of the cross is also found the constellation of the Fly, and further off, the constellation of the Chameleon.

In order to approach the evidence of the use of the Andean Cross in the Andes ever since the second millennium BC, let us look at a technique that has accompanied South American astronomical observations for millennia, the "astronomical water mirrors" that may have originated at this point in time. These look like large mortars carved in the rock. Their form and depth hardly fits their use as mortars, however. When filled with water, the mortars will reflect the light of a star by forming a silvery halo on the border of the circle, when the star is at the zenith. This is due to the fact that the surface of the mirror is concave and so is the surface of the water when it is filled. A result of the use of this technique is the mirror effect. The position of the mortars in space forms a mirror image to their counterparts in the heavens. This technique was resurrected at the time of the Incas.

Salinas del Chao

The water mirror technique is what was most likely used in the "Andean Cross geoglyph" of Salinas del Chao, situated in the Peruvian north coast, north of the Santa Valley and south of Virú Valley, next to the waters of the Pacific. Milla Villena attributes the geoglyph of Chao to the Late Archaic at around 2000 BC. The geoglyph itself is part of an extended site that had temples and ceremonial centers. Among the temples are also two sunken courts. The geoglyph complex is divided in two main parts (figure 2.5):

> a main quadrangle formed by low walls in which is inscribed the geoglyph of the Andean Cross. The markings (mortars) of the cross are inscribed in the center of this area. To the south (close to alpha of the cross) are found the markings of Alpha and Beta Centauri.
> a roughly square area enclosed by walls to the southeast of the first quadrangle. In the middle of it are two geoglyphic carvings that seem to correspond to the stars Alpha and Beta Musca (of the constellation of the Fly).

The Southern Cross is portrayed in the position it assumes at the Winter Solstice, an orientation of 31° 30' right of north; it is reproduced in a reflected position in the geoglyph.

Milla Villena has examined the measurements of the Southern Cross stars, as obtained from an astrophoto, and the measurements obtained on the site of Salinas del Chao for the marks corresponding to the stars, and compared the following proportions between the two sets of measurements: major axis/minor axis; northern section (between two contiguous stars)/southern section; western section/eastern section. There is an extremely high, statistically significant correspondence between each sets of two.[28] The cross is not oriented to the cardinal directions. However, the roughly northeast to southwest diagonal of the large quadrangle goes exactly through the middle of the cross. The major axis of the cross forms an angle of 31° 30' with true north. What is remarkable in this construction is the fact that the angle between the east-west axis and the minor axis of the cross measures 19°, which measures the intersolstitial angle—the angle formed between the positions of the sun at summer and winter solstice sunrise or sunset—at the estimated date of use of the observatory. The angle between the major axis of the cross and the line that reaches from the center of the cross to the southern angle of the quadrangle also measures 19°.
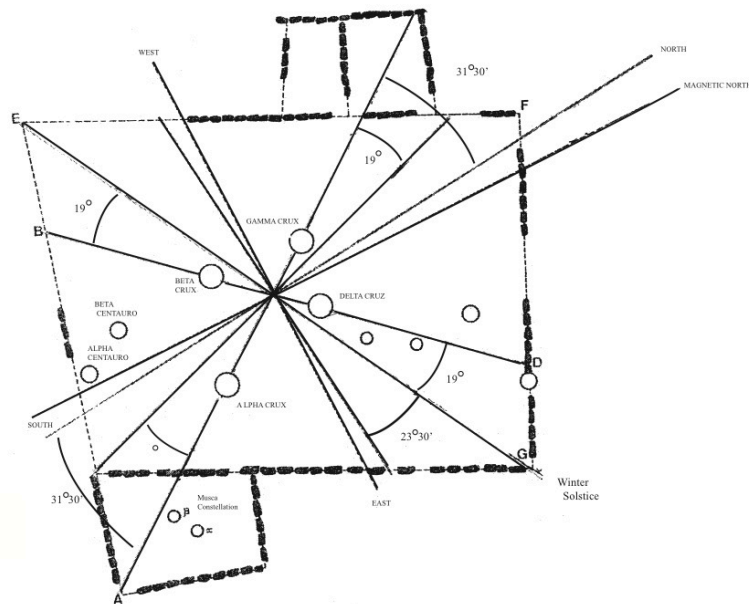
Figure 2.5: Salinas del Chao

Further analysis of the site of Salinas del Chao shows how the site itself was built on the proportions derived from the Southern Cross. Milla Villena finds the measuring patron of the Andean Cross inscribed within the structure of the Salinas del Chao to be the minor axis of the Southern Cross (see figure 2.5). The second square is built with the diagonal of the first square corresponding to the major axis of the Southern Cross. The eastern and western edges of the quadrangle (the low walls enclosing the mortars) lie along the lines that correspond to the square that gives the value of π. Thus, the geometrical properties of the geoglyph indicate a knowledge of the squaring of the circle based on the measurement of the Southern Cross—a knowledge that goes back to at least 2000 BC.

What can be seen in the geoglyph of the Salinas del Chao does not constitute isolated evidence. Other geoglyphs represent the Southern Cross. Such is the case for the geoglyph known as *candelabro* (candleholder) in the far north of the peninsula of Paracas on the southern coast of Peru. The figure is located on a steep slope, close to the top of the hill on compacted white sand overlooking the Pacific Ocean (figure 2.6). The Southern Cross stands upright in the heavens in the same way the candelabra does during the early days of May[29]—an important time of the year, marking the beginning of the agricultural calendar.

The base of the candelabra rests on a rectangular pedestal on which is inscribed a small circle that seems to prolong the vertical axis, acting like the

basis or pivot of the vertical axis. The Southern Cross rotates around the southern pole, which is what the circle in the rectangle seems to show.
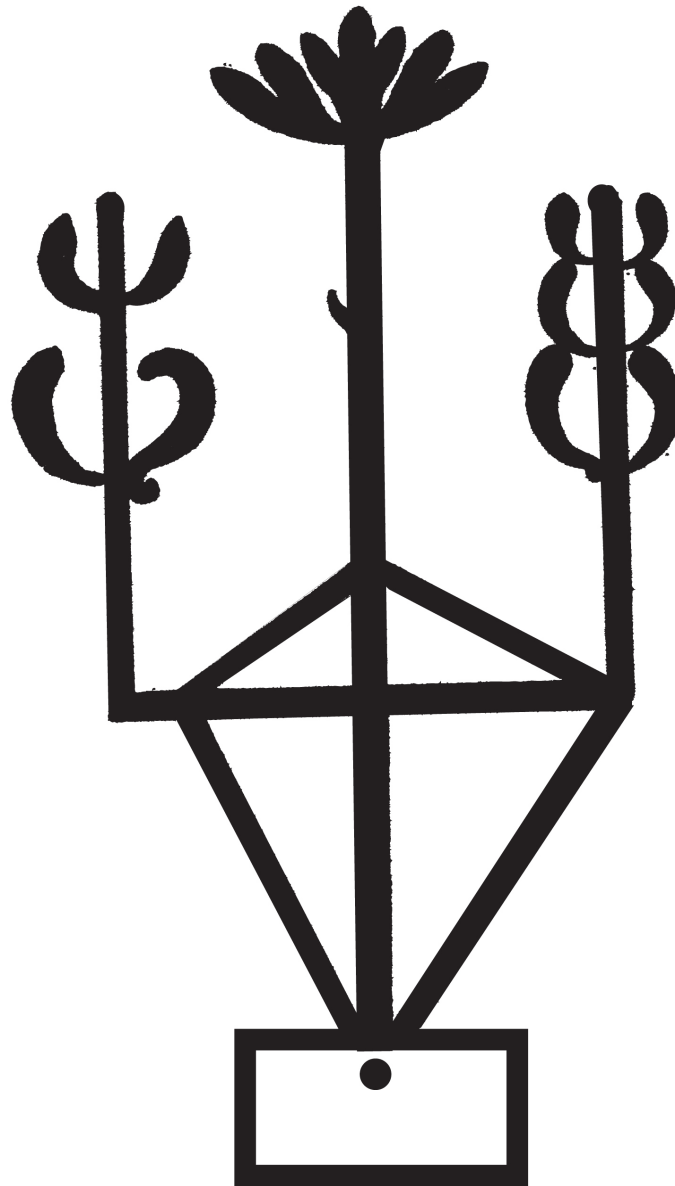

Figure 2.6: Paracas candelabra

The figure can only be observed at a long distance. It cannot be viewed from the north, and even less from the south given its position in the Paracas peninsula. It can, in fact, only be viewed from further out on the ocean. This may be the reason why it is also placed towards the top of the incline leading to the hilltop—viewable from afar, compensating for the

earth's curvature. The candelabra is in fact visible from the nearby islands of Chincha and is perfectly aligned with them.

The Andean Measuring System
It is becoming apparent that the Andean civilization had a very accurate and sophisticated mathematical/astronomical body of knowledge. Like many other civilizations before and after, in order to discern the unfolding of the seasons and to design their calendars, the Peruvian *amautas* (wise men) needed to divide the circumference of the circle (c)—an operation for which it is necessary to assess the value of π (3.14159…), which links the circle's circumference to its radius (r) since $c = 2\pi r$. When the diameter = 1, then the circumference = π. Knowledge of π and of the sacred proportion thus served the purpose of sacred geometry and the building of the monumental centers. Such knowledge was the revolution upon which rested the Second Age.

      Milla Villena's hypothesis is that in order to find the value of π, the *amautas* availed themselves of the most diffused symbol in Andean cosmology, the Andean Cross, which they based upon the patron of the Southern Cross. The Andean Cross arises out of the so-called squaring of the circle—the attempt to find a square and a circle of equal perimeter, which allows one to obtain geometrically a value for π. To do this, starting from an original square through successive diagonals, we generate four series of squares and enclosing circles that come each time closer to the desired goal (figure 2.7). The *amautas* found π as the value of the diagonal of the three adjacent squares of unit value and came to a value of 3.16. In so doing they obtained the most accurate value possible that could be reached through geometrical means.

      Following this initial hypothesis, Milla Villena has discovered that the "Andean operating system of measurement" that allowed measurement of π through the diagonal of the cross also became a system that yielded units, multiples, and submultiples. It served to realize mathematical operations and was utilized for the patterns of design of ceremonial precincts. In essence, all religious symbolism, elements of design, and spatial organization were subjected to this operational system.[30] Knowledge of this operative system survived to the time of the Incas—or was revived by them—as seems obvious from the geographic ordering of their ceremonial centers and temples, to which we will return.
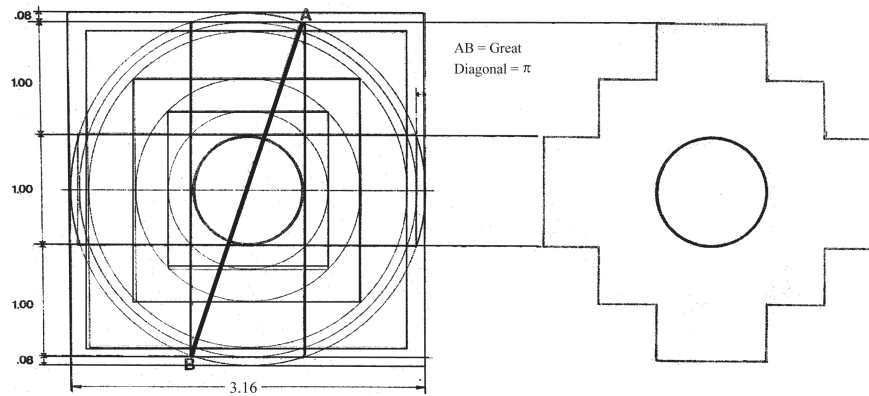
Figure 2.7: Andean cross and its generation

The operative system of measurement (OSM) is geometrical and proportional: its unit patrons are variable. For example, from the unity square, after three operations we obtain the square whose side corresponds to π. This in turn becomes the new unit patron. At the eighth operation we obtain a second square cross, used to obtain a square whose side will be π^2, or ten times larger than the original square ($\pi^2=10$). The ninth operation (yielding a square of $\pi^2 \sqrt{2}$) forms the limit of the second part of the operative system. In essence four operations were needed for reaching the first Square (Andean) Cross and four other operations to reach the second Square Cross. In eight operations the area of the original square is increased by ten.

The crosses resulting from each successive operation grow in the four directions of space. For practical purposes the *amautas* limited some of the artistic and functional representations (particularly in sculpture) and they only represented the first square cross. After that they limited its growth to the vertical dimension.

The Andean system of measurement works first through the "minor diagonal" of the unit square that generates the first Square Cross. The second diagonal is the Great Diagonal that unites the summits of the square cross (three contiguous squares). It has the value of π in the geometric process. The Great Diagonal serves as the main ordering principle of the system. It is used in the blueprint of all the main temples. In relation to this, Maria Scholten d'Ebneth says: "The diagonal is called *chekkaluwa* in Quechua, where the word *ch'ekka* means truth. Thus, overall, for those who devised and realized the great South American operating geographic system, the diagonal may have meant something like 'the path to the truth'."[31] The Andean cross ruled all dimensions of Andean spiritual life. It was applied at all the levels of magnitude.

The crosses of the first, second, third, and fourth orders served to order and organize the use of space of monoliths and minor surfaces. Beyond that the ordering of space reached larger and larger applications:

First cross: generated by the unit square
Second cross: for operating measurements such as the measuring staff of the *amauta*, equaling 1.117 m (3' 8")
Third cross: for the category of the monoliths, or unit patrons such as the famous Lanzon of Chavin (see chapter 3)
Fourth cross: for measurement of minor surfaces
Fifth cross: for the scale of the temples and associated ritual surfaces
Sixth cross: for the ceremonial center and the large associated open spaces
Seventh cross: for itinerant measurements
Eighth cross: for the organization of urban space, such as the later "*ceque* system" of Cuzco, a system of lines that radiated away from the center of Cuzco (See chapter 9.)
Ninth cross: for organizing regional spaces
Tenth cross: for the Andean geographic space. An example of it is the "Route of Wirakocha" (See chapter 5.)

The breadth of the application of the Andean system has no known parallel in history. You could say that in the Andean world, religion and ritual had a mathematical origin or that the *amautas* had a geometric-ritual mind.

The squaring of the circle is only the first part of the operations needed in order for the *amautas* to be able to orient themselves in the dimensions of space and time and to link those two to the eternal. The dimension of space is what the Andean cross addresses. Let us look at the dimension of time and how it affects the *amautas*' worldview.

In all ages and all times, simple observation of the firmament indicated to the initiates and their priesthoods that even the so-called fixed stars are not immobile and constant in the landscape of the heavens. Today we know that this is so thanks to the knowledge of the precession of the equinoxes, which indicates that every 72 years the sun moves by one degree in the heavens in relation to the fixed stars, so that after 30 x 72 years the sun will rise on the spring equinox in a different zodiacal sign than before. This is why we are waiting for the so-called Age of Aquarius. When that age comes, the sun will be shining at the vernal equinox from the constellation of Aquarius. It takes the sun 72 x 30 x 12, or 25,920 years, to move around

the ecliptic and return to the same exact fixed star in one of the signs of the zodiac. This length of time is called a Platonic Year.

Milla Villena formulated a hypothesis of how the determination of the precession of the equinoxes could have been solved by the Andean initiates. It appears that the Andean priest needed to measure the intersolstitial angle in order to incorporate knowledge of the precession of the equinoxes into the calculations that he could obtain from his astronomical observatories. The intersolstitial angle can be measured from the sun (observations on the day of the equinoxes) or the stars (observations of stars on the nights of the equinoxes). According to Milla Villena, the *amautas* used the stellar intersolstitial angle. This fact would be made manifest in the building of the sunken courts in the angle (width) of their stairs and depth of the inner court. The *amautas* would look at a given marker (star) and observe its position against the topographic background at one of the solstices. They first marked the topographic position, then repeated this operation at the following solstice six months later. The stairway extremes mark the position of a given star at one and the other solstice, thus helping to determine the intersolstitial angle.

As interesting as the theory could be, one can argue that, had the *amautas* known how to locate the solstices, they would not have needed such a difficult technique for calculating the intersolstitial angle. Furthermore, there is no evidence so far that Andean cultures knew of a solar calendar at that time. The first, very isolated evidence has only very recently emerged in the case of the solar observatory of Chankillo in the fourth century AD (see chapter 3). However, the thesis of sunken courts as stellar observatories still has some weight, based on the parallels between Mesoamerica and South America. In both places we are faced with observatories that lost their function in the centuries before the turn of our era. In the case of Mesoamerica, the observatories were the Olmec pyramids, in South America, the sunken courts of the Second Age. In the case of Peru, the phenomenon of the precession of the equinoxes probably caused havoc as early as 1000 BC, causing sunken courts to be rebuilt on different locations on the same sites. After a while their use was altogether discontinued. Sunken courts only continued to be built after the turn of our era, in very limited amounts and in cultures of regressive character, particularly the Moche (more about this in chapter 6). It is this author's opinion that the observatories served the purpose of stellar observation, and that the vagaries of their use are due to the shifting position of the stars due to the precession of the equinoxes. The stars could very well be those of the

Southern Cross after all! More research is needed to fully assess this hypothesis.

Let us look at the matter of the sunken courts' demise more closely. There are fourteen sunken courts in the neighboring valleys of Santa and Chao. They present two major variables: the opening angle of the stairs and the depth of the court. On the basis of the above theory we can provide an explanation as to why the observatories would be abandoned when the observatory would not allow the observation of the targeted stars. In such case three things could be done:

-change the opening of the stairway
-abandon the observatory
-build a new observatory and dig deeper than the previous one.[32]

Milla Villena finds no evidence of the first scenario, although the present author surmises this may have been the case in Caral's Hurin sunken court in the example brought forth earlier. The two internal stairways are not aligned to the axis of the pyramid and to the central staircase, but at a slight angle. They face 25$^{°}$ east of north. Historically, the initial design of the stairs was rectangular and later the design was modified to become trapezoidal.[33] The sunken court was originally aligned with the cosmology of the pyramid. Then something happened that negated this cosmology. This independent observation further reinforces Milla Villena's hypothesis of an astronomical function of the courts.

There is evidence for the second and third of the above alternatives in places where there are two sunken courts, used at different times. In this case the second one is dug deeper than the first one. This is what happened in Pampa Yolanda in Santa Valley, Alto Peru de Suchiman, Las Haldas in Casma Valley, Salinas de Chao, and others.[34] After the Moche civilization (~AD 100–600) the sunken courts almost completely disappear. In no instance were they consistently used over time.

We will now move to a plausible hypothesis of the nature of Andean spirituality as it could have been practiced at that time within the precinct of the mysteries in what would have been a purely theocratic society.

Luigi Morelli, www.millenniumculmination.net, 2015