Il cielo e l'uomo: problemi e metodi di astronomia culturale

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Indice

Glimpses into the Inca astronomy from a Jesuit document of the early 17th century

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Abstract. The Miccinelli manuscripts are a set of documents written in Peru by Jesuit scholars during the first half of the 17th century. One of such documents contains the depiction of a Quipu. The drawing is claimed by the author, Blas Valera, to be a reproduction of the Inca calendar of the year of the end of the Inca empire. We give here a complete archaeoastronomical analysis of this document, showing that its calendrical information is actually quite accurate. The possible relevance of these results for the knowledge of the original Inca lore of the sky is discussed in full details.

1. Introduction

The so-called *Miccinelli documents* are two secret Jesuit manuscripts: *Exsul Immeritus Blas Valera Populo Suo* [The unjustly banished Blas Valera to his people] (here referred to as EI) and *Historia et Rudimenta Linguae Piruanorum* [History and elements of the Peruvian language] (here referred to as HR). The document EI, dated Alcalà de Henares (Spain) May 10th, 1618, was written and signed by Blas Valera, a mestice Jesuit whose works were previously known only because they are cited as erudite sources in the chronicle written by Garcilaso de la Vega. The document HR is instead a collection of writings, composed in Peru between 1600 and 1638 by the Italian Jesuits Johan Antonius Cumis and Johan Anellus Oliva. The two documents were presented between 1996 and 2001; they have been recently made available with an exhaustive publication (Laurencich Minelli 2007, 2009); it is worth noticing that their authenticity has been proved beyond any possible doubt (Cantù 2001, Gnerre 2001, Zoppi 2001, Tinti et al. 2001, Laurencich-Minelli et Numhauser 2004, 2007).

Both the manuscripts deal with the surprising personal history of the mestice Blas Valera. His positions were very critical about the destruction of the culture of the natives due to the Spanish invaders. To avoid problems with the Inquisition and the Spanish power, the General of the Jesuit Order, F. Claudio Acquaviva, according to what both documents say, exiled him in Spain in 1592. However, Valera kept on spreading his critics; as a consequence, Acquaviva imposed to him a "juridical" death (1597) which obliged him to silence. Before this fictitious death, according to the documents, Valera gave to Garcilaso de la Vega his work on the history of the Inca to be diffused respecting his writing and authorship; but instead Garcilaso wrote his *Comentarios Reales*, twisting and cutting Valera's ideas and authorship with the aim of presenting the Incas as simple savages, in order to comply with the Conquerors' power. Again according to both

documents, F. Muzio Vitelleschi then helped Valera to return in Perù (1598) to write that "long letter" to the King of Spain in defense of the natives called *Nueva Coronica y Buen Gobierno* (here referred to as NC) that Valera conceived, concealing himself both under the name of the native Guaman Poma de Ayala and the pen of the mestice B. Gonzalo Ruiz. In 1618, the same F. Muzio Vitelleschi, at that time General of the Order, helped Valera to return again to Spain, in Alcalà de Henares, where Valera died in 1619.

The detailed study of the three documents (NC, EI and HR) reveals that their aim is respectively the proposition, accomplishment, and documentation step after step, of a kind of Inca-Christian state in the Jesuitical *Provincia Peruviana*, within the Spanish kingdom. In particular, the ms. EI is a bi-cultural document written in Latin in European characters and in Quechua by using traditional writings (*Quipus* - i.e. knotted cords -, *tocapus* - i.e. textile cartouches with ideographic figures with conceptual reading - and *quillca* - i.e. pictographies -). The parts of EI written with these traditional systems are devoted to the natives, and describe the new, Christian state of the Incas at Paititi (Bolivia), viewed as the continuation towards the East, that is "towards the rising Sun", of the last Inca Reign of Vilcabamba (destroyed with the execution of Inca Tupac Amaru in Cuzco in 1572). This ideal Inca state should be governed by a diarchy between the Inca and the King of Spain, and organized with the *ceque* system (system of radial lines) as was the Inca capital Cusco. The official language of the state has to be the Quechua, written with the traditional systems, and the passing of time has to be accounted for using the traditional Inca calendar. Since this calendar was intimately connected with the Inca religion, however, this last requirement would have been at high risk of being considered as an idolatry. As a consequence, very probably the author's choice was to present an *example* of such a calendar, referred to a particular moment of the pre-conquest "time". This calendar is called *Pachaquipu* or "the Quipu of the cosmological time" and is enclosed in EI in the form of a drawing (Figure 1).

It is this drawing the object of our study in the present article.

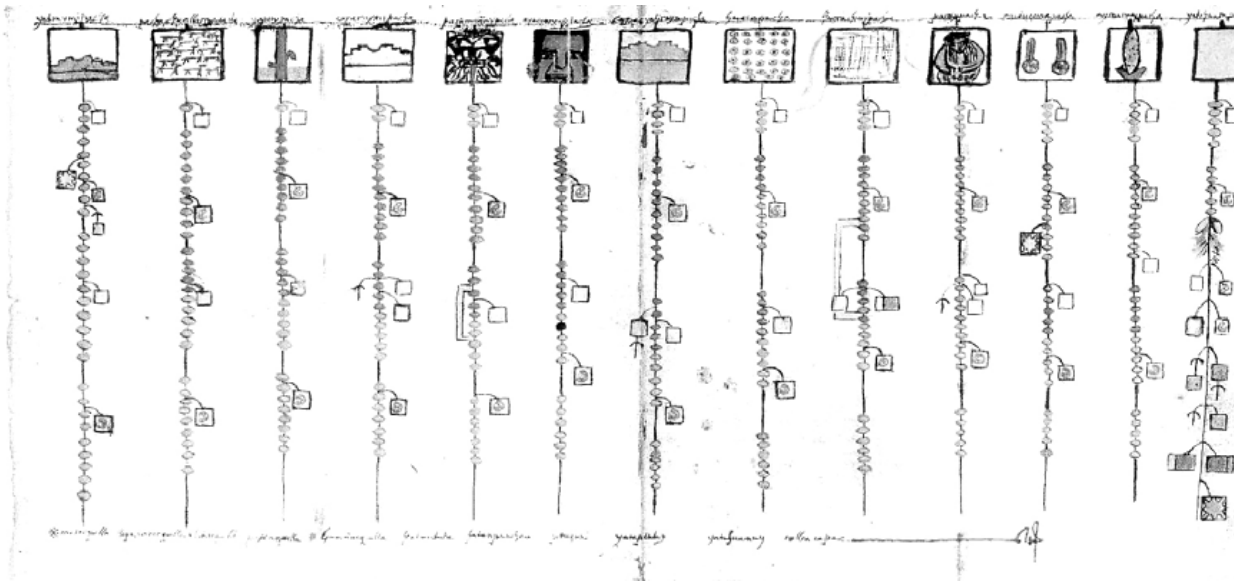

Fig. 1. The *Pachaquipu* (Miccinelli Collection, copying prohibited, published with the kind permission of Clara Miccinelli).

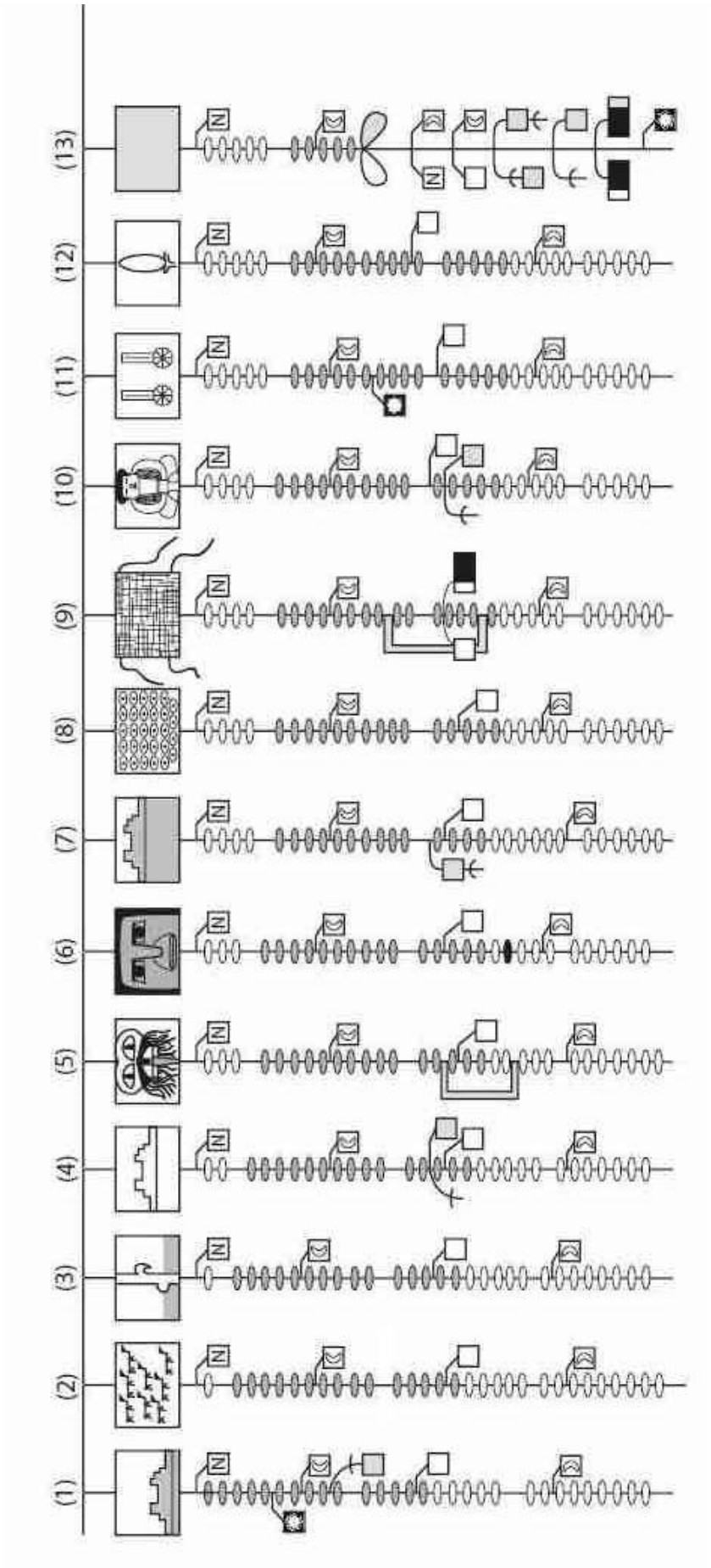

Fig. 2. Graphical scheme of the *Pachaquipu.*

2. The Pachaquipu document

The paper sheet c.18 containing the drawing brings, on the *rectum*, a few sentences written by the author, Blas Valera. These sentences contain a reprimand to Garcilaso de La Vega for his ignorance on the Quipus, and state that the drawing reported on the opposite side is a *Pachaquipu* which "regards the end of the time of the Inca empire". It must be noticed that *pacha* means time as well as space to stress that the calendar allows us to count the Andean "cosmological time".

In order to understand this concept we must first explain that in these documents, as prehispanic and contemporary Andean natives, the universe is conceived as composed of two parts which are at the same time opposed and complementary each other: *hanan* (which is considered by Valera to be high and masculine like the Hananpacha i.e. the place-time of the Hanan, placed on the sky) and *hurin* (which is considered low and feminine like the Pachamama, i.e: the place-time of the Hurin placed on the earth which is ordered by human culture). It should be noted that an "intermediate" earth-level, or Kaypacha, which occurs in later Quechua language and cosmology, is not mentioned in these documents (Isbell 1978, Arnold et Al. 2000, Laurencich-Minelli 2007, 2009).

Back to the *pacha* as the cosmological time and space, this too is divided in the *hanan* time (the time counted with the sun or the stars, on the sky, i.e. on the Hananpacha) and the *hurin* time (the time counted with the moon, on the anthropized land, i.e. on the Pachamama). From the sources which refer of Andean calendars (NC, Molina, Polo), we get that the name of just the Pachamama time was *quilla*, i.e. moon, not only to stress that the main calendar of the Pachamama was a lunar one but also because Quilla, the moon, was considered related to the Pachamama while Inti, the sun, was related to the Hananpacha (see Laurencich-Minelli and Magli 2010 for a complete discussion and for further details). The drawing of the Pachaquipu represents a Quipu composed by a main cord and 13 pendants. Each pendant carries a certain number of knots, for a total of 365; between some of the knots smaller cords are fastened, bringing some symbols, painted on small rectangular cartouches. From left to right we encounter twelve pendants which represent 12 sinodic months, since each cord starts with the symbol of the new moon (see below) and contains either 29 or 30 knots. The days however are *also* counted in groups of 15 each by the use of alternate colors (red and green) as well as groups of 10 by spacing the knots ten by ten. Thus, the Quipu contains a calendar of 12 months; the 1st, 3th, 4th, 6^{th} and 10th months are of 29 days while the others are of 30 days; the "weeks" (periods) of 10 and of 15 days run independently from, but simultaneously with, the month's count. The periods of ten days are marked by spaced groups of 10 knots, and correspond to the Inca weeks mentioned in NC (cc.255, 260) and to the decimal basis which was in use in the Quipus; the periods of 15 days are instead marked alternately by 15 red and 15 green knots respectively, and correspond to a division into two halves of the solar months of 30 days each. These two halves correspond to periods *hanan* (red knots) and *hurin* (green knots): i.e. they fit and enclose both, the Pachaquipu months and the Pachaquipu as a whole, into the two great divisions of the Andean universe.

In the last pendant, the 13th, there are five green knots, which represent the *hurin* days needed to bring the total to 360 (due to the presence of 5 sinodic months of 29 days) plus five further red knots. We can call the corresponding days epagomenal since their function is to bring the count of the solar days to 365, as occurred in many other calendars (e.g. Maya's).

All in all, as said, it is clear that the calendrical structure reported in the document is based on 12 lunar sinodic months. Above each of the corresponding 12 pendants there is a

cartouche containing a symbol for the month, and over each symbol the name of the month is reported. For a thorough analysis of the names and the symbols of the months, as well as for a detailed comparison with the corresponding information contained in the NC document and for the Pachaquipu representing an Inca merging of the two NC calendars, which are instead adapted to western standards, see Laurencich Minelli and Magli (2010). Here, we only mention that, according to EI, many of such symbols (tocapus) which have a conceptual reading are also used as *ticcisimi*, that is textile cartouches inserted in text writing quipus which have also phonetic reading (Laurencich-Minelli 2007, 2009).

The keys needed for understanding the structure of the calendar are present at the end of the 13th pendant (far right), which is called *yntihuatapacyapanapacha* [time necessary for the completion of the calendar year], that is the additional days to complete the year. The cartouche is yellow, i.e. it is the ticcisimi ynti, the sun. The pendant, after the 10 (5 green, 5 red) knots of the additional days, contains a directory of symbols related to astronomical events to be used for reading the calendar: we give here a very brief description of each symbol with its explication, which is written in Latin letters at the bottom of the Pachaquipu.

- A square without color [the *ticcisimi* quilla = moon], the explication is: *mosocquilla* [new moon],
- a left-handed crescent, the explication is: *pacaricquilla/vinacquilla* [waxing - i.e. moving towards full - moon],
- a white square, the explication is: *pascaquilla* [full moon],
- a right-handed crescent, the explication is: *huañucquilla* [waning moon],
- a yellow square [the *ticcisimi int i*= sun] covered by a bow [the *ticcisimi tuta* = night], the explication is: *hatuntuta* [Midwinter, June solstice],
- a yellow square [*the ticcisimi inti* = sun] above the bow [*the ticcisimi tuta* = night], the explication is: *hatunpunchau* [Midsummer, December solstice],
- a yellow square [the *ticcisimi inti* = sun] knotted with the bow [the *ticcisimi tuta* = night] which is on the same level as the sun, the explication is: *pituçuni* [equinoxes],
- a rectangle 1/3 white and 2/3 grey [the *ticcisimi yanpintuy* = eclipse of the moon], the explication is: *yanpintuy* [black sheet = eclipse of moon] (this arcaic word is used - according to Valera, Add. IV - by the *haravec* priests instead of the word *quillamtuta* used by the old countrymen, of the word *quillahuañuy* used by the astronomers and other similar word used in "popular" speaking),
- a rectangle 2/3 grey and 1/3 yellow, the explication is: *yntihuañuy* [eclipse of sun],
- a rectangle containing a shining star with eight jags, the explication is: *Collcacapac* [the Pleiades].

As we shall see in next section, all these symbols are used, attached to days of the calendar, with the exception of the sun-eclipse symbol. It must also be noticed that two further symbols do appear in the calendar but are absent from the directory and from its explanation, precisely a yellow C-shaped cord and a knot marked black holding. The C-symbol appears two times, one on the 5th and the other one on the 9th pendant, while the black knot appears only one time, on the 6th pendant.

3. The astronomical data

The black knot is the key which allows us to "decode" the calendrical data. Indeed, although of course calendars did exist for each year, the drawing is specifically claimed by the author to be a calendar which "concerns the end of the time of the Tahuantinsuyu". It

is, therefore, reasonable to identify the black knot with the day of the battle of Cajamarca, namely November 16th, 1532 (we stress that, if not differently specified, the dates mentioned in this paper are Julian), when the destiny of the Inca empire was decided. We therefore assume - for the moment as a working hypothesis - that all the other knots of the Pachaquipu refer to the days before and after this date and proceed to control if the reported data match with the astronomical data for that period.

Counting the number of the knots back and forth from November 16, it is immediately clear that the 365 days reported in the calendar start from June 3th, 1532 and end on June 2, 1533. This is fully confirmed by the fact that the count of the lunar months agrees with the calculated phases of the moon in that period, starting from the new moon of June 3; the identification of the solstices and of the equinoxes is also coherent.

To proceed further, we must individuate the latitude of the astronomer who compiled the calendar. It is, of course, natural to assume that he was a royal astronomer, working at the latitude of Cusco, the capital of the Inca. The existence of specialized astronomers, who recorded their data on Quipus, is actually attested by the NC, where the depiction of one of them - described as "the astrologer who watch the sun and the stars" and bringing a fork-like viewfinder and a Quipu - is present. Hence, we analyze the other symbols of the calendar assuming this second working hypothesis, which actually reflects the astronomical events that occurred in Cusco in that period fairly well. In fact:

1) The eclipses

To study the eclipses we use the tables provided by Fred Espenak, NASA's GSFC. The Ticcisimi representing the sun eclipse is not used in the calendar, and indeed no sun eclipse was visible, not only from Cusco but from the Inca empire as a whole, in the considered period of time. The Ticcisimi representing the moon eclipse instead appears one time, placed on February 9, 1533. Effectively, within the considered period a visible moon eclipse occurred that day. It was a very impressive total eclipse that reached its maximum just before dawn, around 7.10 a.m. (Cusco local time).

2) The Pleiades

The symbol named *Collcacapac* is a rectangle containing a shining star with eight jags, a sort of generic picture for "star" which occurs also in the Poma de Ayala's chronicle, where it is used for Venus. In any case there is no doubt that the asterism named *collca* by the Incas coincides with the Pleiades. Interest for the Pleiades in the Andean astronomy is indeed well attested, and clearly confirmed by the ethno-astronomical study of contemporary Misminay carried out by Gary Urton in the eighties (Urton 1982). In the Pachaquipu the symbol of the Pleiades occurs two times, and it is located on April 5 and June 7. Clearly, the hypothesis to be tested is if these dates may indicate the period of invisibility of this asterism. As is well known, there is no rigid definition of the period of invisibility, since the observation of heliacal phenomena depends on the skill of the observer, as well as on the atmospheric conditions and, if the case, on the presence of a non-flat horizon at the azimuth of rising. In what follows we thus assume a flat horizon and use as a reasonable estimate for the altitude of the sun at which a star (actually in this case a dense group of stars) with an equivalent magnitude ~3 is firstly visible the value -17° (Aveni 2001). Assuming, moreover, 3° as the minimal altitude of visibility ("Thom's law", that is minimal altitude of visibility = magnitude in degrees) we get a theoretical period of invisibility at the latitude of Cusco in 1533 lasting from April 7-8 to May 25-26.

The agreement with the Pachaquipu, which gives April 5 and June 7, is therefore optimal for the date of disappearance from the sky, while June 7 looks too late to indicate heliacal rising. Perhaps it is an indication of a date in which the Pleiades, known to be present in the pre-dawn sky from a few days, were actually looked at, at a sufficient altitude to distinguish, well above the horizon, their "seven sisters". In this connection, it can be noticed that the chronicler Arriaga mentions the observation of the Pleiades in association with maize production; the corresponding pre-conquest Inca feast lasted a few days and, after the conquest, was linked to the Christian feast of Corpus Christi, which occurs the ninth Sunday following Easter (in 1533 it occurred on June 15). Further to this, it can be noted that, today, the heliacal rising of the Pleiades in the zone of Cusco occurs around June 3-4 (of course Gregorian), but, according to Urton, the observations aimed to make predictions about planting are carried out by the Misminay people (near Cuzco) on the day of St. John, i.e. June 24.

3) The zenith passages of the sun

As mentioned in the previous section, the Pachaquipu contains two yellow C-shaped cloth bands, whose meaning is not explained by Valera. However, due to their yellow color, they definitively refer to the sun. These symbols are placed in correspondence to the following days:

- the first starts between October 12 and October 13, and ends between October 17 and October 18, for a total of five days;
- the second starts between February 5 and February 6, and ends between February 11 and February 12, for a total of six days.

The dates October 19 - the day after the end of first band - and February 4 - the day before the beginning of the second band - are symmetrical with respect to the summer solstice (December 12). Thus they are, of course, suspicious of indicating solar dates, and it can indeed be verified that these two dates correspond to the passage of the sun at the zenith at the latitude of Cusco. Therefore, there can be little doubt on the fact that the C-shaped bands are used as zenith passages indicators.

4. Glimpses into the Inca astronomy

All in all, the Pachaquipu is a lunar/solar calendar of 365 days starting from the new moon of June 3, 1532. It is out of question the fact that the document is original: it was certainly drawn by Blas Valera at the beginning of the 17th century. However, the problem is to understand how much information about *pre-conquest* astronomy is contained in it, as opposed to what the documents inherits from the author's knowledge of *western* astronomy. This problem is both difficult and interesting at the same time, because our current knowledge of pre-conquest astronomy is fragmentary and confused, being mostly based on chronicles, written after the conquest, which give contrasting and/or unclear descriptions. In what follows we shall concentrate on the issues related to astronomical observations, referring the reader to Laurencich Minelli and Magli (2010) for a thorough comparison with the NC and to Zuidema (2007) for a study of the relationship of the Pachaquipu with available pre-conquest calendars.

First of all, it has to be observed that the Pachaquipu contains *specific* data of the years it concerns, such as the new moon on June 3, 1532, and the total moon eclipse on February 9, 1533; further, it contains data which are typical of the latitude of Cusco, such

as the date of the Pleiades disappearance and those of the zenith passages of the sun. There are, however, two quite different ways in which the author could have obtained such data. It may be, in fact, that Valera compiled the calendar by himself. In this case he worked it out in accordance with the Inca customs, but evaluating the astronomical events of 1532-1533 by himself or with the help of an expert Jesuit brother. Indeed, the Jesuits developed a deep interest in sciences in general and in astronomy in particular since their foundation in 1540. They founded dozens of observatories, and relevant astronomical observations by Jesuit astronomers are documented already at the end of the 16th century, for instance by Fr. Cristopher Clavius, active in Rome at the Collegio Romano observatory, and by Fr. Cristopher Sheiner (1573-1650) who, among other contributions, was the discoverer of the sun-spots. Therefore, it is certainly possible that Blas Valera had access to astronomical data and/or to skilled colleagues, not to say that we do not know how deep was his own knowledge of astronomy. Access to "almanacs" (databases) containing eclipse's tables was possible as well, as shown for instance by the famous episode of the eclipse predicted by Columbus on February 29, 1504 and used by him to impress the natives.

The second, quite fascinating possibility, is that Valera collected in Cusco not only information on the general structure of the Inca calendar, but also a set of original data recorded by Inca astronomers on a true Quipu. However, among the few hundreds of Quipus which survived the conquest, only a few are calendrical, and not even one has been as yet identified as a storage of astronomical data. Therefore, the Pachaquipu would constitute the first - although quite indirect - proof of the existence of astronomical Quipus about which refer the chroniclers.

Hints in this direction come especially from the references to the zenith passages of the sun. Indeed, of course, this phenomenon was not experienced by European astronomers in their countries, and therefore it was known by them only at a theoretical level. As a matter of fact, the Inca observations of the zenith passages of the sun should have generated much confusion in writers not expert in astronomy, as it is shown by the ambiguous description made by Garcilaso de La Vega and by Montesinos, which is only valid near the equator, since it associates the zenith passages - measured trough the shadow cast by a gnomon - with the equinoxes. On the other end, many chroniclers report the existence, on the hills at the Cusco horizon, of stone pillars (*mojones*) used as calendrical indications for sunset at specific days, and the Anonymous Chronicler describes the site of the observation as the ushnu, a pillar of well-worked stone said to have been located in the today's Plaza de Armas, not far from the main Cusco temple (Bauer and Dearborn 1995). Unfortunately, no traces of the stone pillars have been found as yet in Cusco, and it is unclear which dates they really defined; however, their former existence is out of question, since examples are known from other Inca sites such as Urubamba and, recently, the existence of a long-standing tradition of sun observation using towers at the horizon has been spectacularly confirmed by the discovery of the pre-Inca observatory of Chankillo (Ghezzi and Ruggles 2005). Here a set of 13 towers at the horizon were used to frame the sun during the course of the year between the two solstices, exactly as the Inca are reported to do more than a thousand of years later. Further, it is almost certain that the Cusco pillars were working as coupled devices; in other words, they were all built in nearby couples, so that the setting sun could be framed between two pillars for a period of time of the order of some days, helping the astronomer to identify the dates with precision. It is, therefore, tempting to suppose that the "C" shaped symbols may represent the interval of days in which the sun *was seen as framed between two pillars at the horizon;* perhaps Valera copied the symbols without even being aware of their practical meaning

and for this reason he did not mention them in the list or, as we have already proposed (Laurencich and Magli 2010), he choose not to mention explicitly an observation which was carried out with devices which might have been regarded, due to the Inca cult of the sun (and their appurtenance to the *ceque* system, i.e. to the system of the Inca's social organization), as "idols" located at the Cusco horizon.

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