PLAUSIBLE CONSIDERATIONS REGARDING THE ASTRONOMICAL MODELLING OF THE SOCIAL AND BIOLOGICAL LIFE OF DACIANS-GETIANS

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RESUMEN

En este artículo se presentan algunas consideraciones plausibles sobre la existencia de un calendario especialmente desarrollado en la civilización y cultura de los Getas-Dacios, localizado en la (supuesta) capital *Sarmisegetusa Regia/Basileia /Cogaionon. Se expone un modelo teórico plausible para un calendario Dacio-Geta hipotéticamente lumi-solar utilizado en la Antigüedad en Sarmisegetusa y se hacen también algunos comentarios epistemoló-gicos.*

ABSTRACT

In the paper is presented some plausible considerations regarding the existence of a calendar specially developed within the civilization & culture of Getians-Dacians and located in the capital *(presumed) Sarmisegetusa Regia/Basileia/ Cogaionon. A plausible theoretical model of a hypothetic lunisolar Dacian-Getian calendar used in Antiquity in Sarmisegetusa is worked. Some epistemological comments are also made.*

Palabras clave: Calendarios, Cronologías, Astronomía, Antigüedad.

1. Plausible considerations regarding the existence of a calendar specially developed within the civilization and culture of Getians-Dacians

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The remarkable civilization and culture[1] created on the Carpanthian-Danubian-Pontic territory by Dacians-Getians plausibly, even necessarily,

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implies the existence of a well-defined system for the time-reckoning, used for organizing both the social-cultural life and the individual one.

Establishing some correspondences between the rhythms of biological life and the astronomical and climatic periods, marked by the periodic motions of sun and moon, is, certainly, a natural and longstanding process to be found to all the peoples founders of ancient civilizations and cultures in the giant area from Indus to Atlantic Ocean[2], area inhabited in Antiquity. We have no argument to believe that Dacians-Getians were, in this respect, an exception.

Contrarily:

a) The healthy climate of the Dacia's regions, the mineral and vegetal riches, the active social life, the serenity of the *Dacian soul,* as it was mentioned in different historical testimonials, their bending towards wisdom and towards the cultivation of liberal arts as well, as the resorting to a rich pharmacopoeia -all these arguments, and others, naturally guide us to conclude upon the existence to Dacians-Getians of many cases of impressive longevity[3].

b) The intense economical and cultural exchanges between Dacia and the lands of the Mediterranean Basin, and of the Near East, advocate[4] for the existence of a luni-solar calendar, with the subsequent divisions: days, decades, months, years, and (plausible) still longer periods[5], because, both Greeks and Romans -obviously the most important partners of Dacians-Getians in their economic and cultural dialogue with foreign countries- still had in their practice luni-solar calendars.

b.1) *The Greek calendar* was based on the Meton's cycle $T = 19$ solar years, and was considered as the most accurate system of time-reckoning at that epoch[6].

b.2) *The Roman Calendar* already underwent some significant changing, i.e. in the early Republican epoch was used (probably) a luni-solar calendar based on a eight years cycle[7], and before the year *46 BC*[8] a calendar (presumably) based on the $T = 11$ years cycle and having years of variable duration[9] according to the formula[10]:

$$355\,x + 378\,y + 377\,z = 4016$$
$$x + y + z = 11$$
$$x = 6,\ y = 1,\ z = 4$$

The Roman cycle accurately included an integer number of lunar synodic periods, namely $N = 136$.

The detailed arguments gathered by us to support the hypothesis of the existence of a luni-solar calendar in Ancient Dacia-Getia, as well as our own efforts to concretize it, are presented in the sequel.

In this respect a study of the elements with presumptive astronomical meaning of the great circular sanctuary from Sarmisegetusa, the royal capital of the Dacia-Getia prior to Roman conquest[11] is undertaken in view of achieving a reconstruction of the Dacian-Getian calendar:

a) accounting, more plausible, for the ancient traditions of time reckoning;

b) accounting more plausible, for the cultural influences exerted upon Dacian-Getian territory.

More definitely, the following logical and archaeological-historical arguments are taken into consideration:

a) Zamolxes, the founder of Dacian-Getian religion studied astronomy[12] in Egypt, in Ancient Israel and Chaldea[13].

b) Deceneu, the great priest of the Dacian-Getian monotheist religion during the reign of the king Buerebista, studied[14] astronomy from Greeks and Jews[15].

c) The strange tablets with cuneiform inscriptions found in Tartaria on the Mures river exhibit[16] a significant analogy with similar tablets of Sumerian origin[17], or wich Cretan tablets[18].

d) The hypothesis, according to which in the last half of the third millennium *B.C.* a definite and intensive trade transit coming from Indus going through Mesopotamia and Syria up to Danube, was put forward[19]. If this hypothesis, supported by palaeographic proofs, will turn out to be a valid and important one, then the Oriental influence upon Dacia-Getia appears not only as likely, but still having an impressive tradition.

e) It was established some connecting lines between the megalithic civilizations of France and England and the civilizations of the Far East[20] (India and Mesopotamia). One if these lines joined Troy of Priam to Stonehenge, via the Vinca culture, located on the Dacian territory[21].

f) The study of the constructions with a presumed astronomical destination, both from Stonehenge and Sarmisegetusa[22], revealed a series of striking analogies which by no means may be overlooked[23].

g) Some historical sources, dated towards the end of Roman Antiquity, mention the existence of some relevant *Cultural including scientific*[24] exchanges[25] between Dacians-Getians and Celts[26].

h) Some various investigations[27] proved, in a convincing way, that the megalithic building of Stonehenge was proper to be operated as an eclipse predictor, because in the construction of the respective monument would be included the number of years of the cycle of lunar orbit nodes as a fraction $N = 56/3$.

Starting from these arguments and frames -i.e. logic, archaeological-historical arguments- we were able to devise a model of the (presumed) Dacian calendar, giving, finally, its (plausible) delineation: it was (plausible) *a luni-solar calendar, mainly based on the 11 years cycle for equalize an integer number of synodic lunar periods with an integer number of sideral terrestrial periods.*

a) The keynote of our construction is the idea that: the circle made up of $N = 30$ large stone pillars of the great circular sanctuary may have a double function:

a.1) in a given rotational sense it is possible to reckon days;
a.2) in the opposite sense it is possible to take into evidence the lunar months.

b) Other details refer to:

b.1) the division of a day and a month in sub-intervals;
b.2) the system of corrections necessary to improve the correspondence between the solar and the lunar parts of the calendar.

For all these aspects we were in a position to find out a motivation just in the *numerology* of Sarmisegetusa: i.e. the set of integer numbers delivered by the finite and discrete number of the sanctuary elements.

a) We consider the large stone pillars[28] as determining the structure of the (plausible) Dacian-Getian calendar[29], from Sarmisegetusa: this is a basic archaeological-numerological hipothesis of our (plausible) astronomical model of the hypothetic Dacian-Getian calendar from Sarmisegetusa.

b) The motion of the Moon[30], has (presumably) a basic role and function in the (plausible) Dacian-Getian calendar from Sarmisegetusa: this is the basic astronomical hypothesis of our (plausible) astronomical model of the (hypothetic) Dacian-Getian calendar from Sarmisegetusa[31].

Our approach is a taking over of the lunar hypothesis based both on:

b.1) the proofs meanwhile accumulated;

and

b.2) the critical and correlative analysis of this amount of data.

c) There are many archaeological facts -observed, and stressed, from a parallel study of the old monuments of Stonehenge and those similar of Sarmisegetusa- which, with the force of evidence, suggest an interesting (or, even, a relevant) analogy[32]. This (undeniable) analogy[33] is used as a peremptory basis[34] for our own (plausible) reconstruction of the (hypothetic) Dacian-Getian calendar from Sarmisegetusa.

The elements of the analogy are the following:

c.1) In both cases we come across a certain enclosure: occupying a central place, and having the shape of a horseshoe.

c.2) In both cases there is a great circle made up of $N = 30$ stone elements: pillars at Sarmisegetusa and great vertical blocks at Stonehenge.

c.3) In both cases it may be ascertained the existence of an intermediary circle between the circle of $N = 30$ stone elements and the central horseshoe enclosure.

c.4) In both cases the great circular sanctuary was put in communication with a smaller construction: the small circular sanctuary at Sarmisegetusa and the, so-called, *Heel-stone* at Stonehenge[35].

c.5) In both cases the line joining the centre of the great sanctuary to the centre of the smaller construction has the same (or a similar) meaning -that of a geographical orientation[36].

d) The motion of the Sun has (certainly) a basic role and function in the (plausible) Dacian-Getian calendar from Sarmisegetusa.

d.1) A great success of the solar variant of the (plausible) Dacian-Getian calendar was considered to be the possibility of incorporating the number $N = 34$ in the structure of the respective calendar: because this number is just the number of wooden pillars of which is built up the horseshoe enclosure find in the excavations of Sarmisegetusa.

d.1.1) The Romanian historian Constantin Daicoviciu proceeded to the deciphering of the hypothesized Dacian-Getian calendar in a quite simple way: he conjectured that the Dacian-Getian year had $T = 360$ days;

d.1.2) The number of wooden pillars to be found on the N = 30 stone pillars circle (which is just $N = 180$) labelled a *Dacian semester.*

d.2) A necessary, and valuable, amendment was brought by a French research worker, Georges Charrière, who observed as is mentioned in [DAICOVICIU, 1981, vol. 1. p. 254-255] that

d.2.1) If at every $T = 34$ *Dacian years* we add a *Dacian semester* then the average tropic year has $T = (365 + 5/17)$ days. This result was considered as satisfactory: taking into account the general level of scientific knowledge reached by Dacins-Getians[37].

d.2.2) As the number of wooden pillars making up the intermediary circle (placed between the $N = 30$ stone pillars ring and the horseshoe enclosure) is just $N = 68$, i.e. the number of *Dacian semesters* entering the correction period of $T = 34$ Dacian years, one was claimed to have in hand the explanation for almost the whole numerology of the Great Temple of Sarmisegetusa.

d.2.2.1) $N = 6$ i.e. the number of wooden pillars placed between two consecutive stone pillars of the great circle made up of $N = 30$ stone pillars, is the *Dacian week.*

d.2.2.2.) $N = 30$, i.e. the number of stone pillars making up the great ring of the sanctuary, is the *Dacian month.*

d.2.2.3) $N = 180$, i.e. the number of wooden pillars placed on the great ring, is the *Dacian semester*[38].

d.2.2.4) $N = 34$, i.e. the number of wooden pillars of the horseshoe enclosure, is the number of Dacian-Getian years after which a corrective Dacian-Getian semester is added.

d.2.2.5) $N = 68$, i.e. the number of Dacian semesters entering a correction period of *34* Dacian years.

d.3) An improved version of this scheme was put forward by Dinu Antonescu, who suggested:

d.3.1) To add a corrective month at every $T = 68$ months rather than to wait $T = 34$ years for adding an entire semester. In this way the climatic correspondence of the calendar is restored, but the (famous) horseshoe enclosure is destitute of its presumed outstanding role, in favour of the intermediary circle (made up of $N = 68$ elements).

d.3.2) To make this suggestion operational we would be, naturally, guided to adopt a scheme based on a $T = 17$ years period made up of $T = 3$ long years (of $T = 13$ months i.e. $13 \times 30 = 390$ days) and of $T = 14$ *normal* years (of $T = 12$ months i.e. $12 \times 30 = 360$ days)[39].

d.3.3) The average tropic year is kept at the value foreseen by Daicoviciu-Charrière scheme[40].

d.4) The urano-solar character of the Dacian religion[41], was invoked as an argument for adopting a pure solar version of the presumed Getian-Dacian calendar[42].

But starting from the axiom (basic thesis) that the (presumed) Getian-Dacian calendar was of a pure solar type, the logical thought reached an unsatisfactory conclusion: the numerology of the Great Circular Temple of Sarmisegetusa may be organized in the framework of a scheme, but this scheme presents incomplete connections with the appropriate observational and mythological Getian-Dacian (presumed) astronomy.

d.4.1) The analysis between religion and main employment of the population on a part, and the calendar officially in use on the other part, among some peoples in Antiquity, founders of relevant Mankind's cultures and civilisations[43] -namely the Egyptians, Chaldeans and Assyrians, Jews, Greeks and Romans- reveals real, but not obligatory, connections[44].

d.4.1.1) The Egyptians had a polytheist urano-solar[45] religion, they were tillers, and their calendar in use[46] was based on some astronomical principles[47].

d.4.1.2) The Chaldeans-Assyrians had an urano-solar religion[48], they were tillers, and their calendar in use[49] was based on some astronomical principles[50].

d.4.1.3) The Jews had[51] a monotheist religion[52], they were tillers, shepherds, fishers, and their calendar in use[53] was based on some astronomical principles: they have used a luni-solar calendar[54].

d.4.1.4) The Greeks had an urano-solar religion[55], they were tillers, shepherds, hunters and navigators[56], and their calendar in use[57] was based on some astronomical principles, they have used a luni-solar calendar.

d.4.1.5) The Romans had an urano-solar religion[58], they were tillers and shepherds[59] and their calendar in use was based on some astronomical principles[60], they have used[61] a luni-solar calendar[62].

d.4.2) The observation of the moon was, for all the considered cases[63] in hand[64], hence it was very convenient.

d.4.3) Thus the following question is to be accounted for why the Dacians-Getians were so indifferent as concerns the moon's motion, the more so as they had a goddess of Moon, of Forests and of Magic Practice[65].

Our model of the (plausible) Dacian-Getian calendar from Sarmisegetusa was made respecting, strictly, the following methodological rules[66].

a) It is recommended to take into account all the possible and plausible cultural and economic influences underwent by Dacian area in the ancient times, and not to devise a calendar scheme that would conflict with these influences.

b) It is recommended to favour the organizing of the Temple Numerology which may assign the best astronomical meaning to various pieces of the presumed Calendar-Temple.

c) It is recommended to prefer, among several formal schemes of reconstruction, that offering a maximal amount of astronomical information.

Using, in an appropriate manner, the afore mentioned archaeological, historical, numerological and astronomical data, and respecting the accepted methodological rules, we succeed:

a) to gather various kinds of arguments in view of making more likely the luni-solar scheme of (supposed) Dacian-Getian calendar reconstruction;

b) to outline some methodological principles so that the adoption of a luni-solar scheme should not appear just as a free choice.

2. The (plausible) theoretical model of the (hypothetic) luni-solar Dacian-Getian calendar from Sarmisegetusa

Therefore, we are now in a position to proceed to our own scheme proposed as a (plausible) model of the (presumed) Dacian-Getian calendar from Sarmisegetusa. We begin our analysis by observing that a luni-solar calendar must fulfil four basic functions, namely:

1) counting of days;

2) counting of months;
3) correction to the month;
4) correction to the year.

These basic functions are to be distributed among the $N = 3$ concentric figures: the great circle, the intermediary circle, and the horseshoe. This distribution must be made in an appropriate manner:

a) it is ascertained that:

a.1) the intermediary circle, and the horseshoe are closed curves almost entirely built-up of wooden[67] (oaken) thin pillars;

a.2) the great circle is built-up of a rigorous alternation of stone (large), and wooden (thin) pillars, amounting to 6 small wooden (thin) pillars for each stone (large) pillar.

The special statute of the great circle seems to indicate that it is suitable to take over rather two than a single one of this four mentioned functions of the calendar, namely, that pair of functions able to account for the ratio $N = 6/1$[68]. We shall see later that these functions are the first two of the previous listing.

b) The two curves having corrective role has different forms.

b.1) The intermediary circle exhibits no visible derogation from a perfect geometrical circle.This circumstance suggests[69] that the calendar function of this curve is related to the sun motion, i.e. this curve can be[70] the register of the tropic years.

b.2) The horseshoe enclosure[71] is a heuristic materializing of the moon in one of its phases. The circumstance suggests[72] that the (supposed) calendar function carried out by this curve is connected to the moon motion, i.e. this curve can be the register of lunations.

c) It is essential now to establish what is the luni-solar cycle, based on which an organizing of the Dacian numerology (in compliance with the functional correspondence between calendar and the elements of the Dacian temple -so as it was outlined above- should be possible. In this purpose we shall proceed to the analysis of the $T = 8y$, $T = 11y$ and $T = 19$ years cycles[73].

c.1) The Babylonian cycle of $T = 8$ years is the first remarkable scientific acquisition of the mankind in matters of calendar. It contains $T = 99$ lunar months and $T = 2922$ days, and is based on the algebraic equations:

$$\begin{aligned} 12x + 13y &= 99 \\ x + y &= 8 \end{aligned} \qquad\qquad \begin{aligned} 29\xi + 30\eta &= 2922 \\ \xi + \eta &= 99 \end{aligned}$$

whose solutions are the following ones:

x = 5 the number of short (normal) years, each containing $T = 12$ lunar months;
y = 3 the number of long (abnormal) years, each containing $T = 13$ lunar months;
$\xi = 48$ the number of short months, each containing $T = 29$ days;
$\eta = 51$ the number of long months, each containing $T = 30$ days;

By denoting the long and the normal years by A, respectively a, we come to the following sequence for the repartition of the two kinds of years inside the $T = 8$ years cycle:

a a A a a A a A

c.1.1) The two characteristic data of luni-solar calendar, namely:

c.1.1.1) the average synodic period of the motion of the moon, T_1;

c.1.1.2) the average tropic year T_2,

acquire the values: $T_1 = 29 + 51/99$ days, $T_2 = 365 + 1/4$ *days*[74].

c.1.2) The succession of the months within the year is[75]:

c.1.2.1) All the years begin with a short month, $T = 29$ *d*[76];

c.1.2.2) The short *(l)* and long *(L)* months are succeeded in an alternative way until the correction month, i.e. the $N = 33$ - *rd* one is reached.

c.1.2.3) The correction month is a long month, $L = T_L = 30$ days, instead of a short month $l = T_l = 29$ days.

c.1.2.4) After the correction month, the normal alternating sequence of months is taken over; beginning again with a short month, until the following correction month is reached; and so on.

c.1.3) The years are:

c.1.3.1) The normal years made up of $N = 6$ short months, and $N = 6$ long months, and, accordingly, containing $T = 354$ days;

c.1.3.2) The long years made up of $N = 6$ short months and $N = 7$ long months and accordingly, containing $T = 384$ days[77].

c.1.4) The correction months are: *(3, IX), (6, V), (8, XIII),* where the Arabic numeral indicates the year inside the $T = 8$ years cycle, while the Roman figure indicates the month in the respective year[78].

c.1.5) The relevant conclusion to be drawn for our investigation from the examining of the Babylonian cycle is:

c.1.5.1) The rendering evident of the *magic number* $N = 33$. As this number, although close to the Dacian magic number $N = 34$[79], is, however, different from this last number, we may conclude that the Babylonian cycle was not used (as such) by the Dacians-Getians *astronomers*[80].

c.1.5.2) The Babylonian cycle is not just the cycle we look for, but we may still use it for finding the very *plausible* cycle.

In this purpose we first observe that the duration of the calendar cycle, expressed in lunar months, is a small multiple of the magic number (in the case of the Babylonian cycle: $99 = 3 \times 33$). Likewise, in the case of the Dacian-Getian cycle, the duration of the cycle, expressed in lunar months, must be a small multiple of the number *34*. Based on the Babylonian cycle we may derive the approximative conversion relation $T = 1$ month $= 8/99$ years and, accordingly $T = 34$ months $= (8 \times 34)/99 = 272/99$ years. Now, we readily obtain: $T = 4 \times 34$ months $= 4 \times 272/99 = 1088/99 = (11 - 1/99)$ years. Leaving aside the small fraction $N = 1/99$, which is surely due to some imperfections of the Babylonian cycle, with regard the astronomical real time, we infer for the duration of the Dacian-Getian cycle:

c.2) The (theoretically acceptable) Dacin Cycle is, $T_D = 11$ years[81], for many reasons:

c.2.1) Because the next cycle (that of $T = 19$ years)[82] seems too sophisticated, and, consequently, not suitable to be taken over by Dacians-Getians.

c.2.2) Because the $N = 11$ years cycle is standing[83] as a basis for the Roman calendar prior to the Julian reform[84]. Thus we appreciate that there are sufficient reasons to proceed to the examining of the cycle of $T = 11$ years. This cycle contains $T = 136$ lunar months and $T = 4016$ days. It is based on the algebraic equations:

$$\begin{aligned} 12x + 13y &= 136 \\ x + y &= 11 \end{aligned} \qquad\qquad \begin{aligned} 29\xi + 30\eta &= 4016 \\ \xi + \eta &= 136 \end{aligned}$$

whose solutions are: $x = 7$, $y = 4$, $\xi = 64$, $\eta = 72$.

c.2.3) The average synodic period of the moon is $T = (29 + 9/17)$ days $\approx$ $29 \cdot 53$ days[85].

c.2.4) The average tropical year is $T = (365 + 1/11)$ days[86].

c.2.5) Each cycle begins[87] with a long month ($T = L = 30$ days), and ends with a long month[88].

c.2.6) It is divided into $N = 4$ identical subperiods, each having $T = 34$ months[89].

c.2.7) The correction month is a long month and it is placed at the end of the subperiod[90].

c.2.8) Each subperiod begins with a long month and exhibits a regular alternance of long and short months, except for the last month (the correction one), which is a long instead of a short one[91].

c.2.9) After the spending of $T = 68$ subperiods (each having $T = 34$ lunar months), i.e. after the spending of $T = 17$ *Dacian cycles (each having* T = 11 years, and $T = 136$ lunar months)[92], it is necessary to add a long month ($L = 30$ days) in view of correcting the tropic year.

c.2.10) The value of the tropic year, averaged over a period of $T = 17 \times 11 = 187$ years, amounts to: $T = (4016 \times 17 + 30) / (11 \times 17) = 365 + 1/11 + 30/187 = 365.251$ days = the (theoretical) *Dacian year.*

This value has an astronomical accuracy similar to that of the Julian tropic year, established (in 46 B.C.) by the astronomer Sosigenes.

d) The test whether the explaining of the Dacian-Getian calendar in the framework of the $T = 11$ years cycle is possible will be given by the possibility of accomplishing a global astronomical meaning of the Dacian-

Getian numerology together with a simple, and reliable, operation procedure of the presumed calendar.

We shall see not only that such a fitting is possible, but it is so impressive that it seems quite improbable to be a simple occurrence.

The operation procedure of the (theoretical/pressumed) Dacian-Getian calendar appears now simple, and natural, because the mnemotechnical elements of the Great Circular Sanctuary of Sarmisegetusa are to be organized in a luni-solar scheme in which the moon is directly pursued.

d.1) On the great circle, made up of *30* stone pillars, a certain marker is moved, simulating the moon motion: it is running in the counter-clockwise sense.

d.2) We denote by *0* (zero) the starting (stone/large) pillar. If a lunation would have just the duration of $T = 30$ days we will expect that, starting from *0* at full moon we reach again the point *0* at the next full moon (running one time through the circle). But actually a lunation is lasting about $T = 29\ 1/2$ days, so that at the next full moon the marker will be placed not at the point *0* (zero) but at the middle of the distance between the pillar *0* (zero) and the stone (large) pillar *29*, the labelling being operated still in a counter-clockwise sense. More exactly: the marker will be located between the third and the fourth wooden (thin) pillars. In this way: while the marker ran in the counter-clockwise sense almost a complete rotation, counting the successive days of a lunation (separated by stone/large pillars), the same marker ran in the clockwise sense only $N = 1/2$ of the separation distance between two consecutive stone pillars counting a lunation. At the following full moon, that is after $N = 2$ lunations, the marker will be placed at the stone pillar number $N = 29$; after $N = 4$ lunations it will be placed at the stone pillar number $N = 28$; and so on. Thus by this clever procedure: the same circle has a double[93] role, i.e. every running sense being endowed with a specific astronomical meaning. Correspondingly, the great circle of the Sanctuary acquires a double labelling:

d.2.1) with Arabic numerals for days; associated to a trigonometric sense of running;

d.2.2) with Roman figures for lunar months; associated to a clockwise running.

d.3) A lunar month is divided (by wooden/thin pillars) in $N = 3$ decades, each decade having about $T = 10$ days[94]. When the month had only $T = 29$ days the third decade reduced correspondingly to a $T = 9$ days period.

d.4) The distance between two consecutive stone pillars represents[95] a $T = 24$ hours day, and such a day is divided, by the $N = 6$ wooden/thin pillars placed between the stone/large pillars, in $N = 6$ times[96]. Assuming that the Dacian-Getian day began at $T = 6$ o'clock p.m. time[97] in order to perform satisfactorily the astronomical moon watching, we may establish the following connection between the Dacian-Getian wooden/oaken/thin pillars and the Sumerian parts of a day[98]:

1st pillar	18 h - 22 h	Rising of Stars	Bararitu
2nd pillar	22 h - 2 h	Zenith of Stars	Qabditu
3rd pillar	2 h - 6 h	Twilight of Stars	Sat urri
4th pillar	6 h - 10 h	Sunrise	Napakh Shamshi
5th pillar	10 h - 14 h	Zenith	Musla lu
6th pillar	14 h - 18 h	Sunset	Ereb Shamshi

e) The *magic number* $N = 34$ -incorporated in the structure of the Great Circular Dacian Sanctuary and whose originality was appreciated as undeniable- it was known to many cultures and civilizations using luni-solar calendars. But the meaning assigned to this number is not that of a correction period of the synodic moon motion[99], but rather of a *straightening out* period of a purely lunar calendar, still based on the $T = 11$ years luni-solar cycle.

e.1) To derive this[100] meaning we proceed as follows:

e.1.1) We consider a purely lunar calendar whose year is made up of $T = 12$ lunation.

e.1.2) Resorting to the $T = 11$ years cycle, we find:

e.1.2.1) the duration of the lunar year: $T = 12 \times 4016/136 = (354 + 6/17)$ days.

e.1.2.2) the duration of the tropic year: $T = (365 + 1/11)$ days.

e.1.2.3) we reach the formula: $T =$ one purely lunar year $= (1 - 1/34)$ tropic years, or $T =$ one tropic year -one purely lunar year $= 1/34$ tropic year.

e.1.2.4) The obvious conclusion is that: the New Year of a purely lunar calendar is sliding towards winter as compared to the New Year of a calendar based on the tropic year, considering that we begin the counting of years when the New Year of the two kinds of calendars are coincident. As the backward sliding of the lunar calendar is $T = (10 + 1/11 + 11/17)$ days for the spending of a single lunar year[101], it follows that in 34 lunar years the New

Year of the lunar calendar is defiling through an entire tropic year (i.e. the solar calendar), and, finally, is again coincident with a New Year, namely, with the New Year of the solar year $N = 33$.

e.2) The double role of the number $N = 34$ i.e. that of ensuring the correct value of the moon synodic period[102] and that of realizing a congruence between purely lunar and purely solar years may be an argument, at the level of reasoning of the epoch for Dacians-Getians, and Celts, scientists & initiated priests to assign to this number a kind of magic value and, finally, to immortalize it by casting it in the structure of their temples.

f) After *34* lunations it is necessary (opportune) to add a day, in order to obtain a correct average synodic period of moon, because the very synodic period of moon is a little greater than *29 1/2* days[103].

For keeping in mind the instant of correction, every complete running of the marker on the great circle[104] (i.e. a lunation) is labelled on a pillar of the horseshoe enclosure. As the horseshoe enclosure has just $N = 34$ wood (oaken) thin pillars it results that:

f.1) Moon period must be corrected every time when the horseshoe is full.

f.2) Every filling up of the horseshoe is marked on a pillar of the intermediary circle.

f.3) Because the intermediary circle has just $N = 68$ wooden (oaken) thin pillars when the circle is *full*[105] a long period of $T = 68 \times 34$ lunar months = *17* luni-solar cycles = *187* = tropic years is elapsed, and the pontifices of the Temple became aware of necessity of correcting the tropic year (by adding a lunation, as we already showed).

g) The astronomic meaning of the number $N = 30$ is (perhaps) to a smaller extent connected to the number of days in a month, but rather to the number of correction pillars on the great circle: this number is, indeed $N = 30$, i.e. the number of all stone (large) pillars in the following order[106]:

13, 26, 9, 22, 5, 18, 1, 14, 27, 10, 23, 6, 19, 2, 15,
28, 11, 24, 7, 20, 3, 16, 29, 12, 25, 8, 21, 4, 17, 0.

h) The distribution of the long and normal years in a $T = 11$ years cycle can be (plausibly) determined. This time we cannot determine the distribution of the different kind of years having in view (directly) the elements of the Dacian-Getian round temple. But we can (plausibly) fill this lacuna by the appeal to the historical tradition in matters of calendar, and by taking for granted that legends about the scientific knowledge of some Dacians-Getians men of culture[107] are not altogether inventions.

The existence of the (presumed)[108] Dacian-Getian calendar is a plausible argument[109] that, indeed, Dacians-Getians benefited of the astronomical experience of the Near East[110].

h.1) We observe that the Jewish sequence[111] giving the distribution of long and normal years in a $T = 19$ years[112] cycle, namely:

a a A a a A a A a a A a a A a a A a A

may be decomposed in two shorter sequences, namely:

a a A a a A a A + a a A a a A a a A a A

h.2) As the $T = 19$ years cycle[113] is based on a period containing $T = 235$ lunations and $T = 6939$ days, the $T = 11$ years cycle, obtained by decomposing the Jewish sequence, may be identified with the *Dacian cycle.* Indeed: $99 + 136 = 235$; $2922 + 4016 = 6938$. The missing day being explained by the fact that shorter cycles are more imperfect as compared to longer ones.

h.3) We may, therefore, reasonably, assume that the long years (A), and normal years (a) in the Dacian cycle of $T = 11$ years were distributed according to the sequence:

a a A a a A a a A a A

h.4) The Dacian sequence differs from the Babylonian one by an initial primitive sequence (a a A), and satisfies, at the same time, the remarkable formula:

Babilonian sequence + Dacian sequence = Jewish sequence

i) A mnemotechnic procedure to mark the *11* years cycle can be found. As such, the spending of a cycle containing $T = 11$ *years* $= 136$ lunations, or $T = 4$ periods of *34* months, will be indicated by drawing on the great circle of a trapezium. The first such a geometrical figure inscribed on the great circle has the corners at the points A *(13, XXXIV)*, B *(26, VIII)*, C *(9, XLII)*, D *(22, XVI)*. It is an isosceles trapezium whose symmetry axis may be taken to be perpendicular on the line joining the centres of the two round sanctuaries: the great and the small one. When this circumstance is ensured then the starting pillar used for reckoning days and months is placed in the Northern direction, as reported to the centre of the Sanctuary[114].

In this way a complete operational scheme of the (presumed) Dacian calendar, i.e. based on the Dacian-Getian numerology *(6, 30, 34, 68)*[115], was devised, putting into evidence $N = 3$ registers of time reckoning, registers corresponding to the $N = 3$ principal pieces of the (presumed) Dacian-Getian calendar temple from Sarmisegetusa: i.e. 1) the great circle, 2) the intermediary circle, 3) the horseshoe.

This proposed theoretical model -i.e. archaeological-historical-astronomical model- can give, in our opinion, a satisfactory answer to almost all the calendar problems that may be raised in connection with the (presumed) Temple calendar of Sarmisegetusa[116].

Some constructive elements of the Temple[117], are still outside the calendar scheme put forward by us. In this situation are:

1. the exterior circle of the Great Round Temple[118];
2. the little round temple[119];
3. the *Sun of andezite*[120].

The exterior circle made up of $N = 104$ andesite blocks, is pressed to the exterior side of the great circle made up of $N = 30$ stone pillars and the constituent blocks are glued together resembling to the bricks of a wall. The aspect and the position of the exterior stone circle, as well as the fact that $N = 104$ is a number without an astronomical meaning[121], entail us to believe that the function of the respective circle is not astronomical, but rather a constructive one: this circle being intented to be a simple protection wall.

The small circular sanctuary[122] equally has (probably) no calendar function, its role -similar to the role of the heel-stone from Stonehenge- being connected to the defining of the Northern direction.

We appreciate that our scheme of Dacian-Getian calendar reconstruction has many chances to be confirmed by further archaeological investigations, being, at the same time, a contribution to the knowledge of the ancient inhabitants on the Carpathian-Danubian-Pontic territory.

3. Some subsidiary comments

1. The first reference concerning a possible astronomical role of the Great Circular sanctuary of Sarmisegetusa seems to come from D.M. Teodorescu, who made excavations during the year 1930. He assumed, in a time when not all the pieces of the Sanctuary were discovered, a relation between the *30*-stone pillar circle and the moon motion.

2. Constantin Daicoviciu and his archaeological team, working during the years T = 1950-1958, succeeded to find out the pieces of the Great and Small Circular Temples, and to give a complete and detailed description of these monuments[123].

3. In T = 1960 Constantin Daicoviciu[124] put forward definitely the hypothesis about the role of the Great Sanctuary as a system of time-reckoning, and introduced the denomination *The Calendar-Temple of Dacians.* At the same time he suggested a solar-type calendar of *360* days.

4. In T = 1963 G. Charrière introduced the *corrective semester, T = 180* days, at every period of *T = 34 Dacian years* (each year containning *T = 360* days, i.e. *T = 12* months of *30* days).

5. In T = 1966 K&G Horedt put forward some strange hypotheses:

5.1. The calendar is based on *T = 10* months, each of *T = 36* days (the number of months being marked by the *N = 10* circular sectors of the so called *Andesite Sun*)[125].

5.2. The division of the year was operated in two sessions:

5.2.1. A summer one, of *T = 222* days, and

5.2.2. A winter one, of *T = 138* days (motivated by the unequal sharing of the number of pillars of the horseshoe enclosure by the line joining the two sanctuaries).

6. In T = 1966, A. Popa made two interesting proposals:

6.1. The Dacian year began at the winter solstice[126];

6.2. The *30*-stone pillar circle of the Great Sanctuary represents a *Dacian month,* containing *T = 30* days, while the *N = 6* wooden/thin pillars between two consecutive stone pillars, represent the divisions of a *T = 24* hour day[127].

7. In T = 1980 a research team of Brasov University composed by S. Bobancu, E. Poenaru and C. Samoila, devised a quite original and strange reconstruction of the (presumed) Dacian-Getian calendar, based on the idea that both Small and Great Circular Sanctuary from Sarmisegetusa have a calendar function[128]. They conclude that:

7.1. Dacians-Getians had two calendars:

7.1.1. One of $T = 365$ days (based on the Small Sanctuary);

7.1.2. Another of $T = 360$ days (based on the Great Sanctuary).

7.2. The correction system of these connected calendars are also indicated in this *archaeological* and *numerological* model.

7.3. The Rectangular Sanctuaries have also a calendar function.

The authors of this model of the hypothetical Dacian-Getian calendar use the archaeological facts, but their model is purely numerological and not at all astronomical.

8. In T = 1983, on the occasion of the Scientific Symposium, devoted to the 75^{th} anniversary of the Astronomical Observatory from Bucharest, a first version of our scheme, concerning the supposed Dacian-Getian luni-solar calendar was communicated[129].

9. In T = 1984, Ioan Rodean published his book *The enigmas of the Sarmisegetusa stones* in which some archaeological and cultural arguments are gathered to support the idea that the Small Circular Sanctuary would be a kind of: *coded library of biorhythmology*. At the same time, the author insists upon the constructive analogy between the Great Circular Sanctuary of Sarmisegetusa and the Stonehenge monument[130], without inferring an astronomical conclusion. Other interesting idea, namely the correlation between the length of pillar shadows at noon and the solstice lines is, unfortunately, based on incorrect hypothesis that the equinoctium sunrise line is rotated by the precession of the equinoctia. In spite of many cultural acquisitions, mainly referring to geometrical symmetries, the reader comes across many unreasonable assertions as well[131].

10. In the T = 1984, on the occasion of the Annual Meeting of the Central Institute of Physics in Sibiu, the late prof. Victor Mercea from Cluj-Napoca[132] related the success of a magnetometery team managed by himself

who put in evidence the existence of a new circle (made up of holes) exterior to the Great Circular Sanctuary[133].

11. The astronomical directions of the place were studied by prof. Gh. Chis from University Babes-Bólyai of Cluj-Napoca.

12. At the end of T = October 1984 an interdisciplinary team (made up of archaeologists, topometers, architects, engineers, a.s.o) pertaining to the Association of Scientists executed measurements at Sarmisegetusa in view of confirming what they called *The numerical system of Geto-Dacians* devised by Timotei Ursu and Florin Stanescu[134].

13. The calculation of the charasteristics of the astronomical observations at Sarmisegetusa Regia has been made by using the following angles, relations and data:

13.1. The angle of maximal ascension of the sun at the equinox: $\Psi_{e.n}$.

13.2. Idem at the summer solstice, respectively at the winter one: $\Psi_{s.s}$, $\Psi_{w.s}$.

13.3. The geographic latitude: α.

13.4. The angle of the inclination of the axis of the geographic poles on the ecliptic: δ.

13.5. For Sarmisegetusa we have: N = $\alpha \approx 45°37'$, N = $\delta \approx 23°0'$, with the correction of the oblicity:

$$N = \hat{\Psi}_{e.n} = \frac{\pi}{2} - \alpha \approx 44°23'$$

$$N = \hat{\Psi}_{s.s} = \frac{\pi}{2} - \alpha + \delta \approx 67°23'$$

$$N = \hat{\Psi}_{w.s} = \frac{\pi}{2} - \alpha - \delta \approx 21°23'$$

13.6. Because Sarmisegetusa is located in an area with mountains with an important horizon height, the directions of the sunrise in different days of the year are sensibly modified with regard to the homologous directions calculated at the sea level. Let be: χ the angular height of the horizon, and, accordingly: χ_1 the angular height of the horizon in the point where the sun rises at the summer solstice, χ_2 the angular height of the horizon in the point where the sun rises at winter solstice.

13.7. The angles between the direction East at the equinox (at sea level) and the directions of the sunrise at the equinox (at sea level) at the summer and winter solstices are:

$$\hat{\omega}_{e.n} = 0, \qquad \hat{\omega}_{s.s} = \delta, \qquad \hat{\omega}_{w.s} = -\delta$$

Due to the height of the horizon (determined by the relief) at Sarmisegetusa the homologous angles are:

$$\hat{\omega}^{S}_{e.n} = \frac{\chi_0}{\operatorname{tg}\left(\frac{\pi}{2} - \alpha\right)} = -\chi_0 \operatorname{tg} \hat{\alpha}$$

$$\hat{\omega}^{S}_{s.s} = \delta - \frac{\chi_1}{\operatorname{tg}\left(\frac{\pi}{2} - \alpha + \delta\right)} = \delta - \chi_1 \operatorname{tg}(\alpha - \delta)$$

$$\hat{\omega}^{S}_{w.s} = -\delta - \frac{\chi_2}{\operatorname{tg}\left(\frac{\pi}{2} - \alpha - \delta\right)} = -\delta - \chi_2 \operatorname{tg}(\alpha + \delta)$$

In acordance with the topometrical measures we have:

$$N = \chi_1 \approx 7°12', \; N = \chi_2 \approx 6°7', \quad N = \chi_0 \approx 7°44',$$

$$N = \hat{\omega}^{S}_{e.n} \approx 7°44' \cdot \operatorname{tg}(45°37') = -7°54'$$

$$N = \hat{\omega}^{S}_{s.s} \approx 23°0' - 7°12' \cdot \operatorname{tg}(22°37') = 23°0' - 3°0' = 20°0'$$

$$N = \hat{\omega}^{S}_{w.s} \approx -23°0' - 6°7' \cdot \operatorname{tg}(68°37') = -23°0' - 15°37' \approx -38°37'$$

13.8 The angle between the north direction and the direction of the sunrise at the winter solstice is:

$$N = \xi = 90° + 38°37' = 128°37' \approx 129°$$

The exactitude of this value is acceptable:

a) In [GLODARIU, IAROSLAVSKI, RUSU, 1989 p. 115, fig. 16] one can found the plan of the great round sanctuary of Sarmisegetusa. Measuring the angle between the north direction and the axis of the stone slabs in the respective figure is obtained $\xi \approx 129°$.

b) In the same book it is given a very plausible argument to support the idea that at Sarmisegetusa there was a centre of astronomical studies: namely it is advanced the idea that *the Sun of andesite* could have functioned as a gnomon, in the sense described in the IXth book *On time measuring* by architect Vitruvius.

c) The determination of the angle between the north direction and the axis of symmetry of the Sanctuary is in qualitative accordance with the measuring made by I. Carnaru and I. Ghica (1986): they obtained $\xi \approx 123°$.

d) It is also to be mentioned that we have made corrections taking into account the fact that the inclination of the geographical poles axis in the antiquity was (presumably) a little different in comparison with that of today (due to the variation of the ecliptic obliqueness).

e) It is to be mentioned the fact that in winter, when the woods surrounding the sanctuary became transparent, the height of the horizon produce a little decreasing of the value of the angle N = 129°.

f) The coincidence between our calculations and measurements can be made with a more satisfactory precision having in view, in connection to the season variation $\delta \chi_i$ of the height of horizon (i.e. $\delta \chi_i$; i = s, w), also:

f.1) The secular variation of the inclination of the polar axis (δP_a) due to the oscillations of the ecliptic plane with a period of $T \approx 4 \times 10^4$ years;

f.2) Some possible shifts of the Earth;

f.3) Some imprecisions in the determination of the centre of the sanctuary and that of the geographic direction of the North.

f.4) The corrections due to the obliqueness of the ecliptic produce the decrease with N = 1° in T = 4000 years of the angle N = 23°27'[135]. For a period of $T \approx 2000$ years we have to consider a correction of $\approx 27'$.

f.5) Due to the precession of the axis regarding the normal against the ecliptic plane with a period of $T \approx 26000$ years, it is not necessary to do any correction because the combined effect of this precess and that of the motion of the Earth on the ecliptic reduces only to a millennial shifting of the vernal equinox from a constellation to another.

f.6) It is true that the North celestial pole, which at present is in Polaris (i.e. α Ursa Minor) was T = 2000 years ago in Dragon, but once the direction of the North is well established at a given epoch on the basis of the respective position of the celestial North pole (i.e. the star, whose circle of declination has a null radius) then this North direction remains unchanged for any coming epoch, and -together with that- the sunset directions of the sun at the solstices.

f.7) Unfortunately, the line on the ground which really must be identified with the *Dacian-Getian* Northern direction is unknown. Nevertheless, with a certain plausibility, this line seems to be the line starting from the centre of the Andezite Sun and passing through the axis of one of the little rectangular temples[136]. We can give an error of $\varepsilon \approx 2°$ in the determination of the direction of the North by the Dacians.

f.8) The shifting of the geological deposited layers must be determined on the basis of special geographical studies to establish if they really occur.

f.9) It cannot be excluded also an increase in T = 2000 years of the heights of the horizon (in the direction of the astronomical interest) due to the dust deposits produced by the strong winds.

14. The attempt to find parallel cultural lines to Dacian-Getian and Maya civilisations seems unlikely, for many reasons:

14.1. Because the Sarmisegetusa monument is much older than the Copan Observatory in Honduras;

14.2. Because no possibility existed for a cultural intercourse between the two cultures and civilisations:

14.3. Because the two cultures and civilisations developed on quite different lines, determined by quite different historical circumstances. Some eventually numerological astronomical coincidences must be judged as such, as pure coincidences.

15. In spite of this clear situation, we may identify easily the tendency of a certain *Maya influence*.

15.1. The S. Bobancu, E. Poenaru, C. Samoilă team speacks about two Dacian calendars: the religious and the civil one.

15.2. Allusive references to Maya culture are still to be found to Ioan Rodean.

However we have not to overlook the presumptive character of the Maya calendars actually they being nothing but a reconstruction due to the archaeologist Eric Thomson[137]. The Maya calendar (based on a T = 260 days year) is specific for the observatories placed in the proximity of the tropic. The correspondence between the two Maya calendars is : T = 52 years of T = 365 days = 73 years of 260 days; i.e. the so called *Maya period.*

We find no reason to identify a Maya period T = 52 = 104/2, N = 104 being the number of stones in the exterior wall of the great circular sanctuary -to Dacians-Getians who were living far from the tropic.

16. Another idea (also put in circulation by Ioan Rodean) used for a corresponding reconstruction of the Sarmisegetusa sanctuaries, is that the middle circle of the great round sanctuary has not 68 wooden/thin pillars but 84!

Although this assumption is not yet a certitude, we must examine also the consequences following from it: if we assume a certain, i.e. not exactly known, number of pillars in the respective circle we obtain the following table for the values of the correction period and the average tropic year:

No. of pillars	64	68	72	76	80	84
No. of years in a period	176	187	198	209	220	231
Average tropic year (days)	365+ 0.261	365+ 0.251	365+ 0.242	365+ 0.234	365+ 0.227	365+ 0.221

16.1. We ascertain that, unlike other schemes, our reconstruction of the Dacian-Getian calendar does not contain the number N = 68 as a critical one.

16.2. The precision of the average tropic year is good enough for any value of the number of wooden pillars lying in the range $64 \leq N \leq 84$.

16.3. To notice however that an exceptional accuracy is obtained for N = 72. In this case the *Dacian average tropic year* would differ from the astronomical value only by T = 2 x 10^4 days over a period of T = 2 x 10^2 years, i.e. an error of T ≈ 1.0 x 10^6 days/year.

17. An open question is the New Year of the hypothetical Dacian-Getian calendar. The remark made by A. Popa that *Dacian Year* began at the winter solstice is based on the ascertainment that the axis of the Dacian-Getian horseshoe enclosure makes an angle of about N ≈ 25° with the West-East line. However the orientation of the horseshoe does not necessarily imply the mentioned conclusion about the New Year, for the very reason that the respective angle of N ≈ 25° not only reveals the sunrise direction at the winter solstice, but, equally, the sunset direction at the summer solstice.

As far as a luni-solar scheme of the calendar is accepted it is quite plausible to assume that the *Dacian New Year* was celebrated in the evening before the summer solstice at T = 18h (l.m.t). But this was possible a single time in an T = 11 year-cycle, namely at the beginning of the cycle. For other years of the cycle the New Year had an oscillation in the proximity of the summer solstice (not exceeding about T = 14 days).

18. Perhaps the most serious objection against the interpretation of the Great Circular Sanctuary as a calendar is the fact that the Sarmisegetusa sanctuary, unlike Stonehenge Sanctuary, does not benefit of a free horizon necessary for observing the sunrise at different seasons of the year.

But if Dacians-Getians were able to observe the sunrise instant at sea level they were able to determine the Northern direction and the equinoctial day by pursuing the length and the direction of the shadow of a certain reference pillar.

The steps of this procedure are the following:

18.1. They would observe that from the sunrise till to sunset the direction and length of the shadow is continuously changing;

18.2. The shortest shadow of the pillar is recorded at the noon (when the ascension of the sun on the sky is maximal);

18.3. The direction of the shortest shadow does not change when is going from winter to summer (the Northern direction);

18.4. At a certain day of the year the shortest length of the shadow is just equal to the length of the pillar: this happens two times in a year, and every time the sunrise direction is perpendicular on the Northem direction. As the Sarmisegetusa Sanctuary is at latitude of about N = α = 45° N, the two days correspond to the two equinoxes;

18.5. The Dacians-Getians astronomers could observe the quality of the light-time and the dark-time at an equinoctial day.

19. It is possible that also the Small Circular Sanctuary should be, somewhat, connected to the four seasons of a year. If we start from the Northern direction of the sanctuary and run in a trigonometric sense on the circle, we come across the following groups of pillars (separated by a pillar of different type): 7 groupings of 8 pillars each, 1 grouping of 7 pillars, 3 groupings of 8 pillars each, 1 grouping of 6 pillars, 1 grouping of 8 pillars. Now, if we count in the trigonometric direction the first N = 12 groupings we obtain 93 wooden (thin) pillars. The following N = 11 groupings give then N = 87 wooden (thin) pillars. In the clockwise direction the counting gives N = 93 pillars and still N = 93 pillars (for two times 12 groupings). Finally, we obtain the following comparative table[138]:

A. TRIGONOMETRIC SENSE	
1) first 12 groupings	93 pillars 23 Sept. - 22 Dec. (91 d)
2) following 12 groupings	87 pillars 23 Dec. - 22 March (89 d)
B. CLOCKWISE SENSE	
1) first 12 groupings	93 pillars 21 March - 21 June (93 d)
2) following 12 groupings	93 pillars 22 June - 22 Sept. (93 d)
TOTAL	366 pillars, 366 d

The beginning of the counting with the Northern stone of the Sanctuary at 23 September (i.e. an equinoctial day), may be correlated to the Northern direction of the shadow at the noon (when the shadow length and the pillar length are equal).

20. The horizon height at Sarmisegetusa is a difficult question which may be invoked as an argument against the astronomical destination of the round temples.

20.1. According to the topometric measurements, the angular height versus the angle between a line joining a reference point to the observer and the West-East line is given by the table:

φ	x	φ	x	φ	x	φ	x
E0°	7°44′	N90°	14°25′	W180°	11°42′	S270°	6°55′
10°	7°44′	100°	17°27′	190°	10°31′	280°	5°18′
20°	7°19′	110°	15°34′	200°	11°18′	290°	4°54′
30°	6°55′	120°	15°57′	210°	10°31′	300°	3°15′
40°	10°07′	130°	17°27′	220°	8°56′	310°	3°16′
50°	10°55′	140°	15°34′	230°	8°56′	320°	4°30′
60°	11°42′	150°	15°57′	240°	5°18′	330°	6°07′
70°	12°53′	160°	15°57′	250°	4°54′	340°	6°07′
80°	14°02′	170°	14°02′	260°	4°54′	350°	6°55′
						E360°	7°14′

20.2. As the angle between the equator and the ecliptic is N = δ = 23°26′54.2″, while the latitude of Sarmisegetusa is N = α = 45°45′16″, we obtain the following situation of the declination angles, referring to the sunrise line at solstices and equinoxes:

	δ at x = 0	δ at x ≠ 0
summer solstice	N = δ = 20°20′54.2″	N = δ = 20°26′48.2″
equinox	N = δ = 0°	N = δ = -7°53′23.0″
winter solstice	N = δ = -23°26′54.2″	N = δ = -38°25′59.2″

20.3. These dates are still to be corrected because the Northern direction used in the topometric works was determined by the magnetic needles. The magnetic declination, is about N = 1°E, with a tendency of increasing the eastern displacement. At the data of topometric measurements (17 April 1982) it is likely to assume a magnetic declination of about N = 1°30′E[139].

21. Concerning the origins and the possible *masters in astronomy* of the old Dacians we will note here two mentions dating from the end of the 19th century:

21.1. *Zamolxis avait beaucoup voyagé et de trés bonne heure. Il avait visité tour à tour les terres classiques de l'Orient, avait séjourné en Egypte, chez les Juifs, en Chaldée, s'instruisant aprés des sages de ces contrées, interrogeant leurs devins et leurs prêtres, se faisant initier aux mystères qu'il devait introduire plus tard ches les Gètes* [H. Ubicini][140].

21.2. *L'origine des Daco-Gètes a été controversée. On s'est efforcé de faire d'eux, tour à tour, des Germains de souche gothique (Jordanes, Jacob Grimm, Carlo Troja, Ozanem, etc.), des Celtes (Pezron, Wachter, Pelloutier, Fr. Müller, Maiorescu, etc.), des Slaves (Bielowski, Zachariev, Vercovitch et la plupart des écrivans russes et polonais). Aucun de ces systèmes ne résiste à un examen sérieux. L'opinion intermédiare de M.M. Henri Martin et Jean Bratiano, B.P. Hasdeu, qui voient dans les Daces de demi-Celtes (Gallo-Gètes) sortis du mélange des indigènes avec les peuplades gauloises environnantes, paraît plus vraisemblable* [J.H.A. Ubicini][141]. To notice that the striking similarities of the symmetry elements of astronomical meaning at Stonehenge and Sarmisegetusa sanctuaries do agree with the Gallo-Getic hypothesis about the origin of Dacians[142].

22. For the shadow diagram, we have used the formula:

$$\frac{x}{l} = \frac{1}{\sin\psi} \sqrt{(\cos\psi)^2 + (tg\varphi)^{-2}}$$

where: φ -the angle of the hour (in the apparent plane of the trajectory of the Sun); ψ -the angle of the season (the inclination of the apparent plane of the solar trajectory).

22.1. For the relevant data we have:

21 June; lat = 45° N	22 December; lat = 45°N
$\psi = 45° + 23° = 68°$	$\psi = 45° - 23° = 22°$
$\frac{x}{l} = 1.0785347 \sqrt{0.1403301 + (tg\varphi)^2}$	$\frac{x}{l} = 2.6694671 \sqrt{0.8596699 + (tg\varphi)^{-2}}$

22.2. For different angles:

$\varphi = 15$	$x/l = 4.04537$	$\varphi = 15$	$x/l = 10.26544$
$\varphi = 20$	$x/l = 2.99067$	$\varphi = 20$	$x/l = 7.74067$
$\varphi = 30$	$x/l = 1.91127$	$\varphi = 30$	$x/l = 5.24447$
$\varphi = 45$	$x/l = 1.15173$	$\varphi = 45$	$x/l = 3.64034$
$\varphi = 60$	$x/l = 0.74228$	$\varphi = 60$	$x/l = 2.91572$
$\varphi = 80$	$x/l = 0.44655$	$\varphi = 80$	$x/l = 2.51945$
$\varphi = 90$	$x/l = 0.40403$	$\varphi = 90$	$x/l = 2.47509$
$\varphi = 100$	$x/l = 0.44655$	$\varphi = 100$	$x/l = 2.51945$
$\varphi = 120$	$x/l = 0.74228$	$\varphi = 120$	$x/l = 2.91572$
$\varphi = 135$	$x/l = 1.15173$	$\varphi = 135$	$x/l = 3.64034$
$\varphi = 150$	$x/l = 1.91127$	$\varphi = 150$	$x/l = 5.24447$
$\varphi = 160$	$x/l = 2.99067$	$\varphi = 160$	$x/l = 7.74067$
$\varphi = 165$	$x/l = 4.04537$	$\varphi = 165$	$x/l = 10.26544$

23. The topic *the old Dacian-Getian monuments of Sarmisegetusa Regia* has generated many controversial answers and interpretations. Of relevant interest are those referring to the aspects less known, or even enigmatical and, a fortiori, those referring to the cases of open problems: mainly the discussions with regard the covered with roofs/uncovered form of the temples[143].

Some authors put forward the following versions[144]: of the archaeological initial form of the round and rectangles sanctuaries from Sarmisegetusa all the temples were completely (sic!) covered, in such a manner that no one element (i.e. neither the wooden/thin pillars nor the stone/wide and flat ones) were visible. On the contrary, they all were engraved: because it is assumed that they have been used exclusively for maintaining the stability of the buildings.

But even in this case some relevant astronomical-geographical directions could be, appropriately marked[145] if the practical, or the conceptual necessity should impose this request.

24. In the frame of the problem of the connection between the archaeological Dacian monuments and the astronomical knowledge attributed to some clever Dacian-Getian priests, some authors make mention of a possible, even plausible, use of the gnomon in that cultural area.

But they do not mention, as direct or indirect proof:

a) any effective astronomic result;
b) the existence, or the non-existence of a Dacian-Getian calendar;
c) the original -or the imitation- type of this very necessary social, economical, religious, scientific tool.

We are deeply indebted to anyone which can give their constructive critical observations or suggestions, so that to improve these plausible astronomical considerations.

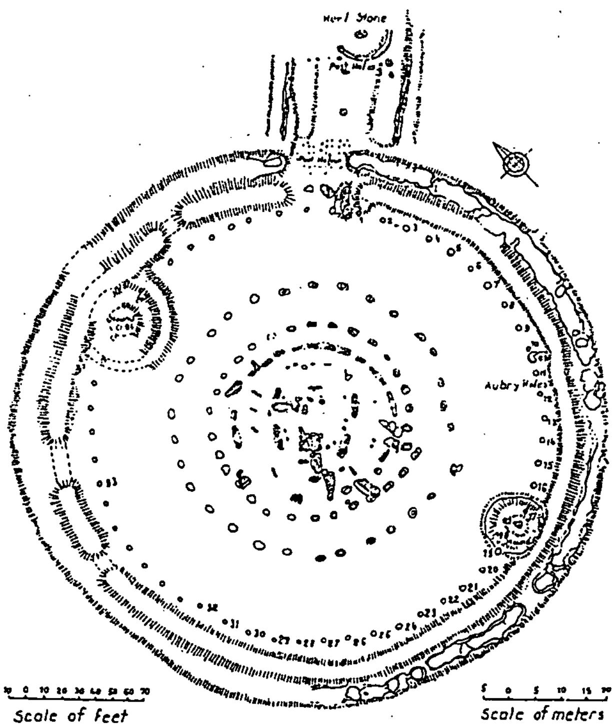

Figure 1. *Plan of the archaeological situs at Stonehenge.*

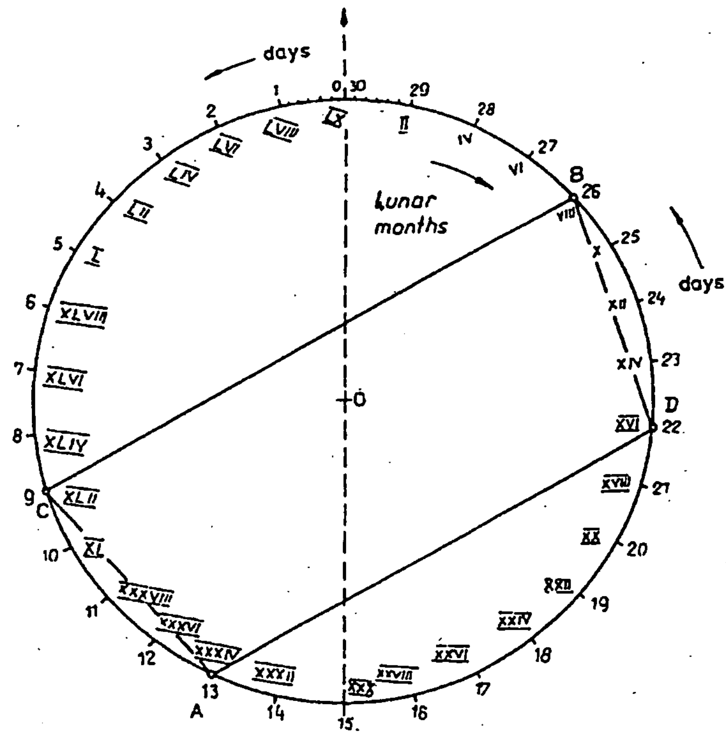

Figure 2. *Diagram for visualizing the hypotethical Dacian-Getian Calendar of Sarmisegetusa Regia functioning according to our reconstruction scheme.*

M: An appropriate marker moved by men.

The marker *M* moved by men in orthograde sense ensures the measurement of days; each day is divided in $N = 6$ time fractions.

The marker *M* moved by men in anti-orthograde sense (watch sense) ensures the measurement of months; each month is divided in three decades (fractions).

The lunation is: $T = 29\ 1/2\ d$; with a correction at the $T = 34$ lunatios. The positions *A, B, C, D* indicate the months when is necessary to make the correction. The first month has $T = 29\ d$.

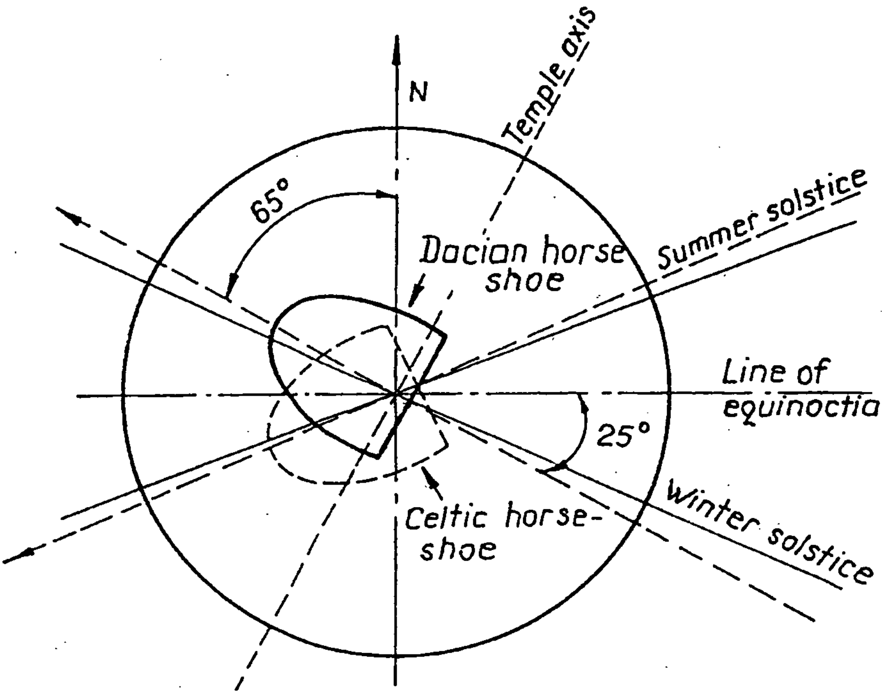

Figure 3. *Horseshoe orientation and sunrise lines at different seasons in both Sarmisegetusa and Stonehenge Temples* (all the topographic details concerning Sarmisegetusa were obtained by the courtesy of dr. ing. Kiss Arpad, from the Topography Department of the University Transylvania from Brasov.

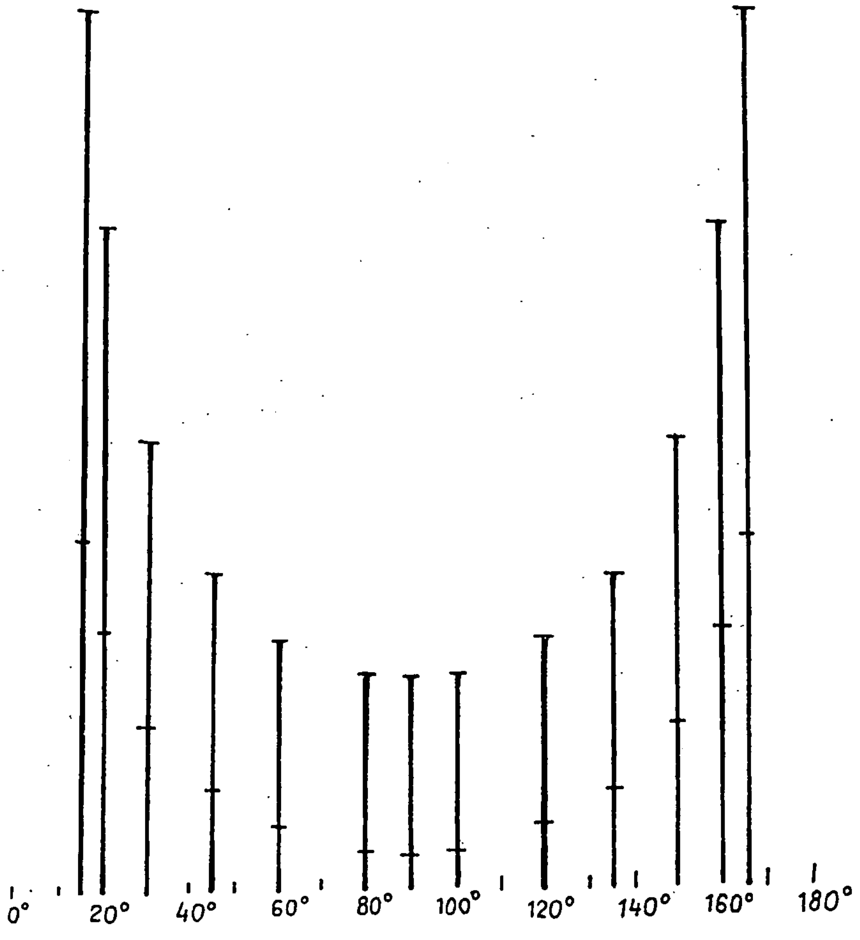

Figure 4. *Shadow diagram at Sarmisegetusa.*

The longer lines represent the dimensions of the shadows at the winter solstice, the shorter ones are at the summer solstice; at the noon, the shadows are $N = 0.404$ times the pillar lenght. To notice the resemblance between the shadow diagram and the mysterious horseshoe enclosure.

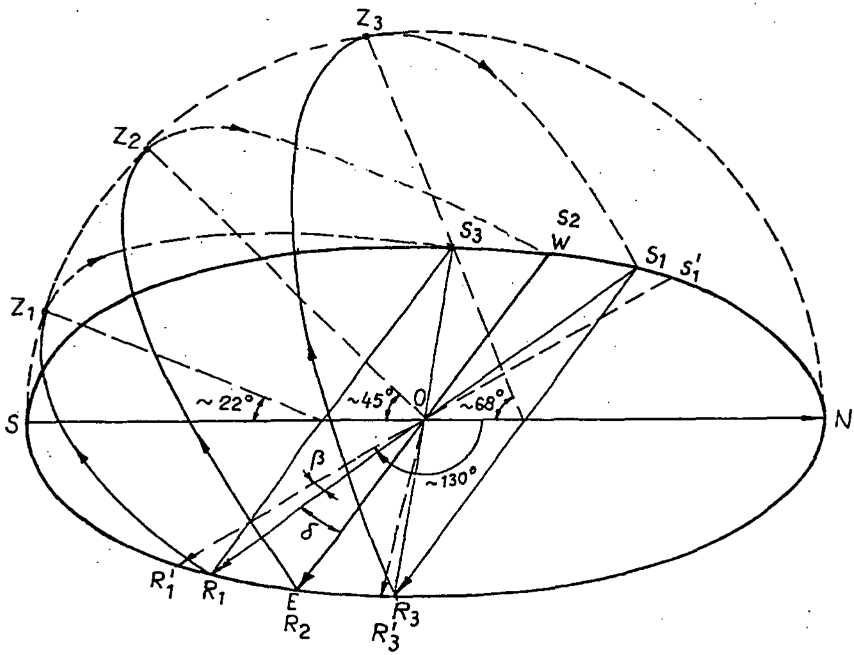

Figure 5. *The apparent motion of the Sun at 45° northern latitude.*

(Z_1, Z_2, Z_3) stand for the zenith position of the Sun at winter solstice, vernal equinox and summer solstice. (R_1, R_2, R_3) stand for the sunrise at the same astronomical days, for a zero height of the horizon. (S_1, S_2, S_3) are the sunset positions for the three dates of the year. (R'_1, R'_3) are the sunrise modified positios due to the horizon height at Sarmisegetusa. $S'_1R'_1$ line coincides with the Round Temple axis going through the horseshoe enclosure. *O* is the observer placed at the centre of the Temple.

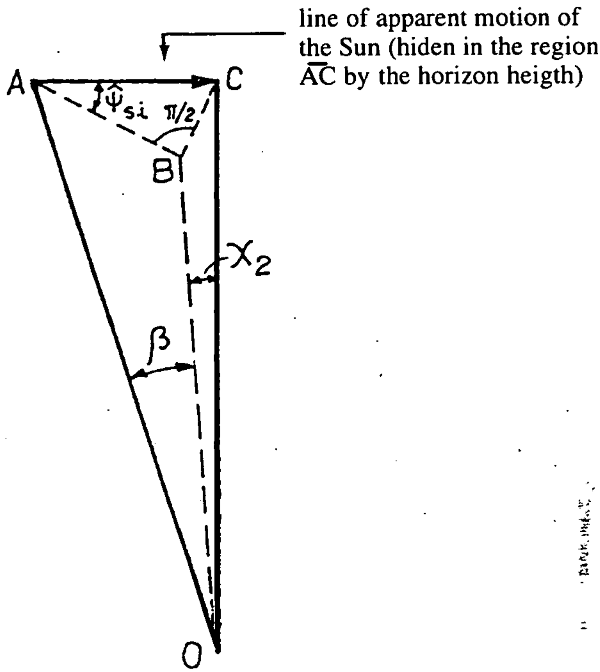

Figure 6

The horizon correction:

$$\overline{OA} \approx \overline{OB} \approx \overline{OC} \approx R$$

$$\hat{\beta} = \frac{\overline{AB}}{R}, \quad \hat{\kappa}_2 = \frac{\overline{BC}}{R}$$

$$tg\ \psi_{s.l} = \frac{\overline{BC}}{\overline{AB}} = \frac{\kappa_2}{\beta} \Rightarrow \hat{\beta} = \frac{\kappa_2}{tg\ \psi_{s.l}}$$

β is the exceeding angle to be added to δ in view of accounting for the horizon height.

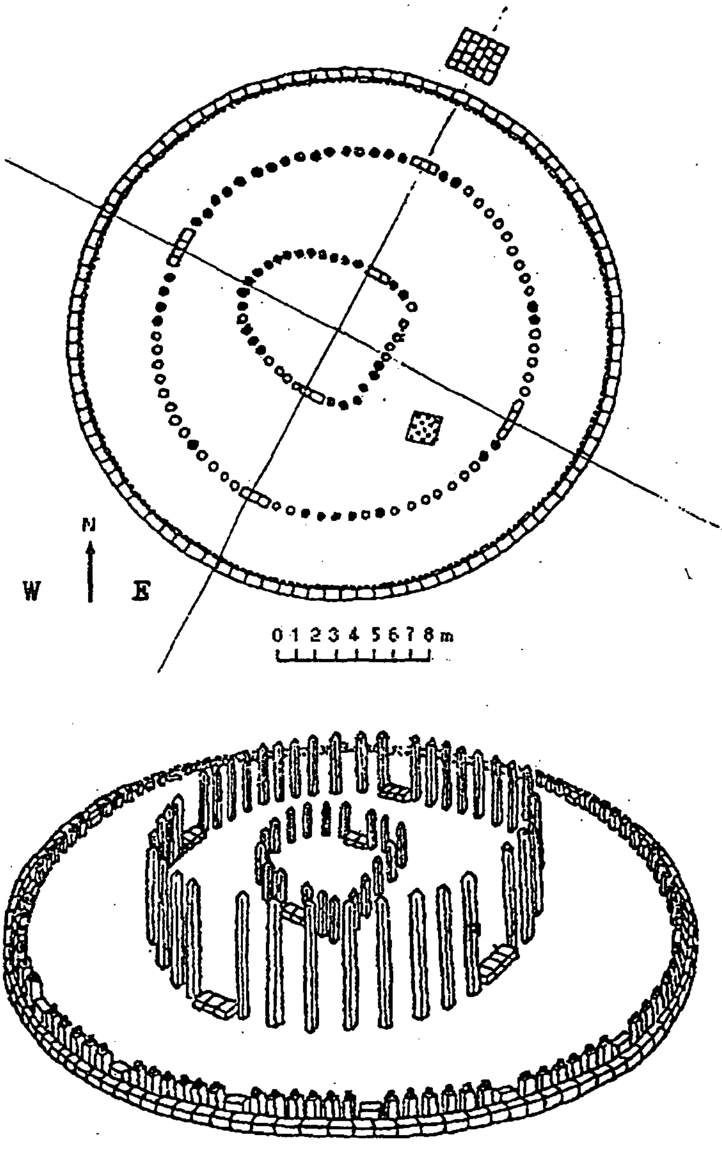

Figure 7. *The Calendar sanctuary of Sarmisegetusa. Plan and essay of reconstruction.* /without the respect of numerical data/Apud H. Daicoviciu/op. cit.

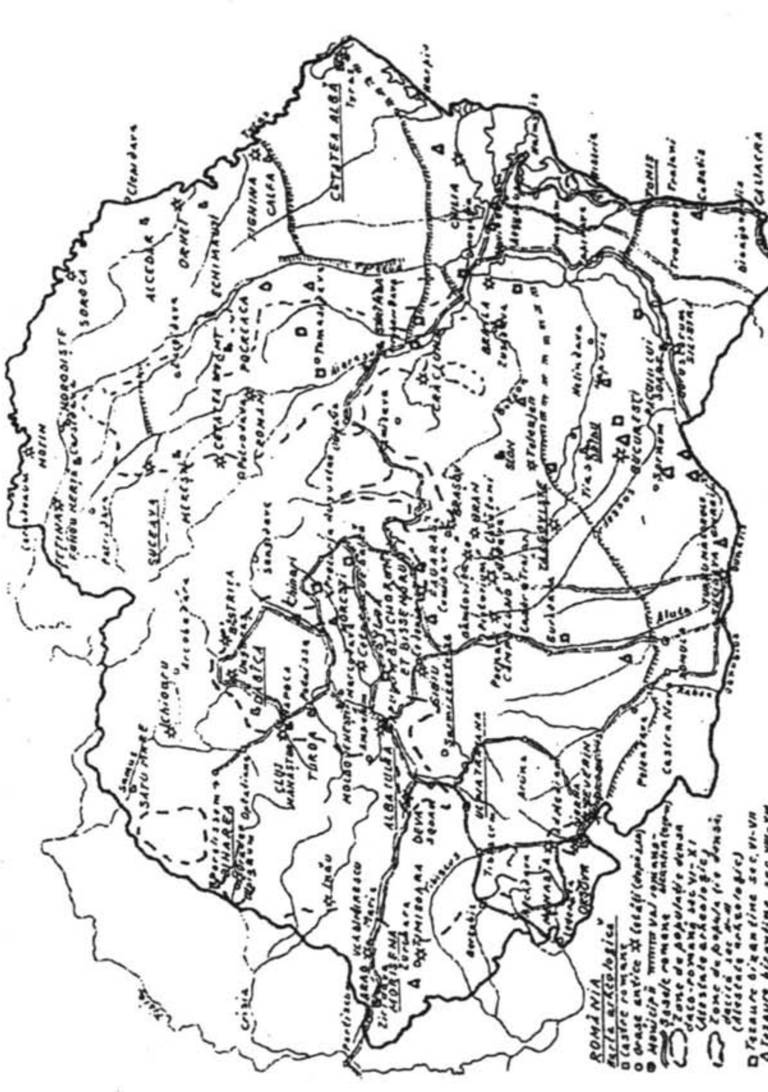

Figure 8

NOTES

1 In our vision, which is an axiological one -i.e. the Imago Mundi of Homo Humanus.

a) The culture is the dynamic set of autotelic values: Truth, Good, Beauty (i.e. the essays and the achievements of Homo Sapiens Scientiae, Homo Cogitans, Homo Aestheticus, Homo Religiosus, Homo Philosophans).

b) The civilization is the dynamic set of mean values: Political, Economical, Technical-Technological, Ergonomical et al., i.e. the essays.

2 See reference 1, especially the part a).

Peoples which had in Antiquity some contacts; some of them are attested; others are only conjectured.

Others civilizations and cultures like those developed during the Antiquity in the Far East Asia, in the pre-Columbian America et al. had their own development.

3 In many cases, greatly exceeding a life expectation of 50 years (Platon, Charmides).

4 As we shall argue in this historical-epistemological work.

5 We note different astronomical periods with T, but without other indices. In some special cases the specific indices will be used.

We note different astronomical numbers with N. In general without others indices; in some special cases the specific indices will be used.

6 1st century B.C. - 1st century A.D.

7 I.e. of Babylonian type.

8 Year of the Julian reform.

9 Namely of T = 355, T = 377, T = 378 days.

10 This is the most plausible reconstruction; the integers *x, y, z* are uniquely determined.

11 At least in this model based on the archaeological details of this central monument only. See [DAICOVICIU, 1972, pp. 232-266].

12 According to some serious historical sources, Herodot, et al. See [SOFONEA-IONESCU, 1993, p. 38].

13 Or (presumably) was in contacts with the sources of ancient astronomy Strabon.

As is mentioned by Jordanes and Hellanicus. See [SOFONEA-IONESCU, 1993, p. 38].

14 According to some serious historical sources, Herodot, et al. See [SOFONEA-IONESCU, 1993, p. 38].

15 Or (presumably) was in contacts with the sources of ancient astronomy Strabon.

As is mentioned by Jordanes and Hellanicus. See [SOFONEA-IONESCU, 1993, p. 38].

16 As was related in 1968 by MSF Hood. See [SOFONEA-IONESCU, 1993, p. 38].

17 Discovered in the Jemdet Nasr excavation site.

18 Coming from Knossos.

Quite recently (about T = 1984), such tablets with cuneiform writing were discovered in an excavation site near Bucharest, strengthening the opinion that their presence on the Carphatian-Danubian-Pontic territory is not a random event.

19 By MSF Hood. See [SOFONEA-IONESCU, 1993, p. 38].

20 By V. Gordon Childe et al. See [SOFONEA-IONESCU, 1993, p. 38].

21 To notice that the Tartaria village, where the aforementioned cuneiform tablets were found, is placed in the region of this culture.

22 Undertaken by us et al.

23 A detailed presentation of this study will be given in this work.

24 *Scientific* activites were intimately connected-influenced by religion in pre-Antiquity and long time later.

25 About astronomy.

26 The neighbours of Dacians-Getians in the Buerebista Epoch.

27 Undertaken by G.S. Hawkins in 1963-64, and by Fred Hoyle in 1972, et al. See [SOFONEA-IONESCU, 1993, p. 38].

28 Which have the same number (and, presumably, the same function, too) in Stonehenge and Sarmisegetusa.

29 Unlike some of the previous enterings upon which disregarded the large stone pillars assigning an astronomical meaning only to the small wooden pillars.

I.e. those made by C. Daicoviciu, G. Charrière, D. Antonescu. See [SOFONEA-IONESCU, 1993, p. 38].

30 It is compulsory to notice here that the hypothesis concerning the moon's motion as basic element for deciphering the calendar of the great sanctuary of Sarmisegetusa is not quite new: it was put forward by M.D. Teodorescu (1930-31). See [SOFONEA-IONESCU, 1993, p. 38].

Nevertheless the lack of direct, i.e. reliable arguments, as well as the lack of a genuine correlation of date pertaining to different appropriate fields of scientific activity able to obtain the necessary proofs, entitled, in 1972, H. Daicoviciu to reject the respective hypothesis as a groundles one. See [DAICOVICIU, 1972, pp. 232-266].

31 A special role in the history of the subject we come to enter upon is a model of a calendar devised by a research team from Brasov University: S. Bocancu, C. Samoila, E. Poenaru). This construction is, doubtless, an enticing one, by both the reached accuracy and the boldness of including in the project elements of economic and social life of Dacians. However, the construction is, on the whole, strange enough, just due to its small connection with the astronomical elements which, as was ascertained, constituted a general trend of the ancient calendars. See [BOBANCU, SAMOILA, POENARU, 1978, pp. 1-150].

32 Some epistemological, as well as some cultural comments were made by L. Sofonea.

33 It is only an analogy. But the role of the analogies in the adventure of the science is impressive.

34 Relying on archaeological facts, astronomical data and historical events (i.e. archaeology: as scientific research of the characteristics of the old

civilizations and cultures, of their features, historical dimensions and reciprocal influences).

35 The presumed connection between the big round sanctuary and the small one consists in the fact than in the big monument it is a way marked by stone slabs having a parallel direction with the basis of the horseshoe, and the extension of this very passage roughly reaches the little sanctuary.

We observe that to Stonehenge the connection line is not parallel with the basis of the horseshoe but perpendicular. This situation can, eventually, suggest that the beginnings of the years at Stonehenge and Sarmisegetusa were shifted with a half of year. It is assumed that the midsummer sunset line is strongly associated with the symmetries of the archaeological monument (see fig. 1).

36 It may be conjectured that in the past the coincidence was still more striking, but during the time some uncontrolled ground slidings presumably happened at Sarmisegetusa.

37 34 x 360 + 180 = 34 . tr . y

1 tr . y = 360 + 180/34 = (365 + 5/17) days

38 A kind of subsidiary time division, necessary for the self-consistency of this project.

39 t = 3 + 14 = 17 years; T = (3 x 13 + 14 x 12) = 207 months.

40 t = 3 + 14 = 17 years; T = (3 x 13 + 14 x 12) = 207 months.

T = 207 x 30 = 6.210 days; T = 6210/17 = (365 + 5/17) days = 1 tropic year.

We cannot deny a certain attracting feature of this version of the Dacian-Getian calendar: altogether original by its non resemblance with known (attested) schemes of time-reckoning. But, presumably, it is just this originality (at any price) which may put under a mark of doubt the reality of this clever scheme.

41 I.e. the adoration of sun, moon, and of certain brilliant stars.

Perhaps a proof of a certain syncretism, despite of their (presumed) monotheism, enthusiastically backed up by the archaeologist Vasile Pârvan.

42 Feature supported by archaeological, historical and logical arguments. This kind of arguments is clearly exposed by Hadrian Daicoviciu in his monograph issued in 1972.

43 And surely having intercourse with Dacian-Getian culture and civilisation.

44 No such rule can be formulated.

45 Mainly.

46 I.e. the official one.

47 The rise of the star Sirius (named Sephedet) and the flux and reflux of the level of water on Nylus, determined by the climatic seasons.

This topic is treated in all General Histories of Science, see, for instance: *General History of Sciences*, under the redaction of R. Taton, vol. I, Ed. Enciclopedică, Bucureşti, 1980.

48 Mainly.

49 I.e. the official one.

50 Observations of the rises, and of the sets of sun, moon, and also some stars.

51 From very early times.

52 Mainly.

53 I.e. the official one.

54 This topic is treated in all General Histories of Science, see, for instance: *General History of Sciences*, under the redaction of R. Taton, vol. I, Ed. Enciclopedica, Bucuresti, 1980.

Preserved and improved during the centuries, up to the present times.

55 Mainly.

56 Mainly.

57 I.e. the official one.

58 Mainly.

59 Mainly.

60 Preserved and improved during the centuries, up to the present times.

61 Mainly.

62 The suppressing of the Roman luni-solar calendar under the rule of Julius Caesar (T = 46 BC) was determined rather by political reasons, in view of decreasing the influence in Senate of the pontifices from the Calendar commission.

See for instance *Encyclopaedia Britannica* (the word *calendar)*.

63 We find that there are reliable rules: from general logical and methodological point of view, from the (plausible) archaeological, historical, numerological and astronomical point of view.

64 I.e. the compatibility, which is a sine qua non condition of this kind of models.

65 Diana-Bendis.

66 We find that there are reliable rules: from general logical & methodological point of view, from the (plausible) archaeological, historical, numerological and astronomical point of view.

67 Excepting some stone thresholds, whose function does not appear as directly connected to the calendar operation.

68 Which is an archaeological fact.

69 I.e. advocates the adopted hypothesis.

70 I.e. advocates the adopted hypothesis.

71 As a figure.

72 I.e. advocates the adopted hypothesis.

73 These cycles T_i , i = 1, 2, 3, are obtained as three successive approximants -Ni = {99/8, 136/11, 235/19}- of the continued fraction of the ratio between the tropic year and the synodic month: N = 365.2422/29.5306.

To notice the missing of the T = 13 years, and of the T = 17 years periods, used by E. Poenaru et al., and by D. Antonescu. See [SOFONEA-IONESCU, 1993, p. 38].

74 2922/99 = (29 + 51/99) synodic lunar period, 2922/8 = (365 + 1/4) average tropic year.

75 This succession is proposed for a best pursuing of the astronomical time.

76 This succession is proposed for a best pursuing of the astronomical time.

77 6 x 30 + 6 x 29 = 354

6 x 29 + 7 x 30 = 384

78 As it follows from the step by step reconstruction of the cycle.

79 34: the horseshoe number.

80 This does not preclude, however, the taking over, by Dacians-Getians, of many elements of the Babylonian calendar, as we shall later on relate.

81 Which is the main idea of this theoretical model.

The number N = 11, as it was shown, is an astronomical number.

82 The number N = 19 has also an astronomical meaning: it is the next approximation in the calendar calculation.

83 In full probability.

84 And the cultural dialogue between Dacians-Getians and Romans was intense enough.

Properly speaking, the Roman Calendar of the Republican era was not a luni-solar calendar, but reminiscences of an early such calendar were preserved.

85 4016 : 136 = 29 + 9/17

86 4016 : 11 = 365 + 1/11

87 As suggests the step by step reconstruction.

88 Again for a best pursuing of the *flowing of time*.

89 Again for a best pursuing of the *flowing of time*.

90 Again for a best pursuing of the *flowing of time*.

91 Again for a best pursuing of the *flowing of time*.

92 68 x 34 = 2312 months; 2312/136 = 17 cycles.

93 Practically, as well as philosophically, the left and the right are not the same, but despite any difference, they are intimately connected.

94 As it necessarily follows from this interpretation of the operation mechanism of the (presumed) Dacian-Getian calendar. Such a situation may be found, for instance, in the ancient Greek calendar, where the Hebrew 7 days week was not known and the month was divided in N = 3 decades:

- the first decade μην ισταμενος
- the second decade (not especially denominated)
- the third decade μην φθινων.

95 Marked by the position of the same marker -but with the sense of motion considered in the counter clockwise running sense (i.e. in the trigonometric sense).

96 Just as in the Sumerian calendar. Just as to some Jewish communities which use the old calendar.

97 To notice that these divisions of a 24 hours day are, to day still, to be found in the folklore tradition of the Romanian people; namely: 1) Seara (Evening), 2) Miezul Noptii (Midgnight), 3) Revarsatul Zorilor (Daybreak), 4) Dimineata (Morning), 5) Prínzul (Noon), 6) Chindia (Afternoon).

98 To notice that these divisions of a 24 hours day are, to day still, to be found in the folklore tradition of the Romanian people; namely: 1) Seara (Evening), 2) Miezul Noptii (Midgnight), 3) Revarsatul Zorilor (Daybreak), 4) Dimineata (Morning), 5) Prínzul (Noon), 6) Chindia (Afternoon).

At the same time we have to remember that not only in Ancient Mesopotamia, but equally in Ancient Greece and Ancient Israel, the beginning of day was in the evening.

99 As in the theoretical model of (plausible) Dacian-Getian calendar.

100 Second.

101 (365 + 1/11) - (354 + 6/17) = (365 + 1/11) - (355 - 11/17) = 10 + 1/11 + 11/17

102 Namely T = 29.5306 days.

103 Namely T = 29.5306 days.

104 I.c. a lunation: T_L.

105 I.e. the marker has made a complete tour.

106 The step being 13.

107 Zamolxes, Deceneu, and also (presumably) other ones.

108 At present almost a certitude.

109 Even a peremptory one.

110 Either directly or through the agency of Celts.

111 Discovered by the astronomer rabbi Hillel.

112 I.e. Meton cycle.

113 I.e. Meton cycle.

114 This peculiarity of the Temple construction does not seem to be a simple hazard!.

115 See [DAICOVICIU, 1972, pp. 232-266].

116 And a fortiori of sacred Area of Sarmisegetusa Regia.

117 And a fortiori of sacred Area of Sarmisegetusa Regia.
Like the rectangular Temples.

118 The exterior circle of the Great Round Temple as a part of this monument and (presumed) astronomical and mathematical tool.

119 Some authors consider that this monument, even by the fact that it is circular, must have calendar and astronomic functions.

120 Expresis Verbis.

121 Or, more exactly, a number to which only scarcely, and somewhat artificially, we may assign an astronomical meaning.

122 Some authors consider that this monument, even by the fact that it is circular, must have calendar and astronomic functions.

123 Our work is based on this description. See [DAICOVICIU, 1981, p. 235].

124 In the first volume of the *History of Rumanians*, written by Constantin C. Giurescu, published by the Academic Press, Bucharest, for the use of specialists and of large public.

125 A polished stone founded in a Sacred Area of Sarmisegetusa City, near the Great Sanctuary.

126 Which seems very likely, taking in view that the Dacian-Getian horseshoe enclosure is oriented at an angle differing by N = 50° from its *Celtic* homologous of Stonehenge.

127 Three intervals of the night, and three for the lighting day.
This author is a forerunner of our own ideas.

128 Hypothesis without astronomical support.

129 See the Proceedings of the respective session.

130 For instance their equal size.

131 The existence to Dacians-Getians *scientists* the concept and representation of the ellipse, as a definite geometrical object, or the existence, in their *science,* of the Pythagorean rule for a rectangular triangle $9^2 + 12^2 = 15^2$, a.s.o. See [SOFONEA-IONESCU, 1993, p. 36].

The number N = 72 may be obtained by labelling not only the 68 oaken/thin pillars, but equally the N = 4 stone thresholds.

The claim that the Great Circular Sanctuary would include the Pythagorean triangle $9^2 + 12^2 = 15^2$, gave rise to another problem: that of a Dacian-Getian unit of length. Actually, what is really claimed is that the ratio of the radii of the two circles of the Great Sanctuary is N = 12/9 = 1.333. However, this is not supported by the topometric measurements N = 14 m / 10 m = 1.400. The difference between the two ratios is statistically significant. To save the situation I. Rodean specified that both the radius of the great circle (made up of 30 large/stone pillars), namely 14.01 m and the radius of the smaller circle (made up of 68 wooden pillars) namely N = 10.00 m refer to the inner sides of the circles, while the Pythagorean triangle would be constructed using the inner radius of the great circle and the outer radius of the smaller circle. According to his calculation, the thickness of the smaller circle is N = 0.40 m and, in addition, the value N = 10.00 m should be corrected by N = 0.107 m (!). Finally, the two quantities adequately prepared would be N = 14.010 m and N = 10.507 m. Their ratio is now N = 1.3334. We make no comment about the likelihood of such procedures. In its turn, the existence of the Pythagorean triangle (claimed above) entitled the author to derive the *Dacian unit of length* N = 14.010/12 = 1.1675 m.

It is stated that the ancient Dacians-Getians were aware of the period of equinoctium precession: just the modern value of T = 25920 years.

Equally fantastic are the opinion of other authors that the same Dacians estimated for the transcendent number π the value N = 3.1416, and determined (accurately!) the Earth-Sun distance and the Earth radius.

132 Speaking in the framework of a round-table.

133 An equivalence between this new ring and the Aubrey's holes of Stonehenge is not excluded. If this will be proved to be the case then the Stonehenge-Sarmisegetusa analogy, upon which our scheme is devised, will be still strengthened.

134 For instance, it is claimed that the diameter of the Earth divided by N = 432000 and again divided by N = 17 (a number to be found in the structure of the Great Temple) leads to the length unit used by Dacians, namely N = 1.734 m.

The results of this research being protected by a *patent* we cannot give more details.

The problem/topics of the knowledge of an (relatively) exact value of the diameter of the Earth in Antiquity is, in fact, a complex problem/topics; its main aspects are: the reputed adequate method of Eratostene, the univocal determination of the unity employed, the plausible conjecture of different other possible, but unmentioned, attempts, et al.

135 After the calculations of C.A. Newham (from the paper "The Astronomical Significations of Stonehenge", Moon Publications, 1972).

136 See [GLODARIU, IAROSLAVSKI, RUSU, 1989].

137 As it results from the presentation made by Pierre Kohler in *Science et Vie*, nov. 1981.

138 Bisextil year.

139 The firs topometric measurements did not find a local magnetic anomaly.

The sanctuaries are built within the space of an artificial terrace escaved in a mountain with big slopes.

140 Jean-Honoré Abdolonyme Ubicini (1987) *Les origines de l'histoire roumaine*. Paris, Ernest Leroux, p. 36. Apud Hellanicus: τελετας χατεδεξε Γεταis.

141 Jean-Honoré Abdolonyme Ubicini (1987) *Les origines de l'histoire roumaine*. Paris, Ernest Leroux, p. 36. Apud Hellanicus: τελετας χατεδεξε Γεταis.

It is mentioned by Gr. Tocilesco, in 1880, in his study *La Dacie avant les Romans.*

142 Put forward much before the investigation of the Dacian-Getian calendar.

143 See, for example, the research and the arguments of Al. Glodariu et al., exposed in their book "Cetăţi şi aşezări dacice în Muntii Orăştiei. Ghid al Munţilor Orăştiei", Ed. Sport-Turism, Bucuresti. 1989; and those of H. Crisan exposed in "Spiritualitatea Geto-Daciça. Repere istorice". Ed. Albatros, Bucuresti, 1986.

144 See, for example, the research and the arguments of Al. Glodariu et al., exposed in their book *Cetăţi şi aşezări dacice în Muntii Orăştiei. Ghid al Munţilor Orăştiei*, Bucuresti, Ed. Sport-Turism, 1989; and those of H. Crisan exposed in *Spiritualitatea Geto-Dacica. Repere istorice*. Bucuresti, Ed. Albatros, 1986.

145 By objects like: nails, needles, lamps, torches, a.s.

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