Epilogue
In Praise of Oral Creativity

1 Introduction to the Epilogue

In this epilogue, I return to my research on the traditional calendar of the Borana carried out in the Sololo area (northern Kenya) in 1986, re-publishing the preliminary report published in 1988. I must admit that I have not undertaken any further systematic verification of the astronomical feasibility of the ethno-astronomical model presented here, for example by computer simulation. However, the model has been constructed through robust ethnographic research and has stood the test of time. Since the publication of the report, I have become aware of other studies that had anticipated some of the elements discussed in the article. Concerning the timekeeping system of the Mursi of southwestern Ethiopia, David Turton and Clive Ruggles (1978) had already pointed out that in lunisolar calendars such as the Borana's, 'institutionalised disagreement' about month and day can occur. This disagreement is eventually resolved by 'retrospective

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adjustments' of which the participants may not be aware. This feature is fully confirmed in the research report republished here, where the name of a lunar month may be repeated based on astronomical observation, thus adding an intercalary month, even if the participants do not explicitly refer to it as an 'intercalary' month: the *ayyaantu* (experts in observing the sky) simply adjust the names of the days and months to match the observed astronomical conjunctions between the stars and the moon.

Ten years later, Ruggles (1987) provided a critical assessment of Asmarom Legesse's ethnographic account of the Borana system of time reckoning (Legesse 1973). Using an astronomically based deductive approach, he was able to identify the shortcomings of Legesse's account and to hypothesise the basic mechanisms that I had discovered in my ethnographic work with Bante Abbagala. These include the fact that the system may work on the basis of the right ascension of the stars, the relevance of the sidereal months of 27.3 days, the presence of retrospective adjustment and the intercalation of days and months. When I wrote the research report here republished (Bassi 1988b), I was not aware of Ruggles' article. We therefore arrived at the same conclusions independently, using different methods.

If the ethno-astronomical model described here is correct, there are other consequential considerations worth highlighting. The first is that the Borana calendar is, to my knowledge, the only lunisolar calendar on Earth capable of maintaining correspondence with the seasons solely by evaluating the right ascension position of the celestial bodies, combined with the position and phase of the moon in relation to the stars. This is achieved without reference to regular natural events, the sun or the heliacal rising of the stars, and without the need for mathematically based corrections or intercalations.

The second consideration is that it is highly probable that the mechanism of month intercalation underpins the eight-year periodisation of the *gadaa* institution, even if this may not be consciously recognised by the participants. In fact, the intercalary month would have to be added in sequences of 3, 3 and 2 years, with a deviation that becomes significant after a few cycles. As mentioned in the introduction to this volume, the eight-year *gadaa* period is the fundamental segment in the Oromo concept of time and history (Legesse 1973; Megerssa, Kassam 2004; 2019).

The third consideration is that the Oromo calendar does not consist of the classical configuration of tables to be followed sequentially to determine the day, month and year. Instead, it is a system of decoding the positions of celestial bodies to ensure the maintenance of certain astrological correspondences: the name of the day and month is derived directly from the 'reading' of the sky. Specifically, a given position of the Moon in 27 sidereal sectors corresponds to one of the 27 day names (*ayyaana*).[1] Each position of the celestial sphere relative to the horizon at a given time of day, evaluated indirectly by the phase of the moon, corresponds to one of the twelve names of the months (*ji'a*). As in many astrological systems, it is believed that the position of the moon in certain sidereal sectors corresponds to a certain characterisation or destiny for individuals born on that day (Megerssa, Kassam 2019, 121-7). Like all ceremonial calendars, every ceremony, every public or family ritual, and every ritual act within complex celebrations must be performed in a predetermined month (*ji'a*) and day (*ayyaana*). Among the Oromo, even the time of day devoted to certain ritual acts is strictly regulated. Consequently, due to the empirical process of cosmological decoding, every ritual act, including the rites and ceremonies for which the *gadaa* officers are responsible to ensure the well-being (*nagaa*) of their political community, must be performed when certain astral configurations occur, i.e. when the sky appears 'receptive', thus allowing the connection between man and *Waaqa Gurraacha* (the 'Black Sky', the unitary divine entity). This cultural construction seems to correspond to the concept of 'naturalistic philosophy' theorised by Antonino Serina (2023) for many peoples of Africa, classical antiquity and the Far East.

Some new data has emerged on the main issue addressed in the research report republished here, namely whether there is a relationship between the Borana calendar and the 'archaeo-astronomical' site of Namoratunga II found in northern Kenya. Based on the ethnography of the Macha and the Tulama in the agricultural highlands, Megerssa and Kassam have presented a more articulated system of Oromo time reckoning. They highlight the attention paid to equinoxes and solstices, assessed by the declination of the sun in relation to landmarks. They link this to the ancient centres of *Abbaa Muudaa* in the northern and central highlands of Ethiopia, and to New Year festivals that are particularly relevant in the agricultural highlands, including the current *Irreechaa* festival (Megerssa, Kassam 2019, 131-47). Today, the Borana are perfectly capable of determining the seasons without reference to the sun and without the use of landmarks to assess the declination of celestial bodies. This contrasting ethnographic evidence need not be seen as contradictory. It may simply be that in different parts of Oromia, *ayyaantu* (experts in observing the sky) use different components of the calendrical system, in different combinations. On the one hand, there are analogies between the system used by the highland Oromo and the declination-based functioning of the Namoratunga II site. The settings

1 Ayyaana means 'day', but it is also a complex religious concept, with many meanings, central in Oromo world-view (Megerssa 2005; Kassam, Megerssa 2019, ch. 5).

of Namoratunga II suggest the existence of some kind of stratification or the presence of a sacerdotal class, a feature that seems rather incompatible with the current organisation of the Borana Oromo. However, as Megerssa and Kassam (2005) point out, it is difficult to establish a direct link between Namoratunga II and the distant ancient centres of the Oromo in the Ethiopian highlands. On the other hand, we find the Borana living in the vicinity of Namoratunga II, but using a system based solely on right ascension. Nevertheless, it is difficult to dismiss the correspondence between the orientation of the Namoratunga II pillars in 300 BC and the stars used by the Borana and other Oromo today, as outlined by Lynch and Robbins (1978). These stars do not seem to stand out for any functional reason: they are not brighter than others, and their right ascension angular distance is not regular. This forces the *ayyaantu* (experts in observing the sky) into the complicated procedure of evaluating conjunctions with the moon described in the report here republished. It is therefore reasonable to assume that there are ritual, symbolic and historical reasons for focusing attention on these stars, until a new system of evaluation, compatible with pastoral livelihoods, was developed by the Borana Oromo or some of their ancestors.

The two systems of observation – using landmark pillars to check declination in Namoratunga II and right ascension conjunctions between the moon and stars by the Borana – may have co-existed for a long time, allowing comparison, evaluation and adjustment. Eventually, the astronomical shift in the declination of the stars due to the change in the orientation of the Earth's axis made the use of the pillars at Namoratunga II impractical.

2 On the Borana Calendrical System: A Preliminary Field Report

Several anthropologists, including Pecci (1941), Baxter (1954), Haberland (1963), and Legesse (1973), have collected data about the calendar of the Borana of northern Kenya and southern Ethiopia. Only Legesse organised his information in a system based on astronomical observation. However, Doyle (1986, 286-7) noted that his description appears to exhibit some astronomical incongruities. Doyle suggests a new interpretation of Legesse's data. This paper aims to present new field information on the calendrical system of the Borana. Most of the

Paragraph 1.2 is adapted from the following original publication: Bassi, M. (1988). "On the Borana Calendrical System: A Preliminary Field Report". *Current Anthropology*, 29(4), 619-24. https://doi.org/10.1086/203682.

data have been provided by my friend, Bante Abbagala, a respected elder and an expert in sky observation and the calendar (*ayyaantu*).

The Borana calendar appears to be unaffected by the patterns of the agricultural cycle. The sequence of months and days is perceived as cyclic, lacking a discernible starting point. This calendar primarily serves ritual purposes, with each ceremony designated to occur on a specific day (refer to Baxter 1954; Haberland 1963; Legesse 1973 for further details).

The astronomical nature of the Borana calendar demands specialised knowledge in sky observation, typically guarded and passed down from father to son. The individuals possessing this expertise, *ayyaantu*, are consulted by the community for various matters, including determining dates for rituals, weather forecasting, and divination. Those seeking consultations usually bring symbolic gifts such as a small amount of tobacco and/or coffee beans; these offerings are not considered payments. It is worth noting that *ayyaantu* share the same subsistence resources and engage in similar social activities as the rest of the community. They lack formal recognition or insignia; they do not constitute a corporation, nor do they regularly convene for meetings or consultations with one another. However, occasional exchanges of opinions may occur if they happen to meet.

According to Legesse, the Borana year comprises 12 named lunar months **[tab. 10]**. A lunar month (*ji'a*, the same word used for 'moon') corresponds to the synodic period of the moon, approximately 29.5 days. In the Borana context, a month starts on the day when a new moon is observed, making it either 29 or 30 days in duration (Legesse 1973, 180). In this paper, 'new moon' refers to the moon's first visible day after the astronomical 'zero phase'. It is noteworthy that the Borana new moon typically occurs one day after the astronomical new moon.

Legesse reports that the Borana year is 11 days shorter than the solar year, resulting in a lack of alignment between years and seasons (1973, 181). The calendar does not have weeks, but Legesse identifies a cycle of 27 named days, referred to as a "ceremonial month" (1973, 184). This ceremonial month, lasting for 27 days does not synchronise with the lunar month, which can be either 29 or 30 days long. Consequently, each lunar month commences on a distinct day or, more precisely, on a different set of two or three successive days (1973, 186) (refer to Table 10).

For a specific month to consistently commence on the same set of days each year, 13 ceremonial cycles (each spanning 27 days) must equal 12 lunar months (each spanning 29.48 days). As there exists a discrepancy of 2.76 days between the 13 ceremonial months and the 12 lunar months, Legesse posits that the system carries a yearly error of 3 days (1973, 184, 187). According to his account, this annual error does not accumulate because it is rectified through observations

Table 10 Borana months, their alternative initial days, and conjunctions used for calendrical correction according to Legesse (SOURCE: Legesse 1973, 183, fig. 7.2; 181, fig. 7.1)

		Conjunction		
Month	Alternative Initial Days	Between Waning Moon and Triangulum	Between New Moon and One of the Seven Stars	[Conjunction Number]
Birra	Gardaduma Sonsa Rurruma	14 (full moon)		[1]
C̣iḳawa	Lumasa Gidada	12		[2]
Sadasaa	Ruda Areri Dura	9		[3]
Abrasa	Areri Ballo	7		[4]
Ammaji	Adula Dura Adula Balla	5		[5]
Gurranḍala	Garba Dura Garba Balla Garba Dullacha	3		[6]
Bittottessa	Bita Ḳara Bita L̇ama	1 (new moon)	Triangulum (Lami)	[7]
C̣amsa	Sorsa Algajima		Pleiades (Busan)	[8]
Bufa	Arb Walla		Aldebaran (Baqqalcha)	[9]
Wac̣abajji	Basa Dura Basa Ballo		Bellatrix (Algajima)	[10]
Obora Gudda	Carra Ṁaganatti Jarra Maganatti Briti Salban Dura		Central Orion (Arb Gaddu)	[11]
Obora Diḳḳa	Salban Balle Balban Dullacha		Saiph (Urji Walla) Sirius (Basa)	[12]

of conjunctions between the moon and one of the seven stars or constellations on specific days (refer to Table 10, columns 3 and 4). Legesse suggests that conjunctions numbered 1 and, particularly, 7 serve as the year's checkpoints, utilised for error correction; when these astronomical events occur, the day is established through inductive reasoning (1973, 185).

A first astronomical discrepancy within the system described by Legesse has been highlighted by Doyle: the conjunctions numbered 7 through 12 in Table 10 cannot occur astronomically as indicated. Doyle, relying on the lunar sidereal rate, has calculated the moon's position at the commencement of each synodic month, starting from the conjunction between the new moon and Triangulum. According to Doyle's estimations, after one lunar month, the new moon and the Pleiades (no. 8) would indeed be in conjunction. However, at the beginning of the subsequent month, the new moon would rise slightly beyond Bellatrix instead of Aldebaran (no. 9), and in the subsequent month, it would rise past Sirius instead of Bellatrix (no. 10) (Doyle 1986, 286).

As an alternative explanation, Doyle entertains the possibility that the term "conjunction" might be interpreted as "rising single-file" rather than "rising with", as implied by Legesse. Under this interpretation, the moon and stars would be considered in conjunction when they shared the same "horizon position", with declination rather than right-ascension being the compared parameter. Doyle's hypothesis gains support from the fact that all the conjunctions specified by Legesse align correctly if the 300 B.C. declinations of the seven stars are compared with the lunar declination between August 7, 1983, and July 28, 1984. The date 300 B.C. has been proposed by Lynch and Robbins (1978) for the archaeological site Namoratunga II (east of Lake Turkana), where 19 basalt pillars are believed to have served as reference points to establish the horizon position of the stars mentioned by Legesse. The astronomical function of these pillars has been scrutinised by Soper (1982). Doyle suggests that the Borana calendar might operate in terms of declination and speculates that it might have been devised around 300 B.C. (1986, 287).

The second astronomical inconsistency in the calendrical system described by Legesse pertains to the annual cycle. The Borana year, consisting of 12 synodic months (equivalent to 354 days), is 11 days shorter than the solar year (Legesse 1973, 180). According to Legesse (1973, 183, 185, 187-188), on the first day of the month *Bittottessa*, the new moon aligns with Triangulum. This alignment should theoretically occur every year. Given that a new moon consistently appears at approximately the same location in the sky (just above the western horizon) and at the same time (just after sunset), if observations are made at this time, the stars should occupy the same position in the sky, using the horizon as a reference, after one solar year. Therefore, if a conjunction between the new moon of the month *Bittottessa* and Triangulum is observed during a year, after 12 synodic months (at the commencement of the month *Bittottessa* again), the new moon will be sighted approximately in the same position in the sky. However, Triangulum will require eleven additional days to reach that point. On average, Triangulum will be approximately 11° to the east of the new moon. With each successive year, this angular distance will increase by 11° until it becomes untenable to consider the new moon of the month *Bittottessa* in conjunction with Triangulum.

The new field data I have collected reveal that the current Borana calendar does not rely on declination. Instead, each named day signifies a specific right-ascension lunar position, determined by the lunar sidereal period, which is approximately 27.3 days in duration. Since a month extends for about 2 days beyond the sidereal period, each consecutive month begins approximately 2 days after the completion of the 27.3-day cycle. The approximate 2-day shift in the cycle of 27 named days at the beginning of each subsequent month effectively aligns the sidereal and synodic lunar periods. To compensate for the 11-day disparity between the Borana year and the solar year, intercalary months are introduced, offering a practical adjustment mechanism.

The constellation of stars utilised to establish the days (*ayyaana*) and months (*ji'a*) is referred to as *urji Dahaa* **[tab. 11]**. These stars constitute the sole celestial references associated with the Borana

Table 11 Urji Dahaa (stars used by Borana as reference points)

		Astronomical Position (2000.0)	
Borana Name	Astronomical Name	Right Ascension	Declination
Lami	Sheratan (β Ari)	1h 55m	20° 48′
	Hamal (α Ari)	2h 07m	23° 28′
Busan	Pleiades (η Tau)	3h 47m	24° 06′
Baqqalch Sors	Aldebaran (α Tau)	4h 36m	16° 31′
Baqqalch Algajim	Bellatrix (γ Ori)	5h 25m	6° 21′
Arb Gaddu	Mintaka (δ Ori)	5h 32m	−0° 18′
	Alnilam (ε Ori)	5h 36m	−1° 12′
	Alnitak (ζ Ori)	5h 41m	−1° 57′
Baqqalch Walla	Betelgeuse (α Ori)	5h 55m	7° 24′
Baqqalch Basa Guddo	Sirius (α CMa)	6h 45m	−16° 43′
Baqqalch Basa Diqqo	Procyon (α CMi)	7h 39m	5° 13′

calendar. The position of the Pleiades is determined in relation to Alcyone, the brightest star within this group. The astronomical names have been assigned by identifying the stars as indicated by Bante on W. Tirion's charts (Menzel, Pasachoff 1983, 162-317). There are some differences between these data and Legesse's account:

- *Lami*, identified as Triangulum by Legesse, is denoted as Sheratan and Hamal according to Bante.
- *Baqqalch Walla*, designated as Saiph by Legesse, corresponds to Betelgeuse.
- *Baqqalch Basa Diqqo*, an eighth Borana star, is not mentioned by Legesse.

These variations highlight discrepancies in the identification of specific stars between the accounts provided by Bante and Legesse.

Astronomical observations are conducted each month over eight or nine successive nights when the moon approaches the eight stars. Bante determines the positions of celestial bodies by gauging the shortest distance between them and an imaginary north-south datum line, practically established by facing either east or west. Essentially,

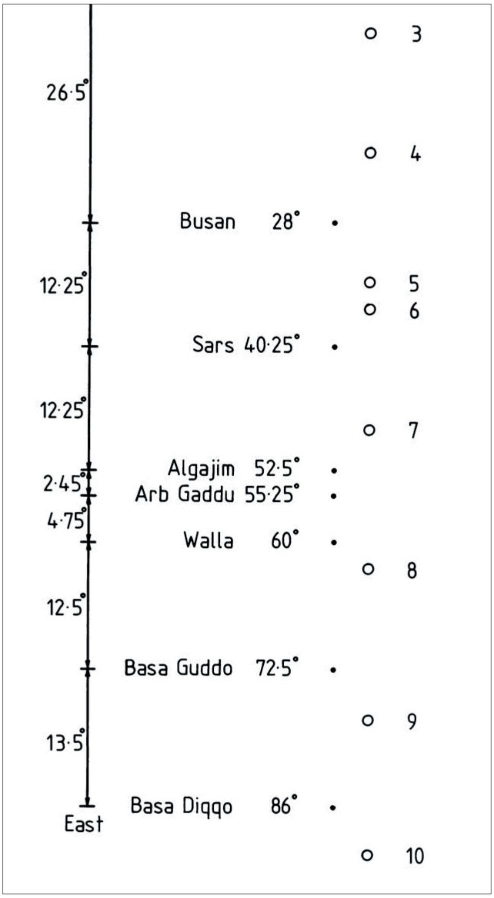

Figure 3
Observed conjunctions

only the right ascension is taken into account, with no consideration for declination. Figure 3 illustrates the right-ascension position of the relevant celestial bodies as seen and recorded over nine consecutive nights during my fieldwork.

In Figure 3, the first column on the left indicates the angular distance between two successive stars (or groups of stars) of *urji Dahaa*; the second column from the left reports the Oromo name of each star (for the equivalent astronomical name, please consult Table 11), followed on the right by the indication of the angular right-ascension distance from Sheratan, the westernmost star of *urji Dahaa*, and dots graphically indicating the position of each star; the small circles in the next column from the left represent the observed right-ascension positions of the moon with respect to the stars in different moments, determined without instruments but using Tirion's charts (Menzel, Pasachoff 1983, 162-317), directly in the field; the column on the right reports the progressive number of each observation, with the corresponding night and time provided **[tab. 12]**. Positions 8 to 10 were determined with the aid of the astronomical almanac since cloud cover precluded direct observation. The group of stars identified as *Busan* by the Borana (Pleiades) is represented in the figure by Alcyone, while the group *Arb Gaddu* by Alnilam, the central one; both stars of *Lami* are shown because of their considerable angular distance and the important role of the western one, Sheratan.

On the initial night of observation, Bante said that if the moon appeared east of the western star of *Lami* (Sheratan) – between the two stars of the constellation – it would be considered in conjunction with *Lami*.

Position 1, September 20, 10 P.M.: The moon was situated west of *Lami*, and there was no immediate conjunction. However, confirmation had to be postponed until morning as the moon gradually moves eastward during the night.

Position 2, September 21, 5:30 A.M.: By this time, the moon had passed the first star of *Lami*. It could tentatively be considered in conjunction with Lami, but a conclusive assessment required verification on subsequent nights.

On the second night, following the provisional establishment of a conjunction with *Lami* from the previous night, an anticipation arose for a conjunction with *Busan*. However, this anticipation needed confirmation.

Position 3, September 21, 11 P.M.: Tentatively considered in conjunction with *Busan*.

On the third night, under the same assumption as the previous night, Bante tentatively predicted a conjunction with *Baqqalch Sors*.

Position 4, September 22, 11 P.M.: Tentatively considered in conjunction with *Baqqalch Sors*.

The fourth night served as a verification night: If the moon did not progress beyond (to the east of) *Baqqalch Sors*, the conjunction would be with Baqqalch Sors instead of *Baqqalch Algajim*, as anticipated. In such a case, the preceding interpretation of conjunctions would need correction.

Position 5, September 24, 12:15 A.M.: The moon remained west of Baqqalch Sors, but confirmation awaited morning.

Position 6, September 24, 5:30 A.M.: By this time, the moon had not yet reached *Baqqalch Sors*. Therefore, on this night, the moon was deemed in conjunction with Baqqalch Sors. The prior interpretation needed revision: Positions 1 and 2, no conjunction occurred; Position 3, conjunction with *Lami*; Position 4, conjunction with *Busan*.

Table 12 Summary of observed conjunctions

Night of Observation	Position of Moon	Date and Time	Conjunction
1	1	September 20, 10 P.M.	—
	2	September 21, 5:30 A.M.	
2	3	September 21, 11 P.M.	Lami
3	4	September 22, 11 P.M.	Busan
4	5	September 24, 0:15 A.M.	Baqqalch Sors
	6	September 24, 5:30 A.M.	
5	7	September 25, 1:45 A.M.	Baqqalch Algajim
6	8	September 26, 5:30 A.M.	Arb Gaddu
7	9	September 27, 5:30 A.M.	Baqqalch Walla
8	10	September 28, 5:30 A.M.	Baqqalch Basa Guddo
9	11	September 29, 5:30 A.M.	Baqqalch Basa Diqqo

From the fifth through the ninth night, observations followed a similar pattern to the second and third nights, with Table 12 summarising the observed conjunctions.

Bante's comments provide insight into the procedure for determining a specific conjunction. The first rule is that on those consecutive nights, there must be a conjunction of the moon with each of the stars in sequence, regardless of the actual distance of the moon from them. The challenge lies in establishing the correct sequence, pinpointing the night of the initial conjunction, and thus establishing a correspondence between the astronomical event and the solar day. To accomplish this, the *ayyaantu* rely on two precise celestial reference points: Sheratan (β Ari – the first star of *Lami*) and Aldebaran (α Tau – *Baqqalch Sors*). On the first night when the moon is situated east of Sheratan, a conjunction between the moon and *Lami* is deemed to occur. On the last night when the moon is positioned west of Aldebaran, a conjunction between the moon and *Baqqalch*

Sors is considered to occur. In both instances, the observations are made just before the moon and the star vanish due to setting or daylight. When there is a discrepancy in the information obtained from the observations of the two stars (as described in this case), the reference to Aldebaran (*Baqqalch Sors*) takes precedence.

The use of two points of reference on two different nights may stem from the possibility that one of the two observations might be unsuccessful. This could occur due to factors such as cloud obstruction or challenging visibility conditions, especially during twilight, when Sheratan, being the less bright star, may be difficult to discern. Using two reference points allows for greater flexibility and ensures that, even if one observation is compromised, the other can still provide valuable information for establishing the sequence of conjunctions.

A procedure of this kind lends considerable precision to the interpretation of a conjunction. A range of 1-2° in the position of the moon is to be considered reasonable in establishing whether the moon is to the east or to the west of a star (the *urji Dahaa* group is near the ecliptic).

In practical terms, only one star, *Baqqalch Sors*, holds true significance for determining a series of conjunctions. However, all the stars within the *urji Dahaa* group can be employed, regardless of their specific value as lunar sidereal markers. The *ayyaantu*, through experience, have a nuanced understanding of the limits within which the moon must appear to be considered in conjunction with each star. This knowledge allows them to establish a correlation between a specific day and an astronomical conjunction on any of the eight nights of observation. This approach proves particularly advantageous during the rainy seasons when observational conditions may be compromised on many nights. However, when the moon is in close proximity to a critical position, and the assessment of the conjunction is challenging, the *ayyaantu* must resort to using Lami (Sheratan) and, especially, *Baqqalch Sors* (Aldebaran) as precise lunar sidereal markers to ensure accuracy.

It should also be noted that the moon is not always in conjunction simply with the star closest to it; this is especially so because of the irregular distance between the stars of *urji Dahaa*.

According to Bante, the fundamental connection between astronomical events and the calendar lies in the fact that each time the moon is in conjunction with one of the eight stars of *urji Dahaa* on one of the eight successive nights, a specific day (*ayyaana*) recurs **[tab. 13]**. This appears to be the key principle of the Borana calendrical system. For instance, the day on which the moon is in conjunction with Lami is consistently *Bita Kara*. On the subsequent day, when the moon is in conjunction with *Busan*, the day becomes *Bita Balla* (equivalent to Legesse's *Bita Lama*, '*Bita* two'), and so forth. Therefore, the solar day derives its name directly from the star with which the moon

Table 13 Conjunctions and corresponding days

Conjunction	Day
Lami	Bita Kara
Busan	Bita Balla
Baqqalch Sors	Sors
Baqqalch Algajim	Algajim
Arb Gaddu	Arb
Baqqalch Walla	Walla
Baqqalch Basa Guddo	Basa Kara
Baqqalch Basa Diqqo	Basa Balla

is in conjunction. By applying this fundamental principle, Bante was able to define the appropriate name for each of the days of conjunction represented in Figure 3.

To denote the names of the 19 or 20 days between two successive series of conjunctions, the *ayyaantu* advance one position in the 27-day cycle every solar day. It is important to note that among the Borana, a solar day (24 hours) begins and ends at sunrise.

If one goes for 27 days shifting through the 27 day-names, will the name *Bita Kara* always recur when the moon is in conjunction with Lami? The 27.3-day length of the lunar sidereal period guarantees this recurrence. However, after about three sidereal periods, the 0.3-day deviation introduces a discrepancy of approximately one day. The *ayyaantu* promptly correct the sequential reckoning of the day-names based on astronomical observation. For example, if they observe the moon in conjunction with *Lami*, and the theoretical reckoning indicates *Bita Balla*, they will designate the day as *Bita Kara*. Thus, a solar day is approximately added every three sidereal periods to maintain the precise alignment in the Borana calendar, without formally acknowledging this correction.

A second important feature of the Borana calendrical system is the use of intercalary months. Similar to the adjustment for the 0.3-day deviation of the lunar sidereal period, the addition of an extra month occurs not at fixed intervals but through astronomical observation. The observation of the lunar phase plays a crucial role in this adjustment. Solar days can also be qualified by their lunar phase.

A lunar month is divided into three periods:

- *Bati*: From the day of the Borana new moon to the day preceding that of the full moon (usually 13 or 14 days).

- *Gobana*: The day of the full moon (a moon is considered full on the first evening that it has not yet risen at sunset).
- *Duqqana*: From the day after *gobana* to the day before *bati* (usually 15 days).

Each day of each period is numbered. It is important to note that these three periods do not precisely correspond to the astronomical waxing, full, and waning moon phases. While the lunar phase can generally be estimated within a couple of days by observing the width of the illuminated part of the moon and checking the time of its setting and rising, only on the nights of the new and full moon can astronomical observation provide a precise correlation between lunar phase and day.

Number	Month	Initial Day
1	Sadasa	Gidada, Rud
2	Abrasa	Areri Kara, Areri Balla
3	Ammaji	Adula Kara, Adula Balla
4	Gurrandala	Garba Kara, Garba Balla
4a	Gurrandala (bis)	Garba Dullach
5	Bittottessa	Bita Kara, Bita Balla
6	Chamsa	Sors, Algajim
7	Bufa	Arb, Walla
8	Wachabajji	Basa Kara, Basa Balla
9	Obora Gudda	Maganatti Jarra, Maganatti Briti
10	Obora Diqqa	Salban Kara, Salban Balla
10a	Obora Diqqa (bis)	Salban Dullach
11	Birra	Gardadum, Sons
12	Chiqa	Rorrum, Lumasa

Table 14 Correlation of sidereal and synodic lunar periods

Table 14 illustrates the set of two or three successive days on which each month begins (*Kara* is equivalent to Legesse's *Dura*). This correspondence remains consistent every year, and the *ayyaantu* know it by heart. A similar correspondence, with some ethnographic variations, is expressed by columns 1 and 2 of Table 10. The first day of a month corresponds to the day of the new moon. Thus, the table establishes a correlation between the sidereal and synodic lunar periods.

This correlation allows the *ayyaantu* to determine the month by combining the observation of conjunctions with the observation of lunar phases. The first type of observation yields the name of a day, while the second provides the lunar phase of that day. By using these pieces of information, the name of the first day of the month (new moon) can be easily derived. This procedure is especially useful for deciding when an intercalary month is needed, as explained by Bante referring to the series of conjunctions reproduced in Figure 3 and Table 12.

During the month of *Obora Diqqa*, Bante carefully monitored the lunar phases, counting days after the new and full moons. On the day *Bita Kara* (the second night of observation when a conjunction between the moon and Lami occurred), the moon was on the third night of *duqqana*. As *duqqana* (approximately waning moon) usually lasts 15 days, Bante progressed by 13 positions in the cycle of 27 named days (Table 10, column 2), starting from Bita Kara, to determine the expected name of the first day (new moon) of the following month, *Birra*. The outcome was *Salban Dullach*. However, as according to the correlation represented in Table 14 the month *Birra* cannot start on this day, Bante suggested that the month *Obora Diqqa* was likely to be repeated (Table 14, no. 10a). A verification of the following new and full moons was necessary, as *duqqana* does not always last 15 days.

According to Bante, only two months can be repeated: *Gurrandala* and *Obora Diqqa*, which are indeed the only months that can begin on a set of three successive days. The indication of the third day in Table 14 (labelled 'bis' in the table, nos. 4a and 10a) signifies the repetition of the month. Therefore, when the combined observation of conjunction and lunar phase suggests that the new moon of *Bittottessa* occurs on the day *Garba Dullach* instead of *Bita Kara* or *Bita Balla* as expected (Table 14, no. 5), the *ayyaantu* assert that the month starting with that new moon is not *Bittottessa* but *Gurrandala* again (no. 4a). Similarly, if the new moon of *Birra* occurs on *Salban Dullach*, that month will be called *Obora Diqqa* again (no. 10a). *Gurrandala* and *Obora Diqqa* are particularly suitable for repetition because the months immediately following them are characterised respectively by a new and a full moon directly in conjunction with the stars of *urji Dahaa*.

Let us examine the astronomical feasibility of this system. The new moon of *Bittottessa* is anticipated to emerge in conjunction with *Lami* or *Busan*. Due to the 11° lag of stars compared to the new moon after each Borana year (12 synodic months), the new moon of *Bittottessa* will gradually appear to the west of *Lami*. This astronomical scenario indicates that the day is *Garba Dullach*, and consequently, *Gurrandala* must be repeated. During this intercalary month, on average, the new moon moves about 389° to the east relative to the stars. This signifies that it completes an entire revolution plus 29°. As a result, the subsequent new moon (commencement of *Bittottessa*) will once again be observed in conjunction with *Busan*.

In summary, the Borana calendar operates by determining the names of days based on the right-ascension position of the moon in relation to the stars. By consistently initiating the month on the same set of 2-3 days, the 11-day difference between a Borana and a solar year is rectified by inserting an intercalary month approximately every three years, through astronomical observation. Since seasons are tied to the solar year, there exists a correspondence between the Borana year (with the adjustment) and the seasons.

The presented data highlight a distinction from Legesse's ethnography. While Legesse considered the 27-day cycle as merely a 'ceremonial month', the information here demonstrates that it also corresponds to the lunar sidereal period, lasting 27.3 days. The 0.3-day deviation is adjusted through astronomical observation. Consequently, the yearly "3-day error" is practically non-existent, as the *ayyaantu*, at various points in the year, simply wait one day before continuing the computation of day-names. Another disagreement pertains to the intercalary month. Legesse's description of the seasons and what has earlier been referred to as the 'second astronomical inconsistency' are rooted in the absence of intercalary months in the calendrical system he depicted.

The conjunctions numbered 7-10 in Table 10 pose a challenge, leading to Doyle's hypothesis that they operate in terms of declination. Legesse's statement (1973, 181), 'In six out of twelve months, the seven constellations appear successively, in conjunction with the moon', should probably be read as a succession of conjunctions over eight consecutive observations on eight consecutive days every month, rather than the conjunctions between the new moon and the stars in each successive month. Nonetheless, Legesse's indication that the calendrical system operates based on the right ascension of heavenly bodies aligns with the field data presented here. Bante does not consider the declination of the moon and stars for calendrical purposes.

While the 'declination' interpretation does not apply to the current calendrical system, Doyle's hypothesis remains interesting in the context of a hypothetical prototype. Changes in the declination of the stars might have led to a shift in the system from declination to right ascension over time.