Intercalation in the Traditional Setswana Calendar

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Abstract

Precolonial Southern African farming societies used lunisolar calendars. The details have largely been lost since these calendars were abandoned in favour of the Gregorian calendar. This article seeks to investigate possible reconstructions of the Setswana calendar, especially in terms of intercalation. It is suggested that month-names may be analysed as 'observation' and 'comment' types, with observation names providing seasonal markers. It is concluded that more study is necessary but methods of intercalation probably lay between case-by-case month-naming and explicit intercalation. Stellar observations were important but it is unclear how they related to the lunisolar calendar.

Introduction

It is now uncertain how the precolonial Setswana calendar worked, which is unfortunate since time-keeping is an important form of indigenous knowledge and can show much about a society's scientific aspect. Sources available include old written accounts of both Sotho-Tswana and other Southern African calendars, linguistic studies of existing calendars in the region north of Botswana, anthropological studies of intercalation elsewhere, and calculations of the dates of astronomical observations such as heliacal risings. Reported oral tradition is very limited.

In the natural world, there are three obvious units of time: the day, the month and the year. The day is universal. The lunar or synodic month, or lunation, is the period during which the moon goes through all its phases, taking each New Moon as the start of a new month. A month must contain a whole number of days, and so although lunations are about 29½ days, months are started after either 29 or 30 days. The solar year, technically known as the tropical year, is the time between two vernal equinoxes,[1] but can be observed, outside the tropics, by the passage of the seasons. In the modern world lunar months may seem unimportant, but in a premodern society without artificial light the situation was different.

The problem is that these three units of time do not fit together evenly. A tropical year is 365¼ days: 12 lunations will be about 355 days, while 13 will be about 384. To resolve this mismatch, a society may use more than one system, or replace the lunar month with an arbitrary month (as in the Gregorian calendar), or use an arbitrary year (as with the Islamic calendar of 12 lunar months). However, a *lunisolar* calendar using both lunations and the tropical year is common in agricultural societies. In a classic lunisolar calendar, there are 12 lunar months, but periodically an embolismic year including an extra 'intercalary' month is inserted to keep the calendar year synchronized with the tropical year and the seasons. This is known as *intercalation*. Calendars of this type include the Hebrew and Chinese calendars. If the lengths of the lunation and tropical year are known accurately, it is possible to work out regular cycles which will, over a period of years, contain the right number of lunations. The Metonic cycle, a 19-year cycle of 235 lunar months, that is, 12 ordinary years and 7 embolismic years at years 3, 6, 8, 11, 14, 17, and 19, was discovered independently in Babylon, Greece, and China (Ronan 1984:156).

Another method is to use fewer than twelve lunar months which are named or counted, with some seasonal sign to mark when the first month should start. This leaves an uncounted period, typically in a season of low activity, in which an unobserved extra lunation, occurring before the start of the year proper, can function as a *de facto* intercalation (Nilsson 1920:240). The original Roman calendar seems to have

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[1] The point at which, in the northern hemisphere spring, the sun crosses the equator and the lengths of day and night are the same. In 2018 this is 20 March. Technically there is a more exact definition.

been of this type, with 10 lunar months ('Roman Republican calendar' n.d.)

Apart from these cases, how does one know when intercalation is necessary? One solution is to note whether seasonal phenomena occur at the wrong time in terms of the calendar. If there are too few months, the year drifts back with regard to the seasons, and seasonal phenomena will appear late in terms of the months in which they occur. If some regular event does not take place in the usual month, intercalation is necessary. Such regular events may be terrestrial seasonal phenomena such as a particular plant flowering, or an astronomical event such as a solstice. An example of simple seasonal intercalation is the system used by the Tao (or Yami) indigenous people of Taiwan. Using a lunar calendar, they go out fishing for flying fish around March. If the flying fish do not appear, they insert an extra month, thus bringing the calendar back into synchronization with the seasons ('Calendar' 2015).

Another possibility, however, is to base months on case-by-case observation. Martin Nilsson (1920:277) argues that in the absence of a mathematical system the most common arrangement is for months to be named according to the observed seasonal phenomena, with adjustment being 'crudely empirical', that is, by occasionally naming a month out of sequence (normally skipping or repeating a month) in order to fit the observations. This can apply to both 12 and 13 month systems. In a thirteen-month system, it will periodically seem from observations that immediately after month *n*, it must already be month *n+2*. In a twelve-month calendar a month might be repeated, but there need not be any *regular* intercalary month. Evans-Pritchard (1939:199) stated of the Nuer people of South Sudan that '[A]ll the Nuer have to do to keep each month in its fixed seasonal position is to change the name of the month they thought it was to the month it must be'. This has tended to be the favoured explanation of African calendars (but *cf.* Randles 1974:276).

It has been argued that some societies have a concept of a year as being twelve lunar months, in which intercalations or out-of-sequence months are perceived as *corrections* rather than adjustments. In an influential article on the calendar of the Mursi of Ethiopia, David Turton and Clive Ruggles (1978) found that the Mursi live with ongoing disagreement about the correct month, but that this is always resolved retrospectively. 'This agreement to disagree, with retrospective resolution... means that lunations can be kept in step with the solar year, and thus with the passage of the seasons, without the Mursi's having to be conscious that their *bergu* [year] can sometimes contain 12 lunations and sometimes 13' (Turton and Ruggles 1978:589). Thus disagreement is not a failing but a part of the system. In a comparable but not identical system, the Fais Islanders of Micronesia use twelve lunar months and resolve the error periodically by repeating a month in what is perceived as 'an ad hoc correction of what is assumed to be a miscount of the lunar months' (Rubinstein 1979:174). Junod (1913:II.282) states that the Tonga did not distinguish the solar year from the set of lunar months.

What was new in Turton and Ruggles's model was the role of disagreement in allowing the year to be conceptualized as always containing the same 12 months. If this is not necessary, the simple case-by-case observation model is sufficient. In Setswana culture there would perhaps have been less concern about the number of months, since there was traditionally a preference to enumerate rather than count. 'If an old woman is asked how many children she has, she will use her fingers and say "Eldest Sipho, next Bunga, next Masego", giving each finger a name without actually counting" (Lea 1989:143).

Principles of Astronomical Observations

The winter and summer solstices can be identified within a few days by observing sunrise from the same location every day. The point of sunrise will move along the horizon until it appears to stop for a few days at one or other extreme, which is the solstice (Malville and Putnam 1993). This 'horizontal calendar' was known in Southern Africa (Beyer 1919:207; Norton 1909:308) and among the Zulu the periods of apparent rest were known as the winter and summer 'houses' of the sun (Callaway 1870:395–6). Whether

the solstices had calendrical significance beyond marking winter and summer is unclear.

A wider variety of points in the tropical year can be noted by observing the position of stars, especially the *heliacal rising* of particular stars. The position of the sun in relation to the fixed stars moves eastward by about one degree per day, which is why the night sky changes over the course of the year. To put it another way, the stars are overtaking the sun by this amount, and thus at a certain point a star which has been too close to the sun to be visible rises far enough ahead of it to be briefly visible before sunrise. (Over subsequent days it will be visible for more and more of the night.) This point is the heliacal rising.

Observation is complicated by two factors. Firstly, the day observed may vary slightly from the exact rising due to weather conditions. Secondly, a slow rotation in the orientation of the Earth's axis, known as the precession of the equinoxes, means that the heliacal rising gradually changes, with that of equatorial stars moving forward about one day per seventy years. Heliacal risings have been widely used across the world, for example by ancient Greek farmers (Hesiod *Works and Days* II.383–404). Less precise observations can be made by noting, for example, a star which is overhead when the sun has set.

Southern African Lunar Calendars

It is well-established that Bantu-speaking societies used calendars based on lunar months. Lists of either 12 or 13 months have been recorded for a number of societies (Lukusa 2005; Atkins 1988; Nilsson 1920:196–206) although the reliability of early European accounts is hard to assess (Nilsson 1920:249).

Modern Batswana use the Gregorian calendar, but the names of Setswana months have been assigned to the Gregorian months. (This may have confused traditions on the subject.) It is generally agreed that precolonial Batswana, like other peoples in the region, used lunar months and that there were 13 months (Lichtenstein 1815 appendix 2). The Setswana names are clearly seasonal in nature and so the calendar year must have been kept in approximate synchronisation with the tropical year. Similarly, the month-names must have been assigned to Gregorian months reasonably close to their original position. Dating the decline of the old calendar is difficult: in the case of Luba, where the process is ongoing, only old people know all the months but even young people continue to use some, such as the month of cicadas (Stephen Lukusa, personal communication, 19 October 2017). The Tonga months seem to have been disappearing at the beginning of the twentieth century (Junod 1913:II.284–5).

Early sources on Southern Africa seem to describe a complicated situation in which both sequence and the seasonal markers were important, but they do not make clear how the two were related. A further complication is that although the general principles appear to have been similar across the region, differences of detail could have had significant implications. For example, the choice of seasonal observations may lead to greater or lesser exactitude. To compare a different society, the New Zealand Māori calendar used a stellar observation for every month (Best 1922:17), but descriptions (evidently referring to different groups) include mention of an uncounted period, of terrestrial observations, of a thirteenth month whose name meant 'odd, in excess' and of the twelfth month specifically being frequently omitted (Best 1922:18–23; Roberts 2006:16–17; Nilsson 1920:211–12; Meredith 2006). This, combined with the apparent wide variation in month-names (Best 1922:15), indicates that intercalary mechanisms may have diverged (Best 1922:9–10, 17). This example suggests that caution is necessary in generalizing conclusions.

Table 1 is taken from Andrew Clegg (1986:36), modified by adding data from Stephen Lukusa's 2005 article and additional comments by Thapelo Otlogetswe (email communication 27 January 2017). Clegg gives 15 names and Lukusa 12. It should be noted that Clegg's methodology was based on the use of students collecting data by questionnaire from elders and so he was not able to directly interview informants. In Table 1 below the 'English' column indicates the Gregorian month to which the name is now applied:

Table 1: Setswana months with meanings

Setswana	English	Meaning (Clegg)	Meaning (Lukusa)	Meaning (Otlogetswe)
Hirikong	January	Where the two years meet.	Doves collect twigs for nests	As Lukusa.
Molomo	January	Kwedi ea molomo, first fruit taste of the year.	[name missing]	Name is archaic; refers to the old first-fruits ceremony. (See Schapera 1971, p. 67)
Tlhakole	February	Motlhakole, berries ripe.	Leaves of Motlhakole green	Mabele a tlhakola mmudula, the grains are shedding their covers
Mopitlwe	March	Mabele a a pitla, sorghum ripens.	as Clegg	'Mabele a a pitla' or 'Mabele a a pitlagana'. The grains are crowding
Moranang	April	Moranang wa hawa, beans ripen.	as Clegg	Hawa should read nawa.
Motsheganong	May	Laugh at the birds—because the sorghum grain is too hard for them to eat.	as Clegg	As Clegg
Seetebosigo	June	Visit at night, because mornings are too cold, or, alternatively, do not visit at night because it is too cold.	Don't visit at night	As Lukusa
Phukwe	July	Cold wind.	Leafless trees start budding	As Lukusa
Phatwe	August	Cracking in wood. Interpreted either as the period when wood 'cracks' to produce green leaves, or as a warning to woodcarvers that it is difficult to tell the difference between dead and live wood, Hence carvings may crack if live, unseasoned, wood is used.	Strong winds strip leaves from trees	As Clegg
Lwetse	September	Lwaa—sickness. The clouds moving up and down are said to be sick. An alternative explanation is that this is the month when disease is common.	As Clegg	Go lwala (to be sick) has idiomatic sense of pregnancy. Clouds are pregnant with rain.
Phalane	October	The Impala give birth.	As Clegg. But also called *Mosetlha*	Not Mosetlha
Ngwanatsele	November	Even the children have plenty to eat.	Children help themselves due to abundance of berries	As Lukusa
Mosetlha	November	The Mosetlha tree blossoms.	[name missing]	As Clegg

Sedimonthole	December	The end of the year.	Ancestors get this load off my head (also *Sedimonthole wa Morula* with reference to morula fruit)	Squash is ripe but since this period comes before Molomo (first fruits ceremony, in which kgosi has to sample the first fruit before everybody else) people would smuggle squash from the farms covered with small morula branches. On arrival home, one carrying the load would say 'Sedimo, nthole morula ke o', 'Please help me lift morula off my head' Sedimo here means 'motho wa Modimo' (person of God) an expression used in pleading, equivalent to 'Please'
Morule	December	Morula tree fruits.	[name missing]	

Clegg concluded that Hirikong and Sedimonthole were modern names since the meanings referred to the start of the year in January. However, Lukusa and Otlogetswe give different interpretations, and it seems that modern interpretations have been given to traditional names, a phenomenon Lukusa (2005:18) also found in explanations of a Silozi month-name around January.

I would suggest that the Setswana month-names can be divided into 'observation' names and 'comment' names. Observation names are those in which the name reflects an observation of a seasonal phenomenon, such as *Mosetlha* ('The *Mosetlha* tree blossoms'). Such phenomena could be used for determining whether the calendar had gone too far out of synchronisation. Comment names, on the other hand, do not refer to observations which could be used in this way, but are more in the nature of comments about the season. An example is 'Don't visit at night because of cold': although this does refer to the season, it is too general to constitute an observation point. In Table 2 below I have made a division on this basis (following Otlogetswe where opinions differ). Although *Sedimonthole* and *Molomo* refer to a ritual, its timing was determined by the ripeness of a crop, so they are observation names.

Table 2: Setswana months: observation and comment names

	OBSERVATION NAMES		**COMMENT NAMES**	
	Name	Meaning	Name	Meaning
1	Hirikong (January)	Doves collect twigs		
1A	Molomo (January)	First fruits ceremony		
2	Tlhakole (February)	Grains shed cover		
3	Mopitlwe (March)	Grains crowding		
4	Moranang (April)	Beans ripen		
5			Motsheganong (May)	Laugh at the birds, because the sorghum grain is too hard for them to eat.
6			Seetebosigo (June)	Don't visit at night, because of cold.
7	Phukwi (July)	Leafless trees start budding		

8			Phatwe (August)	Cracking in wood.
9			Lwetse (September)	Clouds pregnant with rain
10	Phalane (October)	The Impala give birth.		
11A			Ngwanatsele (November)	Even the children have plenty to eat.
11B	Mosetlha (November)	Mosetlha tree blossoms.		
12A	Sedimonthole (Dec.)	Please take this load off my head.		
12B	Morule (December)	Morula tree fruits.		

It will be noted that the names seem to divide into a series of observation names suitable for identifying synchronisation, followed in the cold season by a series of mainly comment names. *Ngwanatsele* is marginal, and *Phukwe* may be either depending on whether Clegg or Lukusa is followed. The comment names fall mainly in winter, when there are fewer possible observations and perhaps fewer occasions when precise timing is necessary. Such a period of relatively unimportant month-names may be akin to the uncounted interval in some calendars.

By this analysis, the need to intercalate would become visible through a series of observations. It is interesting to note that the run of observation names (October to April) matches the period during which almost all rain normally falls (Schapera 1971:11), with rainmaking particularly focused on the period between September and November (Shillington 1994:222). This could have suggested the period as a suitable one for calendrical correction—as the months regressed the rainy season would start later in terms of the months, a fairly dramatic effect in Botswana. Also, of course, the rainy season naturally produces more seasonal markers.

Names may have changed over time. As has been noted, *Molomo* lost currency when the ritual to which it referred fell out of use. Isaac Schapera (1971:65n2) notes that elderly Bakgatla-ba-Kgafela in Botswana maintained that before the introduction of the plough women began to hoe in *Phatwe* and rain fell earlier, and he speculated that this referred to the Bakgatla's earlier location in the Transvaal. Climate change is also possible. Assuming there is something more than nostalgia involved, however, such changes might impact on month-names.

Lukusa also analysed month-names in Luba (Democratic Republic of Congo) and Silozi (mainly Zambia) (Table 3). An important observation is that, unlike in Southern Africa, the start and end of Luba months may depend on the observed phenomena rather than a New Moon (Stephen Lukusa, personal communication, 19 October 2017; Mbiti 1969). The number of months indicates that they do however remain linked to lunations, possibly as part of a number of interlocking observations (for example, women observe the full moon to track menstrual cycles) (Stephen Lukusa, personal communication, 19 October 2017). The same pattern of a division into observation and comment names is visible, clearly in Silozi and less so in Luba, though the details reflect the different environment. In Lukusa's (2005) tables lunar months are numbered from the approximate position of January, a convention I have followed here and in other cases.

Table 3: Luba and Silozi observation and comment names

	LUBA	**LUBA**		**SILOZI**	**SILOZI**
	Observation names	Comment names		Observation names	Comment names
1	Drought		1	Children defecate on the path because they eat too much (food plentiful)	
2	Many edible caterpillars		2	Fish seen swimming in small pools	
3		Gather hoes ready for cultivation	3	Flood waters	
4		Distribute hoes (field work)	4	River waters seem still, after flood	
5	First maize harvest		5	Dry patches as flood water recedes	
6		Start of dry season	6	Days change	
7		Dry season: cool winds	7		Little sun
8		Hyenas of cold (coldest period)	8		Strong winds
9		Female hyena (possibly because not as cold as 8.)	9		Big sun (explained as sharp sunlight)
10	Cicadas		10		Sun and rain go together
11	Winged termites are too young		11		Small cultivation (probably meaning stores have run out)
12	Termite larvae harvested prematurely (because of lack of food)		12	Winged termites (not eaten by Lozi, unlike Luba)	
13	Many winged termites		13		*Odd or short moon* (see below)

Source: Lukusa (2005:17–19), summarized and divided into types by this author.

Two points of the Silozi list are particularly interesting. Cycle 6 (Mbuwana), meaning 'days change', is explained by Lukusa as 'the days change because of occasional clouds' (Lukusa 2005:18). However, he also notes that it is the time of the winter solstice. This would be another possible meaning, and if so would indicate an astronomical marker. Cycle 13 is Sikwetikweti:

> A short lunar month added to December. The reduplicated form [kweti-kweti] (from [kweti]/[kweli] which means 'moon') carries the implication of oddness or shortness, and there is a lot of confusion around this lunar cycle. People wonder when exactly it occurs, whether it actually does occur, and also whether it should be seen as occurring at the end of the year or the beginning (Lukusa 2005:19).

This could possibly be some type of intercalary month. It is unclear why it is described as a 'short' month, unless it is one of those months that need not actually start and end at New Moon. The sense of 'oddness' would be obvious, and the confusion about when and whether it occurs is consistent with a month which occurs only when adjustment is necessary.

Sikwetikweti, however, comes *before* the series of observation names, so could not have been intercalated on the mechanism suggested. However, Lukusa's informants expressed doubts about the calendar, and there is a complication in that Silozi derives from a merger of Sekololo and the non-Sotho language Luyana, as a result of the conquest of Luyana-speakers by the Sotho-Tswana Makololo. Although it is now a Sotho-Tswana language, the month-names derive from Luyana and so the calendar may not be closely related to the Setswana case. Furthermore, their sense is obscure to modern speakers (Lukusa 2005:18).

An important question in each case is whether there was an identified intercalary month (including the case of an explicitly repeated month), or whether the calendar simply used month-by-month determination. If there was an identified adjustment point, this would I suggest probably follow a period of seasonal observations. However, the situation is complicated by the fact that some alternative month-names, which may have been regional variations, also existed (B.L. Janie, personal communication, 11 November 2015). In fact, it seems likely that month-names varied considerably. Justinus Sechefo, a Mosotho convert (1909) and G. Beyer (probably Gottfried Beyer, Berlin Missionary Society) (1919:208) give almost completely different lists of Sesotho months. Beyer includes possible observation names at 1, 2, 5, 8, and 12, while in Sechefo's list only 11 and 12 seem likely.

Lichtenstein (1815 appendix 2) states that some of the months 'were named after certain colours'. These variations raise questions about the standard modern Setswana names; that is, whether and how one list rather than others was adapted for the Gregorian months, if indeed it is a single list rather than a conflation. If lists were conflated, then analysis of the mechanisms is harder. It is notable that in New Zealand a standard set of Māori month-names was assigned to the Gregorian months (previously known by transliterations of English) by *Te Taura Whiri i te Reo Māori* (the Māori Language Commission) in 1990, using a list which a Māori traditional expert had explained to an ethnographer (Meredith 2006) although many other different Māori lists existed. Research may be able to establish how the standard Setswana list was established.

The Zulu case is better understood than most, partly because it was still in use when it impinged on relations with colonial government and employers. Keletso Atkins has shown how Zulu employees interpreted a 'month' in employment in lunar terms, leading to serious conflict with employers when they were not paid after 28 days. The Zulu used tally sticks to count days (Atkins 1993:80).

Clement Doke's list (1988:369–70) of 13 Zulu month-names includes possible observation names at 1, 2, 5, 8, 10, 11, and 12. For the Zulu calendar at least two slightly different accounts exist. Keith Snedegar (1998) states that the lunar calendar was checked by a number of natural signs, including the nesting season of the Black-Shouldered Kite (*Ncwaba*, August), the River Willow flowering (*Mfumfu*, October), and the heliacal rising of Pleiades (*Nhlangula*, June). About every three years (when the error approximates to a month) there would be argument about the correct month, which would be settled by popular consensus rather than by royal diktat. Snedegar (1998) and Thebe Rodney Medupe (2015) relate this to Turton and Ruggles's (1978) model of the Mursi calendar. The process does suggest a concept of the correct month being *discovered* rather than *designated*. However, the dispute was not continual as with the Mursi but seemed to arise especially when a discrepancy appeared. The extra month, to which Snedegar refers as a 'period of uncertainty', was sometimes known as *Ndid'amDoda*, the 'month that puzzles people'. This bears a striking resemblance to the 'odd' month Sikwetikweti in the Silozi calendar.

James Macdonald, a Scottish Free Kirk missionary, states:

> The beginning of a new year is determined by the budding of certain trees and shrubs, after which spring operations commence. They calculate only twelve lunar months for the year, for which they have descriptive names, and this results in frequent confusion and difference of opinion as to which

> month it really is. The confusion is always rectified by the first appearance of Pleiades just before sunrise, and a fresh start is made and things go smoothly till once more the moons get out of place, and reference has again to be made to the stars (Macdonald 1890:194-195).

This implies that the Pleiades provided a much more definitive reset. There are other examples in Southern Africa of the Pleiades as a month marker, including a Khoikhoi example (Nilsson 1920:197). It is apparent that Zulu month-names were at least sometimes *definitions* of the seasonal markers. It seems reasonable to assume that this pattern applied also to Setswana months.

Astronomical Observations in Southern Africa

A number of astronomical observations were made in the region (Campbell 1815:426). Two astronomical observations which are well-attested throughout the region are the heliacal risings of the Pleiades (*Selemela* in Setswana) and of Canopus. Some sources have suggested alternative identifications for the latter, but Snedegar (1995:531) gives convincing arguments that it must be Canopus. A tradition is recorded among several societies of keeping watch for the rising of Canopus (Snedegar 1995:531), which in Southern Botswana would be in early June (Hearnshaw 2016).[2] In some cases a prize was awarded for the first sighting (Beyer 1919:209 and Snedegar 1995:531). For Sotho-Tswana groups it was *Naka*. In at least some cases it was connected to male initiation and rainmaking (Snedegar 1995), though in Botswana the date of initiation varied widely across autumn and winter (Morton 2011:40n5 and *cf.* Breutz 1941:60). By some accounts its rising marked the start of a new year among Sotho-Tswana groups (Beyer 1919:209; Kidd 1904:320), though a 1909 account by Sechefo states that the year began with *Phato*, circa August (Sechefo 1909:933). Confusingly, Beyer (1919) states that *Phato* is January. Unfortunately Sechefo did not discuss intercalation.

Over a wide area of Africa the Pleiades were connected to the time of cultivation (Hirschberg 1929). Names refer to preparation for cultivation. In Setswana *Selemela* means 'the one that cultivates for', apparently abbreviating a fuller expression found for example in Luba (*Cidimina-nzaji*), 'the one that cultivates in preparation for thunder [storms]' (Stephen Lukusa, email communication, 23 October 2017), but information is inconsistent. Some sources (Snedegar 1995:533 and Beyer 1925:210) have referred to their rising as indicating the start of cultivation, but this does not seem to match the Southern African agricultural season: in Serowe in 1875 it would have been 7 June (Hearnshaw 2016). A possible explanation is that the observation point was moved from the rising as peoples migrated. Henry Callaway (1870:397) quotes a Zulu informant as saying that 'and Isilimela (the Pleiades) dies, and is not seen. It is not seen in winter; and at last, when the winter is coming to an end, it begins to appear—one of its stars first, and then three, until going on increasing it becomes a cluster of stars, and is perfectly clear when the sun is about to rise. And we say Isilimela is renewed, and so we begin to dig'.

This is, however, ambiguous. 'Perfectly clear' might refer to a point later than the heliacal rising. Snedegar (1995:533) suggests that this was meant to refer to rising late at night: 'From Zululand, men retiring late after a drinking-party can see the Pleiades rising at midnight toward the beginning of September'. A manual for Zulu court interpreters states that they 'may be observed in the early morning during the month of August', appearing 'when ploughing begins' (Rudolph n.d.:48). William Norton, an Anglican missionary (1909:307), states that the rising of *Selemela* 'warns the early-rising farmer that

2 The heliacal rising of Canopus at the site of modern Gaborone in 1875 was 1 June, and at the site of modern Serowe it was 5 June. Dr John Hearnshaw notes (email 22 October 2016): 'For the Pleiades I took helical rising to mean that the Pleiades is 15 degrees above the E horizon at sunrise. Because the Pleiades has an azimuth at sunrise similar to that of the Sun, its altitude would need to be greater than that of Canopus, which is a long way south of the Sun. Also Canopus is very bright, more so than any of the Pleiades stars, so can be seen closer to the horizon at dawn'.

ploughing-time is at hand'. George McCall Theal (1901:418) states that 'the planting season' was marked by the Pleiades rising 'shortly after *sunset*' (emphasis added). In Serowe in 1875 this would be 20 November (Hearnshaw 2016).

Clegg states (1986:35; see also Lea 1989:144–5) that when *Selemela* is 'overhead in the evening, it is time to plough' which might mean being overhead when the stars become visible after sunset. In fact the Pleiades can never be directly overhead in Botswana, but from Serowe in 1875 they reached their culmination (maximum altitude) at sunset on 4 February (Hearnshaw 2016). Robert Moffat (1843:229) unhelpfully recorded only that among the Batswana cultivation began 'when this constellation assumes a certain position in the heavens'. Sechefo (1909:931) mentions use of the Pleiades' 'position, time of rising and setting'. Although he gives no details, this indicates that there were multiple observations of the Pleiades, which may explain the confused records.

Clegg gives a total of nineteen stellar observations, though in many cases he could identify the stars, if at all, only tentatively. The following are the cases in which there is a clear seasonal observation:

Table 4: Setswana stellar seasonal observations

Selemela	Pleiades	An important group. When overhead in the evening, it is time to plough.
Naka	Canopus (Argo)	Winds will soon start to blow and the trees will lose their leaves. Time to put the sheep to the ram.
Serogabolo	Betelgeuse? (Orion)	When vertically above in the evening, rain is due.
Magakgala	Antares (Scorpio)? Spica (Virgo)	When visible in the early evening, the corn should be harvested.
Tshobego	Unidentified.	A southern star visible in winter. Plants will die when it appears.

Source: Clegg (1986:35)

Clegg (1986:35) states without explanation that Canopus marks the start of winter, which would fit its rising at the start of June, while for some observations data such as 'When vertically above in the evening' is given. This may suggest that in tradition the mention of a star without explanation means by default its rising, but as data was lost this is unlikely to be a safe rule. Breutz (1941:14) states that stars were important, but does not elaborate.

In the case of the Setswana calendar, astronomical observations do not seem to be recorded as month-markers, and may have been treated as an independent system. However, the use of multiple astronomical markers suggests there would probably be some awareness of a relationship, especially since it is known that the days of a lunation were counted at least by the Zulu (Atkins 1993:80) and that Khoikhoi sometimes counted months by notches on a stick (Lichtenstein 1815:72).

From a modern viewpoint, astronomical observations provide a more accurate determination of time than months based on terrestrial seasonal observations. Thus the modern scholar may consider that the calendar would have been improved by making astronomical observations the key. However, the two probably served different purposes. Terrestrial observations were important in themselves. Also, although astronomical observations gave useful indications as to the appropriate times for agricultural activities, they could not be decisive. For example, although the Pleiades could indicate the digging season, the actual decision to begin would depend on precise local conditions, and in Setswana tradition was announced by the chief.

Month Designation and Intercalation

Analyses of Southern African calendars have tended to refer to Turton and Ruggles's (1978) model of intercalation (Snedegar 1998:38 and Medupe 2015:1033). However, this seems problematic. The point of the Mursi system is that adjustment is made without recognizing a break in sequence (Turton and Ruggles 1978:589). Southern African calendars however seem to have recognized adjustment in some cases. The Silozi and Zulu cases seem to point to a differentiated thirteenth month, which at least in the Silozi calendar seems to have a defined place in the sequence.

William Alfred Norton, an Anglican missionary and scholar who was later the first Professor of Bantu Philology at the University of Cape Town ('Obituary' 1962), stated that among the Basotho 'It is said that though much doubt often arises about the exact name of the current moon, they have no name for the thirteenth moon' and apparently no process for intercalation (Norton 1909:308). This may indicate a month-by-month model for the Sesotho calendar and is consistent, as far as it goes, with Sechefo.

Clegg (1986:37) concluded that in the Setswana calendar 'the length of some years is twelve lunar months and in others is thirteen' but did not suggest a mechanism. A difficulty is caused by the uncertainty as to the significance and use of the lunar months in Setswana culture. In Nguni culture some important rituals were fixed by moons (Snedegar 1998, see also Junod 1912:I.51 for 'presentation' of a child to the moon among the Tonga), but evidence is lacking for this in the Setswana case. It was noted by missionaries that at New Moon there was dancing (Mackenzie 1871:473; Campbell 1815:170) and that on the day following no cultivation was done (Livingstone 1857:235 and Kidd 1904:109; Rudolph n.d 50 and Junod 1913:II.283), but it does not seem that the lunar calendar had the sort of significance which in Nguni societies preserved it for a while after Gregorian months had replaced it for farming purposes. Junod's (1913:II.285) interesting observation that missionary attempts to revive the Tonga names were met with indifference may suggest either that the Gregorian calendar had cultural prestige or that farmers simply found it more practical.

Conclusion

The evidence is at present inconclusive, but seems to point to Southern African calendars falling between month-by-month naming and the model of explicit intercalation. The Zulu and Silozi calendars seem to have had a form of intercalary month, whereas Sesotho practice probably used simple month-by-month naming, though caution is needed. Where the Setswana calendar should be placed on the continuum is unclear, but the names suggest a period of concentrated observation, which may be linked to a typical adjustment period. Some use of the winter as a quasi-uncounted interval should also be considered as a possibility.

Variations existed in month-names and in the expected seasonal observations. Calendrical observations included seasonal phenomena named in surviving month-names, but probably also other phenomena known in separate traditions which may now be lost. A number of astronomical observations were a part of the total calendar, especially the heliacal rising of Canopus and observations of the Pleiades, but also including other stellar observations, and solstices. Evidence is lacking as to their role if any in intercalation by the Batswana. It is known however that the Pleiades were used as a month marker by the Zulu, and it thus seems likely that there would have been some link.

Acknowledgements

I am very grateful to Dr John Hearnshaw, University of Canterbury, New Zealand, for astronomical calculations cited in this paper. Thanks are also due to Benjamin Janie, Stephen Lukusa, and Thapelo Otlogetswe for their generous assistance. However they should not be blamed for my mistakes or misinterpretations.

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