IRREGULAR DATING IN LAN NA: AN ANOMALY RESOLVED

J. C. Eade

Abstract

A large number of Lan Na records from the Chulasakarat 850s (1490s AD) appear to be disrupted when considered in isolation. And there are so many exhibiting the same "error" (a one-day difference in reckoning) that one suspects there may be a single reason for it. Since the geographic range of these inscriptions argues against it being a local idiosyncrasy, one looks to the system used to determine the calendar—and there indeed is an explanation, since a rule governing how the calendar was to be organised was (legitimately) broken for the first time in the Era. An explanation is given of what was involved, as a preliminary to a table showing which inscriptions accommodated the rare event and which did not. Appendices deal also with three inscriptions that involve difficulties of another kind.

There was an unusual amount of inscriptional activity in Lan Na in the Chulasakarat 850s (from the late 1480s AD) and the inscriptions are of particular interest from one aspect, in that while many of the dates appear to be irregular when considered in isolation and judged against the norm of reckoning, when viewed together many are found to have a common basis. Indeed, the explanation for their apparent irregularity allows us to categorise them as exhibiting a difference in common rather than an error in common.

The technicalities that allow us to gain a clear picture of the situation involve initially the way in which the civil days in the calendar relate to the lunar days of waxing and waning.

Just as with the years, a series of ten words and a series of twelve were paired together. The ten-series is :

กาบ ดับ รวย เมือง เปิก กัด กด ร้วง เต่า กา

The twelve-series is:

ใจ้ เป้า ยี หม้า สี ใส้ สะง้า เม็ด สั้น เร้า เส็ด ใค้

The combinations are limited to 60 since only odd with odd and even with even are allowed; but the sixty pairs are themselves combined with the weekday, so that a

complete cycle, from Sunday *kaap cai* to Saturday *kai khai*, runs to 420 days and no combination can appear twice in a year. Both the cyclic pairs and the weekdays tie in directly with the *ahargana* (elapsed days in the era), which gives them a fixed and secure relation to a given date. This means, too, that they have a correspondence with a Western date, as having the day of the week in common. But it is not also the case with luni-solar calendars that a given Western date must have one single lunar date answering to it. There was, for instance, a rule in Thailand that if a lunar year had an extra month, it could not also have an extra day; whereas in Burma a lunar year could have an extra day only if it also had an extra month. Thus the Thai lunar calendar could differ for much of the time from the Burmese lunar calendar and both would not necessarily be in agreement with Indian reckoning.[1]

These potential differences make it necessary to be on the alert for what are genuine differences in reckoning as opposed to seeming or palpable errors in the record. And it is essential to have clear and dependable benchmarks by which to assess what was the norm for a given system. In this regard the Northern Thai inscriptions are particularly useful, since they contain as standard elements extra information that in one sense is redundant but in a more important sense is invaluable, because all these "superfluous" elements (anything beyond day-month-year) must constitute a coherent whole and so serve as checks upon one another. A rogue element is one that cannot simultaneously be true if the other elements in a record hold good and combine to tell against it.

The apparent problem with some of the Lan Na dates from CS 850 onwards is that they consistently appear to be running one day out by standard reckoning.

The anomaly can be seen in inscription Phayao 6. It contains the date 3 waxing *Asvina* of CS 855. The stone also exhibits a *duang chata* (horoscope) flanked by two numbers that have been variously read: *Silpakorn* (17.4; repeated *in Prachum Charuk Müng Phayao*[2] deciphered 10457 and 31466 (5 digits); *Lanna Inscriptions*[3] detected 10457 and 312465 (correctly, and with 6 digits). This latter, the *ahargana*, combines with the *nakshatra (rksa)* specified as *Citra*, to make it plain that Friday, 13 September 1493 is intended. But it is also clear on the stone that the day is labelled "3" waxing, and by standard reckoning 3 waxing comes to Saturday, 14 September, the next day. This one-day difference is evident not only by reference to the benchmark one uses to check the dates, but also by contrast to a

[1] The primary difference between Indian modes and Southeast Asian modes was that in India adjustments to the lunar calendar were made as they fell due, whereas in Southeast Asia adjustments were made only at fixed points.

[2] *Prachum Charuk Müng Phayao: Inscriptional History of Phayao*, [Bangkok, 1995], p. 136.

[3] *Lanna Inscriptions, Part I: Inscriptions from Chiang Rai, Nan, Phayao, and Phrae*. 2 vols, James Thompson Foundation, Bangkok, 1991, p. 111.

number of records from the same time and region that do not exhibit the one-day lag. The task, then, is to find a reason, perhaps geographic and in any case systematic, to explain the anomaly. And as it happens a convincing explanation does comes to hand, one that involves an event of very rare occurrence, not encountered up to this date in the Thai system of reckoning.

To understand what was involved it is necessary to examine the system by which the chief problem inherent in a luni-solar calendar was handled. We can say in round terms, sufficient to make the problem visible, that a solar year has 365.25 days in it and a lunar year normally has 354 days in it (12 times 29.5 days, distributed as alternate months of 29 and 30 days). Again in round terms, this means that the lunar year falls 11 days short of the solar year, so some means has to be found to make up the shortfall. This is where intercalation comes into play. The solution was to divide the years up into blocks of 19 years and 57 (3 times 19) years. In this longer span there would be 20819 solar days, but if every lunar year had only 354 days, there would be only 20178 lunar days in the same length of time.[4] The lunar calendar would therefore be a massive 641 days behind. The solution was to find a way of inserting 641 extra days into the lunar calendar, in a manner similar to our needing, on a much lesser scale, to give February an extra day once every four years. Clearly with a number this large the backlog of 641 days could be substantially cleared by inserting entire lunar months into the reckoning (of 30 days each in a second *Ashadha* month); and it was found that the frequency needed to be 7 extra months in every 19 years, amounting to 21 extra months in every 57 years, or 630 days in all. This left a remainder of 11 days still be to be found, and this gap was taken up by adding an extra day, on the frequency of 11 in 57, to the month of *Jyestha,* which then would contain 30 days rather than its normal 29.[5]

There was a fixed pattern at any one time for the insertion of these extra months such that, for instance, some Northern Thai MS calendars from the nineteenth century routinely record the year's เศษ (remainder), i.e. its value modulo 19 that indicates whether or not this is an *adhikamas* year. It would be such if the remainder answered to years 2, 4, 7, 10, 12, 15, 18 in the given block. The problem of tabulating the years that were *adhikawan* was more complicated, partly because

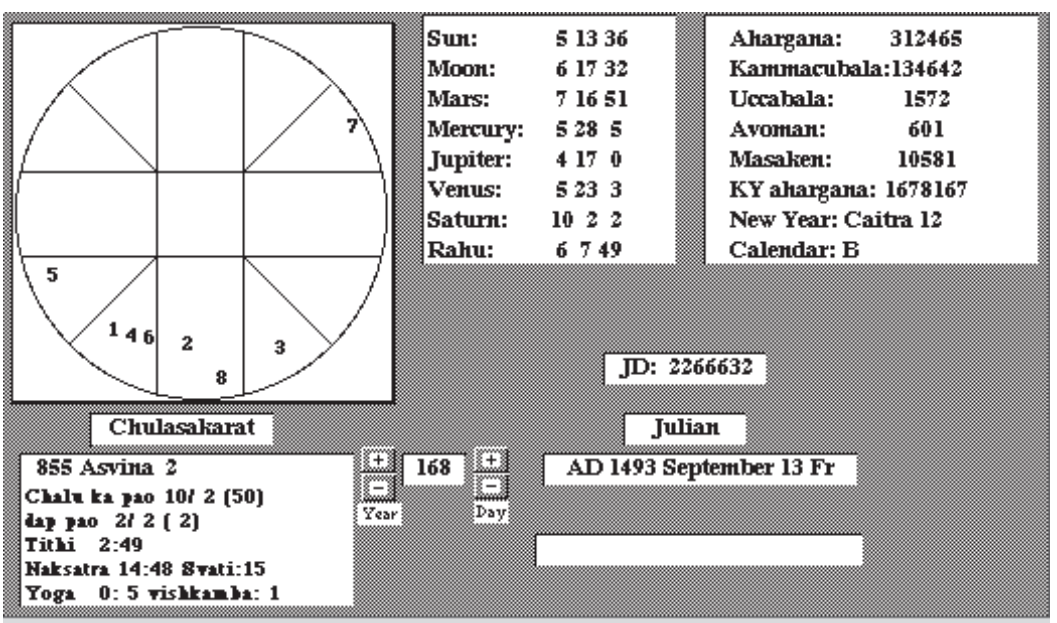
[4] The lunar days in this context are not "tithi", which Southeast Asia largely ignored, but successions of waxing and waning days in the month (measured in fact as "nights").

[5] Since it was the lunar months that governed the year, it could be said in more general terms that the overall objective was to prevent the lunar months from falling by degrees out of step with the seasons. It is an unresolved problem why, as will be seen later, what is now geographically Thailand variously adopted three different months to be called their first month, ranging from September to November. Some consider that the reason must be agricultural.

two lots of four and one of only three were required, and since they had to be interspersed evenly between the *adhikamas* years this left many alternatives open.[6]

Of course there were more technical ways of determining intercalary position, which involved examining the values of two of the five elements that give a year its profile.

If we use inscription Phayao 6 as an example, we find as follows (planetary position here is exactly the same as on the stone):[7]



The two numeric values already mentioned as being recorded on the stone are (or were intended to be) the *ahargana* and the *masaken*; and the two numbers that would indicate whether or not the year is *adhikawan* (called calendar "B" in the table below) are the *kammacabala* and the *uccabala*. It was their value on astronomical New Year's Day that counted, and it so happened that in this year the two numbers were, respectively, 242 and 137.[8] One of the rules generating an

[6] In the nineteenth-century MS calendars there is a definite pattern, running on occasion counter to the position theory would determine, but the distribution adopted is by no means the only feasible solution despite the constraints that symmetry imposes.

[7] The diagram was generated solely by giving our computer program "SEAC" the three values 855-asvina-2. It can be downloaded at larsg@thep.lu.se.

[8] This can in fact be deduced. It will be seen that the number of days into the year is 168. Now, the *kammacabala* increases by 800 units per day, where 800 * 168 is 134400. If the current value is 134642 it must therefore have begun at 242. The *avoman* increases by 11 units per day up to 692=0, where 137 + (168 *11) - (692*2) = 601 as required.

adhikawan year was that the *avoman* had to be 137 or less, and this condition was satisfied by CS 855. But remarkably, for the first time in the CS Era this value generated a twelfth *adhikawan* year in its block of 57 years. Now, any person using a mnemonic or a rule of thumb similar to the remainder value for the *adhikamas* years would miss this unique event; and even those who saw that the *avoman* value was indeed 137 could well imagine that something was wrong with the supposed rule.

The consequence of missing this extra day falling at the end of *Jyestha* would be as follows:

	with *adhikawan*:	without *adhikawan*:
Thur *kaa sai*	*Jyestha* 29	*Jyestha* 29
Fri *kaap sanga*	*Jyestha* 30	*Ashadha* 1
Sat *dap met*	*Ashadha* 1	*Ashadha* 2

The failure to register the extra day would cause the reckoning to fall one day behind the norm, which would be emphasised by the cyclic day combination being also in arrears (a valuable check). And it is this one-day default that most, though not quite all, the Lan Na inscriptions that do not conform to expectation exhibit.

Before the list of dates is presented there is one other technicality requiring consideration. This involves the Thai habit of using numbers in preference to Sanskrit names for the lunar months. If we consider *Caitra* as being the start of the month sequence, its numeric equivalent in the South is 5, in the North it is primarily 7, but in parts of the North it is 6. Some Northern records give both a number and a name, which makes the given system clear, and it is also sometimes revealed by the numeral for the intercalary month *Ashadha*, which may appear as 88, 99, or 1010. Finding a designation for these three systems is unexpectedly complicated: my own solution has been to designate them by the places with which, in Thailand, they can be associated: Sukhothai (Skth), Keng Tung (KT) and Chiang Mai (ChM).[9]

In the period commencing in CS 855 the one-day dislocation prevailed: of the first 26 inscriptions listed below, only 8 conform to theory and so imply that the extra day has been included; but of the last 11 inscriptions, none fails to conform to theory.

[9] There is, to my eye, no clear grouping of the inscriptions that recognised the extra day with either region or the numeric style of the lunar month.

Dates that comply with the theoretical computation and observe the extra day do not have a weekday entry under their Western date (col. 4).[10]

cycles complete / year in cycle	lunar date (1 waxing = 16, etc.)	weekday / cyclic day	Western date	year type[11]	place[12]
44:18	854 *Vaisakha* 3: *visakha duan* 7 (KT)	Friday *kaa rao* (10)	1492 Mar 30	C	Chiang Mai Wat Tapotharam
44:18	854 *Karttika* 27: *duan yi* (ChM)	Friday *kaap cai* (1)	1492 Nov 16	C	Phayao 4 Wat Wisuttharam
44:19	855 *Asvina duan* 12 (KT)	Friday *dap plao* (2)	1493 Sep 13 Sat *rawai yi* (3)	B	Phayao 6 Wat Nang Mun
45:1	856 Asvina 12: *hura duan 11, Thai duan chieng* (Skth / ChM)	Appendix A		A	Phayao 26 *Wat Aram Pa Noi*
45:2	857 *Jyestha* 8: *jyestha, duan* 9 (ChM)	Appendix B		C	Phayao 27 Wat Li
45:2	857 *Sravana* 9: *hura duan 9. duan 10, Thai duan 11* (!)	Friday *ruang mao*	1495 Jul 31	C	Phayao 7 ? Wat Aram Pa Ya
45:2	857 *Sravana* 15: *duan 11* (ChM)	Wednesday *rawai san* (33)	1495 Aug 6 Thursday *müng rao* (34)	C	Chiang Rai 2 (1st) Muang
45:2	857 Pausha 1: pusya, Thai duan si (ChM)	Wednesday *kat rao* (46)	1495 Dec 17 Thursday kot set (47)	C	Phayao 39 Wat Choi Sae
45.2	857 *Pausha* 13: *duan 4* (ChM)	Monday *ruang rao* (58)	1495 Dec 29 Tuesday *tao set* (59)	C	Chiang Rai 2 (2nd) Muang
45:3	858 Caitra 16: *citra, Thai duan 7* (ChM)	Tuesday kaa sai (30)	1496 Mar 30 Wednesday *kaap anga* (31)	A	Chiang Mai Wat Rang Ban Nongnamthung

[10] It is of course possible that some of the dates that follow contain a local error and not a systematic difference; on the whole, however, the dates contain ancillary data that increase their verifiability.

[11] Years that are normal are here designated A; years with an extra day are B; and years with an extra month are C.

[12] Places are given according to those assigned by the various editions.

cycles complete / year in cycle	lunar date (1 waxing = 16, etc.)	weekday / cyclic day	Western date	year type[11]	place[12]
45:3	858 *Jyestha* 2 *duan 8* (KT)	Friday *pæk yi* (15)	1496 May 14 Saturday *kat mao* (16)	A	Lampang 6 Wat Ban Dan
45:3	858 *Jyestha* 16 *duan 9* (ChM)	Friday *tao si* (29)	1496 May 28 Saturday *kaa sai* (30)	A	Phayao 89 Wat Ban Pan
45. 3	858 *Ashadha* 18 *duan 10* (ChM)	Sunday *tao set* (59)	1496 June 28 Tuesday *kaa[p] cai* (1)	A	Chiang Rai 2 (3rd) Muang
45:3	858 *Sravana* 1 *duan 11* (ChM)	Sunday *rawai cai* (13)	1496 Jul 11 Monday *mæng pao* (14)	A	Chiang Mai 16 Wat Sri Bun Ruang
45:3	858 *Bhadrapada* 1 *duan 11* (KT)	Monday *dap sai* (42)	1496 Aug 9 Tuesday *rawai sanga* (43)	A	Chiang Saen Wat Prasat
45:3	858 *Margasirsha* 19 *duan 3* (ChM)	Wednesday *tao si* (29)	1496 Nov 24 Thursday *kaa sai* (30)	A	Lampang Wat Pa Bong
45:3	858 2 *Caitra* 10 *duan 6* (KT)	Sunday *ruang sai* (18)	1497 Mar 12 Monday *tao sanga* (19)	C	Lampang 2 (1st) Wat Phra Dhatu
45:4	859 *Bhadrapada* 11 *duan 10* (Skth)	Wednesday *kat mao* (16)	1497 Sep 7 Thursday *kot si* (17)	C	Phayao 8 Wat Pa Mai
45:4	859 *Margasirsha* 21 *duan 3* (Chm)	Thursday pœk sanga (55)	1497 Dec 15 Friday *kat met* (56)	C	Chiang Mai (Silapakorn, 14.5)
45:5	860 *Vaisakha* 27 *duan 7* (KT)	Wednesday *ruang mao* (28)	1498 May 17 Thursday *tao si* (29)	A	Lampang 2 (2nd) Wat Phra Dhatu
45:6	861 *Magha* 23 *duan 4* (KT)	Thursday pœk san (45)	1500 Jan 24 Friday *kat rao* (46)	B	Lampang 2 (3rd) Wat Phra Dhatu
45:7	862 1*Ashadha* 15 *duan 9* (KT)	Wednesday *mæng mao* (4)	1500 Jun 11 Thursday *pæk si* (5)	C	Nan 2 Wat Phra Koet
45:7	862 *Sravana* 5 *duan 10* (KT)	Friday *pæk sanga*	1500 Jul 31	C	Lamphun 26 Wat Mahabot

cycles complete / year in cycle	lunar date (1 waxing = 16, etc.)	weekday / cyclic day	Western date	year type[11]	place[12]
45:7	862 *Margasirsha* 15 *mikasira, Thai duan chieng* (Skth)	Appendix C		C	Lamphun 15 Wat Phra Dhatu Hariphunchai
45:7	862 *Magha* 2 *magha, Thai duan 3* (Skth.)	Wednesday *ruang kai* (48)	1501 Jan 21 Thursday *tao cai* (49)	C	Chiang Mai Wat Sri Suphan Aram (1st)
45:8	863 *Pausha* 9 *duan 3* (KT)	Friday *tao sanga* (19)	1501 Dec 18 Saturday *kaa met* (20)	A	Lampang 2 (4th) Wat Phra Dhatu
45:9	864 *Jyestha* 24 *duan 9* (ChM)	Monday [not given]	1502 May 30	A	Lamphun 19 Wat Phaya Ruang, Phayao
45:9	864 *Ashadha* 13 *duan 8* (Skth)	Thursday *kaa [met]* (20)	1502 June 17 Friday *kaap san* (21)	A	Chiang Mai Wat Sri Suphan Aram (2nd)
45:9	864 *Phalguna* 6 *duan 6* (ChM)	Wednesday *kaa rao*	1503 Feb 1	A	Chiang Rai 5 Wat Srisutthavasa (1st)
45:9	864 2 *Caitra* 15 *duan 7* (ChM)	Sunday *tao cai*	1503 Mar 12	A	Chiang Rai 5 Wat Srisutthavasa (2nd)
45:10	865 *Vaisakha* 4 *visakha, Thai duan 6* (Skth)	Thursday *kot sanga*	1503 Mar 30	C	Chiang Mai, Wat Sri Suphan Aram (3rd)
45:10	865 1 *Ashadha* 27 *duan 9* (KT)	Tuesday *tao si*	1503 Jun 20	C	Phayao 10 Wat Ban Don
45:10	865 *Pausha* 26 *duan 3* (KT)	Friday *pœk sanga*	1504 Jan 12	C	Lampang 2 (5th) Wat Phra Dhatu
45.11	no record			B	
45.12	no record			C	
45:13	868 *Asvina* 24 *duan chieng* (ChM)	Sunday *ruang pao*	1506 Oct 11	A	Lamphun 22 Wat Wisuttharam, Phayao
45:14	869 *Phalguna* 30 *duan 5* (KT)	Wednesday *pœk si*	1508 Mar 1	A	Lamphun 18 Weluwan-aram

cycles complete / year in cycle	lunar date (1 waxing = 16, etc.)	weekday / cyclic day	Western date	year type[11]	place[12]
45:15	870 *Sravana* 11 *duan 11* (ChM)	Monday *mœng met*	1508 Aug 7	C	Phayao 11 Wat Phu Po
45:16	871 *Ashadha* 11 *ashadha, duan 8* (Skth)	[Thursday] *tao san*	1509 June 28	B	Chiang Mai Wat Sri Suphan Aram (4)
45.17	no record			A	
45.18	no record			C	
45:19	874 *Ashadha* 17 *ashadha, duan 10* (ChM)	Wednesday *kot yi*	1512 June 30	A	Lamphun 34 Suwanna-aram
46:1	875 *Caitra* 23 *citra, Thai duan 7* (ChM)	Tuesday *tao set*	1513 Mar 29	B	Phayao 12 Wat Phra Koet

There are five dates in inscription Lampang 2, four of which (CS 858, 860, 861, 863) have not included the extra day, whereas the fifth (CS 865) has; similarly, Wat Sri Suphan Aram has four dates, two of which (CS 862, 864) do not include the extra day and two of which do include it (CS 865, 871). They have it in common to come back into line in their entry for CS 865.

It is difficult to see how a return to standard reckoning could have been achieved other than by edict or by general consultation and consensus. Those who employed theory could have assimilated the extra day without even realising that it was unusual; but those who followed the rule of thumb would not have in it any mechanism to accommodate an exception. In short, the error (or, more neutrally, the difference) in reckoning would not simply correct itself.

We have the evidence of the *Padaeng Chronicle* (under CS 934 ff.) for a lengthy and acrimonious dispute about the calendar some eighty years later, but nothing (known at least to this author) about this earlier problem. There is, however, a similar complication mentioned much later, when it is noted by a *Chotmaihet Hon* for CS 1094 Jyestha 29 (22 June 1732): "Rat, CS 1094. In this year there was an extra day for a second year running".[13] And in that instance there is nothing in the New Year values to indicate where or how the error occurred.

[13] *Prachum Phongsawadan*, vol. 8 (Bangkok, 1808, repr. 1964), p. 113. The Thai is not explicit and says "2 years side-by-side". But the previous year, CS 1093, had been a regular *adhikawan*, so the pair of years will have been 1093–4, not 1094–5.

It is satisfying to be able to find a reason for what could otherwise appear to be a considerable disarray in the Northern record. From a calendrical point of view the Lan Na material is the most interesting of the Thai modes of recording a date and in other respects it exhibits a high degree of accuracy. Detecting the presence or absence of the extra day gives us a different perspective on this supposedly rogue element in the data.

Appendix: Month Style versus Irregular Intercalation

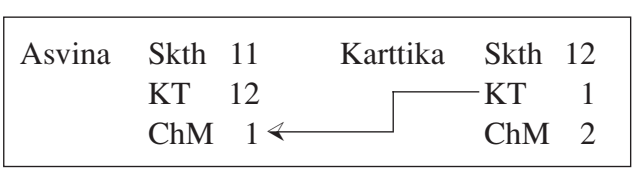
A: Phayao 26

Dates sometimes contain sufficient information to indicate that for some reason they are one month, rather than one day, out from what would be expected. Phayao 26, for instance, gives *Asvina* 12 waxing as Saturday *pœk set*, which is correct for *Karttika* 12 waxing:

856 *Asvina* 12 *taam Buddhasaasan hura wa duan 11* [= Skth] *Thai wa duan chieng* [= ChM] *ook 12 ... pœk set meng wan 7*	Saturday *pœk set* = *Karttika* waxing 12 = 1494 October 11	Phayao 26 Wat Aram Pa Noi

The month is here described elaborately: "according to the Buddha-sasana the horas say month 11, the Thai say the first month", the "first" being the numeric designation of *Asvina* in Chiang Mai style. And here may lie the confusion: we can imagine a situation in which *Karttika* was called "month 1", as it was in the intermediate Keng Tung mode, and then misidentified as Chiang Mai month 1. Once this category mistake had been made, it would be natural to consider its "Buddhist" equivalent to be month 11 and therefore to create an equivalence with *Asvina,* not *Karttika*. But the weekday, cyclic day, and *rksa* all side with *Karttika* against *Asvina*.

The confusion here as to the month did not also entail the omission of the extra day, and to this extent the inscription is orthodox.



B: Phayao 27

857 *Jyestha* waxing 8 *duan jyestha Thai duan kao ...* *wan kot yi meng wan athit*	Sunday *kot yi* = 1st Ashadha waxing 8 = 1495 May 31	Phayao 27 Wat Li

The month is given as follows: "month *Jyestha*, the Thai say month 9". This is Chiang Mai style, but the *ahargana* (given correctly in *Prachum Charuk Mœng Phayao* as 313090) and the cyclic day both belong to 1st *Ashadha* (= Keng Tung month 9). The text is also specific about the time: "midday plus three measures (*bat*) of water, *rksa* 11, called *Buppaphaguni*". This is true of 1st *Ashadha* 8 waxing and so of course not also true of *Jyestha*, the previous month.

Here the difference between the supposed date and the actual one is 31 days: from 27th in order to 58th. It is clear, though, that the same category mistake has been made as in Phayao 26. The numeric value "Thai 9" has been misinterpreted as the Chiang Mai month 9, one before Ashadha as month 10, when the data plainly and solely fits with the Keng Tung month 9, which is also *Ashadha*.

If a monk accustomed to the "Chiang Mai" mode of reckoning got hold of a calendar constructed according to the Keng Tung mode, he would see "9" and assume the intended month was *Jyestha*, there being nothing in the layout of the document to warn him. To judge by later MS calendars it is necessary to know by their position and value what the various numerals signify.

It may be noted that again there is no one-day difference in the count when applied to the intended month:

Jyestha	Skth	7	Ashadha	Skth	8
	KT	8		KT	9
	ChM	9		ChM	10

C: Lamphun 15

862 *Margasirsha* Full Moon: *mrikasiramaasa ...Thai duan chieng* [= Skth] *meng wan chandra Thai* *wan dap met*	Monday *dap met* = Pausha 15 = 1501 January 4	Lamphun 15 Wat Phra Dhatu Hariphunchai

The dislocation here includes a conflict between the month and day against the nakshatra. The month is specified as "*Mrikhasira*, Thai month one" and the rksa as *"Bharani"*. Now, *Bharani* is number 2 and the month *Margasirsha* is so

named because *rksa 5: Mrgasira* will normally be in operation at Full Moon, and the moon cannot cover the intervening ground (nearly 27°) in one day. However, the month is also in conflict with the cyclic day combination,: "Meng Monday, Thai *kaap med*", which answer to *Pausha* 15 (and moves even further away from the nakshatra named).

This puts in question what element, if any, to privilege in the data. It is sometimes plausible to imagine that the author has turned to the wrong page in an almanac. This time, however, any simple explanation does not work because *Pausha* in nobody's month 1:

Margasirsha	Skth	1 → ←	Pausha	Skth	2
	KT	2		KT	3
	ChM	3		ChM	4

There is no evidence either way as to whether calendars or almanacs were used or whether dates were calculated from scratch. In the present case, however, one would opt for poor calculation made (to judge by the date of the *duang chata* at the head of the stone) eight years later. It is unusual to find that of three elements in the data all three are in conflict with one another.[14]

[14] It may be worth mentioning here that the text also includes a vague reference to shadow length. Unfortunately there is no text (at least none known to this author) in which shadow length is combined with reference to a *lagna*. If there were such a text, it would be possible to deduce the height of the gnomon used for sundials and hence to interpret sundial references. In the case of Wat Phra Yun (Griswold & Prasert, *JSS*, 62.1 (January 1974)) Billard's time of "about 9 a.m." entails a gnomon of just under 9 units for a shadow of 15 units. The *Suryasiddhanta* iii.2 (ed. Ebenezer Burgess, University of Calcutta, Calcutta, 1935, p. 108) specifies a height of 12 units.