COMPUTER-ASSISTED DATING FOR THAI INSCRIPTIONS
An Instance From Wat Si, Phayao

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The commemorative function of stone inscriptions necessarily means that the majority of them carry an indication of the date that was chosen for the particular event or ceremony that was being celebrated. In some cases that date is very fully expressed: the year (usually reckoned in terms of Chulasakarat, the Little Era whose origin is in March 638 AD) may be accompanied not only by the animal name of the year, but also by the cyclic year designation, that combination of a sequence of ten names with a sequence of twelve names whose rate of rotation is sixty years.

The lunar month is then designated, either by its Sanskrit name or by a numeric equivalent, and this is paired with the day in the waxings or waning phase of the moon, with a strong preponderance of Full Moon as the time chosen. Then follows the planetary weekday, again designated either by name or by numeral, and this is often accompanied by the same set of cyclic terms as are used to define the years, but this time applying to the day. For good measure the mansion occupied by the moon (the *rœk*, or *naksatra*) may also be specified.

This degree of information is almost always sufficient on its own for the historian to identify a date with certainty—or rather it would be if there were no problems with the legibility of inscriptions. But since there are often difficulties here, it is an additional benefit as regards the Northern inscriptions that they sometimes carry detailed information of an astronomical variety. Most commonly this takes the form of a circular diagram (a *"duang"*, or *"duang chata"*) that locates each of the planets within the sign of the zodiac, the *rasi*, it occupies at the time. And since these positions are determined essentially by mathematical calculation, the *duang* may also be accompanied by some of the numerical values used in that process. There are frequently six numbers, each relating to the positions found for the sun and the moon, of which the *"horakhun"*, the number of days that have elapsed since the start of the era, is the most familiar.

A clear understanding of these astronomical data is clearly of considerable usefulness to the historian if, that is, the means are available for assessing them accurately. And it is at this point that one calls upon the assistance of the computer.

The extent to which this assistance can be used to advantage can be gauged if we look at an interesting inscription from Wat Si, Phayao (Phayao, number 28), which contains exactly that wealth of astronomical and calendrical detail just referred to. Consequently, although the inscription has already been published in *Sinlapakon* (22, 2, July 2521), it merits further examination.

The body of the inscription gives the date as: "*saka* 862, *kot san;* month eight, full moon; Saturday *kap cai; rœk Vaisakha;* BE 2044".[1] The lunar month is here called number eight, and this is by one of the two modes of Northern reckoning, in this case answering to month six in the Central region.[2] This would lead one to suppose that the occasion at issue was the Vaisakha Full Moon of CS 862, a date corresponding in Western terms to 13 April 1500. But if one looks more closely, one finds that the weekday and cyclic day permutation of that Full Moon was in fact Monday *kat sai.* This is a long way distant (both calendrically and epigraphically) from the Saturday *kap cai* which the inscription attached to its date.

The question, then, is whether the permutation assigned is a simple mistake, or whether it is, instead, the reflection of an intention that we have not yet grasped. The first step in attempting to resolve the problem is to tabulate the positions of the planets as assigned by the inscription and as determined by the computer. For reasons that will appear shortly, one requires the planetary positions for 14 Vaisakha in CS 863 and well as those for Vaisakha Full Moon in CS 862:

	duang	CS 863	CS 862
sun	1	1	0
moon	7	6	6
Mars	11	11:00	2
Mercury	1	1	0
Jupiter	0	0	11
Venus	0	0	1
Saturn	1	1	0 signs 29
Rahu	1	1	2

The above numerals represent the *rasi* (and, where significant, the *angsa*—the zodiacal signs and degrees of the sign)[3] in which the planets are located by the inscription on the one hand, and by computer reckoning on the other. It can be seen that with the exception of the moon the match is exact for CS 863 and completely out for CS 862. It emerges, then, that the year mentioned in the body of the text and the date represented by the *duang* stand a year apart.

This being so, we might wish to conjecture that the abbot or his deputy wrote the body of the inscription; that another person, possessed of the necessary expertise, devised the *duang;* and that the two operations came to be at cross purposes. Such a conclusion, however, would be hasty. We have still to accommodate the anomalous cyclic day permutation.

On some occasions one has to entertain the possibility that the details handed to the engraver were not very legible, but *tao si* and *kap cai* are sufficiently distinct from each other for that consideration not to have any force here. Is this discrepancy, then, merely another error or confusion? We can pursue the matter further, by examining the numbers that flank the *duang.*

As is the case here, these numbers are often allowed to speak for themselves and are not attended by captions. This means that one has to learn to judge by a number's size and position what it represents. But a little experience allows one to make this judgement. Here, for instance, the number "118" is very much too low to represent the intended year, and the number "862" would be much too small to represent the *horakhun.* We can therefore approach any set of numbers, when they are plainly of this category, with some understanding. Indeed, in the course of investigating these kinds of data one learns to adopt two principles: that position means something, but the intended meaning is assumed, not specified; and that the answer to a seemingly intractable or impenetrable problem ("What *is* this number doing here?") will turn out to be simple enough, if/when it is resolved.

The values presented are as follows (I have added their unexpressed function):

862 [CS]	315224 *[horakhun]*
10675 *[masaken]*	318753 *[kammacubala]*
118 *[avoman]*	11273 *[ucabala]*.[4]

The number in the *kammacubala* position is much the most interesting one. It looks to be far too large at "318753", since that value would yield (as a result of division by 800) 398 days, and even an intercalary year, such as CS 862 was, will contain only 384 days.

Yet again we may be tempted to conclude that we are faced by a mistake of some kind—perhaps a faulty calculation on the part of the people preparing the inscription, or a faulty reading by modern epigraphers. However, there are other possibilities that must still be investigated. We note, first of all that, that the problem "862" (for 863) has made another appearance. Does it suggest anything? Indeed it does—the following expedient. Begin at the New Year's day of CS 862, which was 29 (14 waning) *Caitra,* and then add on the number of days implied by the *kammacubala,* viz., 398 days. The result is that one arrives precisely at CS 863 *Vaisakha* 14, as implied by the *duang.* One can again employ the computer to determine what the other calendrical values (*"masaken", "avoman"*, etc.) were on that day. The values generated are followed here by those of the inscription:

10676 [10675: *masaken*]
118 [118: *avoman*]
315252 ["315224": *horakhun*]
1127 ["11273": *ucabala*]

We can see that the *masaken,* the *avoman,* and all but one of the digits assigned to the *ucabala* are correct for the CS 863 date, to which we have been led by the initially bewildering *kammacubala.* But the *horakhun* (despite its being the base number in the set, the one from which the others derive) is still out. How can it be that the other numbers derive from 315252, whereas 315224 is certainly a possible reading of the inscription?

In the Northern script it is only too easy to confuse not just 4 and 5, as in the Central script, but 2 with either of them. Here one finds that what has been read as "---224" could very easily be turned into "---252", where the latter would in fact be correct for the date and tally not only with all the other calendrical elements, but of course with the *duang* that they flank. We are therefore at liberty to say that the *horakhun* "ought" to have been 315252, but that the last three digits could easily be misread as ---224.

There is now only one more step to be taken, and this relates to the cyclic day permutation, which is still out of kilter. One's first task is to determine the day on which in fact the inscription's Saturday *kap cai* fell. It proves to be 15 *Caitra* in 863—and it is surely no accident that the *horakhun* of that day was *315224!* I take this to be clear evidence that the number was misread in the devising or execution of the inscription.

Finally, we have a minor detail to clarify: that the only discrepancy between the inscription's *duang* and the computer findings was that the inscription located the moon in *rasi* 7 (Scorpio), whereas the computer indicates that the moon was in *rasi* 6 (Libra). The *rœk* (lunar mansion) specified in the body of the inscription, which is *Visakha,* would permit either *rasi* to be correct. At this point, then, yet another detail comes into play. This is the *"lagna"*, i.e. that part of the zodiac that is on the eastern horizon. This is located in the *duang* at *rasi* 3 (Cancer), from which one can deduce a time of about 9.00 a.m.[5]

Putting the computer to work on the *rœk* and the *lagna* together, one can say that at 9.00 a.m. on 14 *Vaisakha* in CS 863 the *rœk* was only 15:11, *Svati,* and that the moon did not reach *rœk* 16, *Vaisakha,* until midnight on the 15th. This discrepancy might be set down as, at worst, a minor error, were it not that other explanations offer themselves. The *duang* and most of its associated detail, we note, is valid for 14 *Vaisakha,* not 15 *Vaisakha.* Why then "Full Moon"? There are other instances where the time of the month is said to be "เพ็ง" in the text and the moon is none the less (in distinction from the present instance) not yet in the *rasi* opposite the sun—an indication the word does not always require the strictest application.[6] Then again, the moon might have been placed in *rasi* 7, *pro forma*, to conform with the principle determining that the name of a lunar month is defined by the name of the *rœk* that the moon will normally occupy when Full. Whatever the explanation, the discrepancy is slight. It has no power to cast doubt on the other findings.

The main conclusion to be drawn from this investigation, I believe, is that the computer assistance now available to historians represents an extremely powerful tool for research and analysis.[7] The complications here detected and resolved would not even have been recognised as complications without its aid. And had they been seen, one would probably have been forced to conclude that the data were irrecoverably corrupt.

We can summarise as follows: the inscription initially purports to commemorate an event that took place on *Vaisakha* Full Moon in CS 862, that year number appearing twice and being supported by the cyclic year combination assigned to it. At odds with this is the accompanying *duang* and its attendant calculations, which point to the year following. The main clue to the mystery is the excessive value assigned to the *kammacubala*, which proves to represent an interval whose origin lies in the start of CS 862. Had its origin been in the start of 863, its value would have been only 26586. The evidence may also suggest that more than one "expert" was involved in the calculations. It is difficult otherwise to explain the anomaly of the cyclic day, since perhaps the only viable way of making sense of the anomaly is regard the cyclic day as based on a *horakhun* that has itself been misread.[8] Nothing then prompted the scribe to detect a rather gross mistake: presumably he saw no cause to check whether the cyclic day named was coherent with the *avoman* and the other values given. But then, without the computer, we too would be hard pressed to uncover this and the other curious features the inscription betrays.

NOTES

1 One notes that the BE-AD difference is 544 in this instance.

2 It is not widely recognised that the two-month numerical difference between the North and the Central regions can by no means be automatically applied. There is a middle reckoning which one may label Keng Tung-style reckoning, where the difference is only one: the month *Caitra*, for example, is 5th for the Central region, 6th on Keng Tung reckoning, and 7th on Northern reckoning. This observation applies to the inscriptions published in *Sinlapakon*, 13, 6 (2513), 93; 14, 3 (2513), 88; 14, 4 (2513); 95; 17, 6 (2517), 59; and 18, 2 (2517), 51 and to the Fine Arts Department inscriptions 67, 70, 87, and (probably) 100. A number of other dates are complicated by the fact that they fall after *Ashadha* in what should be intercalary years, where failure to intercalate could produce the impression of Keng Tung style reckoning.

Inscription 103 is particularly interesting, in that it labels the month as "9th Buddhist, 10th, 11th Thai" (cf. no. 72, where *Ashadha* is called "8th Buddhist, 9th Thai").

3 It may be observed, in particular, that though Mars was not yet a full *angsa* into *rasi Mina*, that is none the less the *rasi* assigned to it by the *duang*. The constraint, in other words, is severe. The position of a planet in a given *rasi*, on the face of it, presents an ambiguity of 30°—the convention never defines what degree of what sign the planet occupies. But if, for instance, the computer program indicated that the position of a planet was in fact 1 sign 29, rather than 2 signs 1, the leeway would be reduced to only two degrees.

4 The technical sense of these terms is of no great importance: it is of more significance that they are all interdependent and that once the *horakhun* (elapsed days of the era) is known, the *masaken* (elapsed months), the *kammacubala* (indicating bissextile years), the *ucabala* (indicating the position of the moon's apogee), and the *avoman* (indicating years in which *Jyestha* takes 30 days) can all be found. The *kammacubala*, by orthodox reckoning, would have been 26586, representing 186 parts of 800 (800 units per day), plus the 33 days from 10 Caitra (the start of 863) to 14 *Vaisakha*. Instead, as indicated above, 318753 represents 353 parts of 800 and 398 days (33+365 days)—another year in addition. One sees, on reflection, that the intended *kammacubala* must have been 318793: i.e. (365.25875 x 800=) 292207 plus 26586. (We have to add 9/5 to our list of numeric ambiguities.)

5 The working is as follows: the sun is somewhere in *rasi* 1 and the *lagna* somewhere in *rasi* 3. Setting both, by default, in the middle of their *rasi*, one has to add the following amounts on to 6.00 a.m.: 48 minutes from Taurus (half), all of 72 minutes from Gemini, and 60 minutes (half) from Cancer—i.e. 3 hours on to 6 a.m. The reckoning, though susceptible to an ambiguity of 1 hour 48 minutes in this instance, does at least place the auspicious time within a given "watch" of the day.

6 For instances where *"pheng"* is not exactly Full Moon day, see Hans Penth (ed.), *Kham charuk thi than Phra Phuttarup nai Nakhon Chiang Mai*. Bangkok, BE 2519, no. 21 (Pausha CS 924); *Mission Pavie (Etudes*

Diverses II: Recherches sur l'histoire du Cambodge, du Laos et du Siam contenant la transcription et la traduction des inscriptions par M. Schmitt. Paris, 1898, no. 8 (Bhadra- pada CS 943); and *Sinlapakon*, 15, 2 (BE 2514), 89 (Phalguna CS 977).

7 Those without access to computer assistance may care to avail themselves of my *Southeast Asian Ephemeris: Solar and Planetary Positions, AD 638-200,* Southeast Asia Program, Cornell University, 1989. A companion lunar volume is forthcoming.

8 If this interpretation is correct, then it argues that someone must have known the rule that says, in order to find the cyclic day permutation for a given date, you must add 17 to the *horakhun* and find the remainder from division by 60. The working is as follows: 315224 plus 17 = 315241. Over 60 this yields 5254, remainder 1 (first in the sequence): *kap cai.* For the weekday, divide the *horakhun* itself by 7. Both variants give the same result: 315224 by 7 = 45031, remainder 7 = Saturday; whereas 315252 by 7 = 45035, remainder again 7.