USING SEQUENTIAL RELATIONS OF DAY-DATES TO DETERMINE THE TEMPORAL SCOPE OF WESTERN ZHOU LUNAR PHASE TERMS

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The four temporal expressions *chuji* 初吉, *jishengba* 既生霸, *jiwang* 既望, *jisiba* 既死霸 mainly appear after the month in the dating formulas on bronze inscriptions, followed by a sexagenary day-date, and scholars commonly refer to them as lunar phase expressions, or lunar phase terms.[1] When it comes to the length of time respectively denoted by these four lunar phase expressions, there has always been much debate, with the result that there are competing interpretations—a four phase hypothesis, four fixed-day hypothesis, a two-part bisection with two short periods hypothesis—each of the latter two also having variants. Existing research, for the most part, has approached the meaning of these terms either from the philological and textual perspective, or else by first identifying the royal reign and historical period to which related vessels belong, and then comparing how the definitions of the lunar phase terms match up with the resulting calendrical dates.[2] However, because it is not possible to establish conclusively to which reign a majority of bronzes belong, and because there are no definitive conclusions about the lengths of reigns of the individual kings of Western Zhou, the inevitable result has been that attempting to date the bronze inscriptions containing full dating formulas (comprising the four elements, year, month, lunar phase, day-date) in absolute historical terms, in order to establish the significance of the lunar phase expressions, has only provoked even more debate.

On the other hand, if a single bronze inscription contains two or more lunar phases and day-dates, the number of days intervening between them can be accurately computed, and given the constraints this relationship imposes, one can investigate the possible temporal scope of the

1. Wang Guowei 王國維, "Shengba siba kao" 生霸死霸考, in *Guantang jilin* 觀堂集林(Beijing: Zhonghua, 1959), 19–26.

2. See Ye Zhengbo 叶正渤, "Ershi Shiji yilai xizhou jinwen yuexiang wenti yanjiu zongshu" 20 世紀以來西周金文月相問題研究綜述, *Xuzhou shifan daxue xuebao* (Zhexue shehui kexue ban), 30.5 (2004), 9–13.

lunar phase terms. If this method is broadened to include many bronze vessels, or if a group of vessels can be securely ascribed to the reign of the same king, the number of days separating their lunar phases can be established and a similar method used to study the temporal scope of the lunar phases in that vessel group. The present article applies precisely this approach to the analysis of the meaning of the lunar phase expressions. First, four vessels were selected whose inscriptions all contain two or more lunar phase dates, these four are: *Zuoce Hu you* 作冊魖卣, *Hu ding* 曶鼎, *Jin Hou Su zhong* 晉侯蘇鐘, *Jing fang ding* 靜方鼎.[3] Besides these four vessels, which have two or more lunar phase dates, three groups of bronze vessels were selected, each of which has been determined to belong to the reign of a single king. These three groups are: (i) the three Sima Gong司馬共 vessels generally considered to belong to the reign of the same king, (ii) the three Wei 衛 group vessels belonging to the reign of King Gong, together with the King Gong type-vessel *Cuo Cao ding* 趞曹鼎; (iii) the two sets of *Zuo (Lai) ding* 佐鼎 (逨鼎) vessels excavated in 2003 and dated to the 42nd and 43rd year, respectively.[4] No attempt is made to assign absolute dates to the bronze vessel calendar that emerges from the study, but by exhaustive discussion of the relative dating imposed by the calendrical constraints, it is possible to determine the possible temporal scope of the lunar phases in each case. Finally, a comprehensive analysis of those results will allow us to reach definite conclusions about the meaning of the lunar phase expressions.

Although scholars have different explanations for the four lunar phase terms, all hypotheses consider the term *jiwang* to refer to the day or days following the full moon,[5] and the present article takes this as the

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3. These four vessel inscriptions were first suggested to me by Professor Li Xueqin 李學勤 who advised me to analyze lunar phase terms using the methodology adopted here. *Jin Hou Su zhong* was found in 1996; see Ma Chengyuan 馬承源, "*Jin Hou Su* bianzhong" 晉侯蘇編鐘, *Shanghai bowuguan jikan*上海博物館集刊 7 (1996). For the *Jing fang ding*, see Li Xueqin 李學勤, "*Jing fang ding* yu Zhou Zhaowang liri" 靜方鼎與周昭王曆日, in *Xia shang zhou niandaixue zhaji* 夏商周年代學劄記 (Shenyang: Liaoning daxue, 1999), 22–30. *Hu ding* was found in mid-Qing, and first recorded in Ruan Yuan's 阮元 *Ji gu zhai zhong ding yi qi kuan shi* 積古齋鐘鼎彝器款識. *Zuoce Hu you* was first published in Chen Mengjia 陳夢家, "Xizhou tongqi duandai (2)" 西周銅器斷代 (二), *Kaogu xuebao* 10 (1955), 69–142, which dated the vessel to King Cheng's reign.

4. The name of the maker of these vessels unearthed in Yangjia village, Meixian, in 2003 was initially interpreted as "*Lai ding*" 逨鼎. Subsequently, Li Xueqin held that they should be identified as "*Zuo ding*" 佐鼎. His explanation is given in n. 8 below. Here I follow Li.

5. In the "four-phase" hypothesis, *jiwang* refers to days 16–23, in the "four fixed-days" hypothesis *jiwang* refers to the day immediately after full moon, and in the "bisection plus two short periods" hypothesis *jiwang* refers to several days after the full moon. See Ye, "Ershi shiji yilai xizhou jinwen yuexiang wenti yanjiu zongshu".

basic premise on which to gauge the meaning of the other lunar phases. Specifically, for the purpose of calendrical calculation, a working definition of days sixteen to twenty-one of the lunar month is adopted for the duration of *jiwang*. In the tables below the reader can see the results of either lengthening or shortening the duration of *jiwang*.

We also know that the Western Zhou calendar was a luni-solar calendar, with long months of 30 days and short months of 29 days, using intercalary months to synchronize the lunar year with the seasons. With regard to the intercalation method used by the Western Zhou calendar, there is no evidence to suggest that intrayear intercalation was in use in the Spring and Autumn period,[6] and there are some examples of Western Zhou bronzes dated to the "13th month," an indication still found on the *Wu Hu ding* 吳虎鼎 from late Western Zhou, showing that the intercalary month, denoted "13th month" was placed at the end of the year.[7] Therefore, it is assumed here that in the Western Zhou period calendar there was no intrayear intercalation: intercalary months were always placed at the end of the year.

When discussing the relationship between two calendar dates the question of placement of the intercalary month only arises if the two dates fall within the same year; that is, in interyear intercalation the two dates do not allow for the insertion of an intercalary month between them. If the two dates are not in the same year, the question of interyear versus intrayear intercalation does not even arise. Among the seven inscriptions, or group of inscriptions, discussed in the present article, there are two whose calendar dates fall within the same year, these are the *Zuoce Hu you* and the *Jin Hou Su zhong*. In four other cases with multiple dates, none are within the same year; these include the *Jing fang ding*, the three Wei group vessels together with the *Cuo Cao ding*, the Sima Gong group of vessels, and the two *Zuo ding*. The two calendar dates on the *Hu ding* might or might not refer to the same year.[8] In what follows the discussion

6. Zhang Peiyu 張培瑜, Chen Meidong 陳美東, Bo Shuren 薄樹人, Hu Tiezhu 胡鐵珠, *Zhongguo gudai lifa* 中國古代曆法 (Beijing: Zhongguo kexue lishu, 2008), 192–204.

7. Li Xueqin , "Wuhuding kaoshi" 吳虎鼎考釋, *Xia shang zhou niandaixue zhaji*, 22–30.

8. *Hu ding* contains three paragraphs, each narrating the details of a lawsuit. The first paragraph begins with, "It being the King's 1st year, 6th month, *jiwang*, day *yihai* (12)" 惟王元年六月既望乙亥; the second paragraph begins with, "It being the King's 4th month, *jishengba*, the *chen* was at *dingyou* (34)" 惟王四月既生霸辰在丁酉; and the third paragraph begins with "formerly" 昔. Wang Guowei proposed that the two dates are in the same year, the second one being three months earlier than the first one, with an intercalary month between them; see Wang, "Shengba siba kao". Guo Moruo 郭沫若 suggested that the second date might be in the second year of the same king; see Guo, *Liang Zhou jinwenci daxi* 兩周金文辭大系. Dong Zuobin 董作賓 also held this view; see Dong, "Sifen yi yue shuo bianzheng" 四分一月說辨正, *Dong Zuobin xiansheng quanji jiabian* 董作賓先生全集甲編 (Taipei: Yiwen, 1977), 1–22. Li Xueqin thought that the

assumes in principle that intrayear intercalation did not occur, and the final result shows that the conclusions based on these seven inscriptions are consistent. Conversely, this shows that in analyzing these inscriptions it is reasonable to exclude the possibility of intrayear intercalation.

Before discussing the specific inscriptions, it is necessary to say something about the methodology adopted in this article. In research on the calendar and chronology of Western and Eastern Zhou, none of the three elements—absolute dates of the reigns of kings, meaning of the lunar phase terms, and reigns to which specific vessels belong—are definitively established. Therefore, all research must involve some assumptions; all of which have their reasons, of course. Some research has assumed definitions of the lunar phase terms, the reign dates of certain kings, and the accession years of certain kings, after which the bronzes are placed in the calendar. If a satisfactory calendar cannot be found then the conclusion is drawn by most that a group of vessels does not belong to the reign of a particular king, or that the king in question had two different accession years, as Professor Nivison and Professor Shaughnessy do.[9] In this article I choose a different approach, which is to study the meaning of the lunar phase terms based on those groups of vessels that bronze specialists think ought to belong to the reign of a particular king, based on typological study and the content of their inscriptions. The methodology is very straightforward; that is, to seek out all groups of bronzes among which each group contains more than one date and lunar term and is thought to be belong to a single king, to disregard the dating of the bronzes and to which reigns they belong, as well as to ignore the explanations of the lunar phase terms in ancient texts, and instead to investigate the possible meaning of the terms based on the constraints imposed by the mutual relations between the calendars and lunar phases of each group bearing multiple such dates. At present seven groups of bronzes fitting this description have been found. In actuality, there is only one vessel in each of the first four groups, while each of the last three groups each contain several vessels. It is these that I will study in the present paper. This is an inductive method, which requires that one consider all the

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two days were in the same year; see Li, "Lun *Hu ding* jiqi fanying de Xizhou zhidu" 論曶鼎及其反映的西周制度, *Zhongguo shi yanjiu* 1 (1985), 95–102. More recently, Li suggested to me the possibility that the second date is one year earlier than the first; i.e., in the last year of the former king.

9. David S. Nivison, "The Dates of Western Chou," *Harvard Journal of Asiatic Studies*, 43 (1983), 518–24; for a Chinese translation, see "Xizhou zhi nianli" 西周之年曆, in Beijing shifan daxue guoxue yanjiusuo 北京師範大學國學研究所, ed., *Wuwang ke shang zhi nian yanjiu* 武王克商之年研究, (Beijing: Beijing shifan daxue, 1997) 431–44. Xia Hanyi (Edward L. Shaughnessy) 夏含夷, "Sishi'er nian sishisan nian *yu qiu ding* de niandai" 四十二年四十三年虞逨鼎的年代, *Zhongguo lishi wenwu* 5 (2003), 49–52.

relevant sources, instead of some of them. Some scholars may gain the impression that, based on the first four cases, one may reach the same conclusion as Wang Guowei in his "Shengba siba kao," [10] but when the seven cases are considered together, the conclusion reached here is in complete disagreement with Wang Guowei—this is the crux of the matter.

Some scholars may argue that in both case five and case six there is at least one vessel that does not belong to the same calendar. In fact, on the basis of typology and inscriptional content, the great majority of scholars all agree that the two groups each belong to the reign of a single king. Of those scholars who point out that in each of the two cases there is at least one vessel that does not fit in the calendar, all do so on the grounds that, according to their interpretation of the lunar phase terms and the calendar, those vessels cannot fit.[11] They do not even consider whether their definitions for the lunar phase terms might not be correct. Here I study this question from a different angle, treating the two groups of vessels as each belonging to the reign of a different king in order to investigate the meaning of the lunar phases. If one is to say that research that first assumes definitions for the lunar phases is one analytical approach, then the methodology adopted here is a different approach.

1. Zuoce Hu *You*

The *Zuoce Hu you* inscription does not record the year in the king's reign,[12] but does include two lunar phase dates:

2nd month, *jiwang*, day *yihai* (12)
4th month, *jishengba*, day *gengwu* (7)

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10. Based on analysis of ancient texts and inscriptions, Wang reached the conclusion that:

初吉，謂自一日至七八日也；二曰既生霸，謂自八九日以降至於十四五日也；三曰既望，謂十五六日以後至二十二三日；四曰既死霸，謂自二十三日以後至於晦也

chuji refers to the period from the first to the seventh or eighth day of a month, *jishengba* refers to the period from the eighth or ninth day to the fourteenth or fifteenth day, *jiwang* refers to the period from the fifteenth or sixteenth to the twenty-second or twenty-third day, and *jisiba* refers to the period from the twenty-third to the last day of the lunar month

See Wang, "Shengba siba kao".

11. For example, David S. Nivison, "The Dates of Western Chou".

12. Jing Bing 景冰 made a comparison of the two dates on the *Zuo Ce Hu you* in which he made two assumptions: either (i) *jiwang* is a specific day between the 12th and 17th days (taking the first appearance of the lunar crescent as the beginning of the month); or (ii) *jiwang* is a period of days between the 12th day (taking the first appearance of the lunar crescent as the beginning of the month) and the 30th day (taking new

Table 1. Zuoce Hu *you* lunar phase calendar

		Both months long		One month long, one short	
2nd month 1st day	2nd mo. *jiwang*, *yihai* (12)	4th mo. 1st day	4th mo. *jishengba*, *gengwu* (7)	4th mo. 1st day	4th mo. *jishengba*, *gengwu* (7)
gengshen (57)	16th	*gengshen* (57)	11th	*jiwei* (56)	12th
jiwei (56)	17th	*jiwei* (56)	12th	*wuwu* (55)	13th
wuwu (55)	18th	*wuwu* (55)	13th	*dingsi* (54)	14th
dingsi (54)	19th	*dingsi* (54)	14th	*bingchen* (53)	15th
bingchen (53)	20th	*bingchen* (53)	15th	*yimao* (52)	16th
yimao (52)	21st	*yimao* (52)	16th	*jiayin* (51)	17th

The two calendar dates should belong to the same year, hence their separation in days can definitely be tabulated.

The 2nd and 3rd months could both be long months of 30 days, or one could have 29 and the other 30 days. If both are long months, the first day in each case should be the same sexagenary day-date. If one is a long month and the other short, the first day of the 4th month will be one day earlier in the cycle.

Because *jiwang* should include some number of days after the full moon, *jiwang* is here considered to begin on the sixteenth day of the month. Table 1 shows the sexagenary day-date for the first day of the 2nd month corresponding to a date "2nd month, *jiwang*, *yihai*" falling in the range of days sixteen to twenty-one. Table 1 also shows the day-dates for the first day of the 4th month indicated by the possible combinations, two long and/or one long plus one short month, together with the sequential location of day "*gengwu*, *jishengba*" in the 4th month.

From Table 1, one can see that if the range of *jiwang* is taken to be days sixteen to the twenty-first of the month, then the possible range for "4th month, *jishengba*, *gengwu* (7)" will be the eleventh to the seventeenth days. But if "*jishengba*, *gengwu*" were the sixteenth or seventeenth day, that would correspond to days twenty to twenty-one for *jiwang* in the 2nd month. This would mean that in this one inscription both *jishengba* and

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moon day as the beginning of the month). His result for the possible range for the day *gengwu* (7) within *jishengba* was that it could be either between the 8th–13th day in the first case or between the 8th–26th in the second case. See Jing, "Xi Zhou jinwen zhong jishi shuyu—*chuji, jiwang, jishengba, jisiba* de yanjiu" 西周金文中紀時術語——初吉、既望、既生霸、既死霸的研究, *Ziran kexueshi yanjiu* 18.1 (1999), 55–68. The major difference between the present article and Jing's study is that here *jiwang* is held to refer to a period of days following the full moon, from the sixteenth to the twenty-first, taking the new moon day as the beginning of the month.

Table 2: Relationship between the 1st day of the 6th month and "6th month, *jiwang*, *yihai*"

6th mo. *jiwang*, day *yihai* (12)	16th	17th	18th	19th	20th	21st
6th mo. 1st day	*gengshen* (57)	*jiwei* (56)	*wuwu* (55)	*dingsi* (54)	*bingchen* (53)	*yimao* (52)

jiwang would have to be after the full moon, and what is more, *jishengba* would have to be closer to the full moon than *jiwang*. In other words, *jishengba* would better fit the definition of *jiwang* than *jiwang* would, which is clearly unacceptable. As a result, from the *Zuoce Hu you* we conclude that *jishengba* ought to fall between the eleventh and fifteenth days of the month.

2. Hu *ding*

The *Hu ding* inscription contains two lunar phase dates:

It being the King's 1st year, 6th month, *jiwang*, day *yihai* (12)
It being the King's 4th month, *jishengba*, the *chen* was at *dingyou* (34)

The sequential relationship between the two dates in the *Hu ding* is not absolutely certain: three possibilities exist. One is that the "4th month, *jishengba*, day *dingyou*" is in the year preceding the "King's first year," and is the last year of a different king, so "1st year, 6th month, *jiwang*, day *yihai*" is later. A second possibility is that "1st year, 6th month, *jiwang*, day *yihai*" is first, and "4th month, *jishengba*, day *dingyou*" is later, making the actual date "[2nd year,] 4th month, *jishengba*, *dingyou*." The third possibility is that "4th month, *jishengba*, day *dingyou*" is also in the king's first year, with only two months separating it from "6th month, *jiwang*, day *yihai*." Each circumstance is discussed below. The character *chen* has different meanings in classical texts. In bronze inscriptions, it seems to be used to emphasize the date referred to.[13]

2.1 "4th month, *jishengba*, day *dingyou* (34)" is the preceding year, and "1st year, 6th month, *jiwang*, day *yihai* (12)" is later

Because we are here taking *jiwang* to refer to certain days after the full moon, the relationship between "6th month, *jiwang*, day *yihai*" and the sexagenary designation of the first day of the 6th month can be tabulated as in Table 2.

From the 4th month of one year to the 6th month of the next there are

13. Ye Zhengbo 葉正渤, "Lue lun Xizhou mingwen de jishi fangshi" 略論西周銘文的記時方式, *Xuzhou shifan daxue xubao* (Zhexue shehui kexue ban) 26.3 (2006), 48–52.

Table 3: Result with the Hu *ding* "4th month, *jishengba*, *dingyou* (34)" prior to "King's 1st year"

		7 months short, 8 long		8 months short, 7 long	
6th month, *jiwang, yihai* (12)	6th month, first day	4th month, first day	4th month, *jishengba, dingyou* (34)	4th month, first day	4th month, *jisheng ba, dingyou* (34)
16th	*gengshen* (57)	*dingyou* (34)	1st	*wuxu* (35)	no
17th	*jiwei* (56)	*bingshen* (33)	2nd	*dingyou* (34)	1st
18th	*wuwu* (55)	*yiwei* (32)	3rd	*bingshen* (33)	2nd
19th	*dingsi* (54)	*jiawu* (31)	4th	*yiwei* (32)	3rd
20th	*bingchen* (53)	*guisi* (30)	5th	*jiawu* (31)	4th
21st	*yimao* (52)	*renchen* (29)	6th	*guisi* (30)	5th

fourteen months, if no intercalary month intervenes. Assuming alternating long and short months, fourteen months amounts to 413 days. If *jiwang* in the 6th month falls between the sixteenth and twenty-first days of the month, calculating the calendar days shows that there would be no day *dingyou* (34) in that 4th month. Therefore, it would be reasonable to assume that an intercalation occurred between the two years, so that from the first day of the 4th month in one year, to the first day of the "1st year, 6th month" the following year, would be fifteen months. In fifteen months there could have been two successive long months, but there might also not have been. Hence there will be two possible alternatives: (i) seven short months plus eight long months for a total of 443 days, making the first day of the 4th month in the one year 23 days earlier in the sequence by comparison with the sexagenary date of the first day of the succeeding "1st year, 6th month"; (ii) eight short months and seven long months for a total of 442 days, making the first day of the 4th month in the one year 22 days earlier in the sequence by comparison with the sexagenary date of the first day of the succeeding "1st year, 6th month."

Table 3 shows the resulting sexagenary day sequence for the "6th month, *jiwang*, *yihai* (12)," for the first day of the 6th month, for the corresponding combinations of 7 short + 8 long and 8 short + 7 long months, as well as for the "4th month, *jishengba*, *dingyou* (34)."

From the relationships among the calendar dates tabulated above one can see that if "6th month, *jiwang*, day *yihai* (12)" falls between the sixteenth and twenty-first days of the month, then "4th month, *jishengba*, day *dingyou* (34)" in the preceding year should fall between the first and sixth days of the month.

Table 4: Result with Hu *ding* "4th month, *jishengba*, *dingyou* (34)" in the second year

		5 short months, 6 long		6 short months, 5 long	
6th month, *jiwang*, *yihai* (12)	6th month, first day	2nd year, 4th month, 1st day	4th month, *jishengba*, *dingyou* (34)	2nd year, 4th month, 1st day	4th month, *jishengba*, *dingyou* (34)
16th	*gengshen* (57)	*yiyou* (22)	13th	*jiashen* (21)	14th
17th	*jiwei* (56)	*jiashen* (21)	14th	*guiwei* (20)	15th
18th	*wuwu* (55)	*guiwei* (20)	15th	*renwu* (19)	16th
19th	*dingsi* (54)	*renwu* (19)	16th	*xinsi* (18)	17th
20th	*bingchen* (53)	*xinsi* (18)	17th	*gengchen* (17)	18th
21st	*yimao* (52)	*gengchen* (17)	18th	*jimao* (16)	19th

2.2 "1st year, 6th month, *jiwang*, day *yihai* (12)" first, followed by "4th month, *jishengba*, day *dingyou* (34)" in the following year

If no intercalary month intervenes, from the first day of the "1st year, 6th month" to the first day of the "4th month" the following year, there are ten months, and assuming alternating long and short months this will total 295 days. Compiling the calendar we find that if "6th month, *jiwang*, day *yihai* (12)" falls between the sixteenth and twenty-first days of the month, then the "4th month" in the following year has no day *dingyou* (34). Therefore, there must be an intercalary month between the two dates, for a total of eleven months. Taking into consideration the alternation of long and short months and whether or not there were two long months back-to-back (i.e., five short + six long months, or six short + five long months), the corresponding number of days will be 325 and 324.

Table 4 below shows the sexegenary sequences for the "1st year, 6th month, *jiwang*, day *yihai* (12)," the first day of the "King's 1st year, 6th month," together with the solutions in the following year for the first day of the "4th month" and for a "4th month, *jishengba*, day *dingyou* (34)" corresponding to the alternative combinations of long and short months.

The results here are very similar to those for the *Zuoce Hu you* above, the difference being that now the "4th month, *jishengba*, day *dingyou* (34)" falls between the thirteenth and nineteenth of the month. But as in the former case, on a single bronze, *jishengba* should not follow the full moon and also be closer to it than *jiwang*, so that here we conclude the range of possible days for *jishengba* should be from the thirteenth to the fifteenth.

Table 5: Result with Hu *ding* "4th month, *jishengba*, *dingyou* (34)" in the First Year

		one short months, one long		both long months	
6th month, *jiwang*, *yihai* (12)	6th month, first day	4th month, 1st day	4th month, *jishengba*, *dingyou* (34)	4th month, 1st day	4th month, *jishengba*, *dingyou* (34)
16th	*gengshen* (57)	*jiwei* (56)	no	*gengshen* (57)	no
17th	*jiwei* (56)	*wuwu* (55)	no	*jiwei* (56)	no
18th	*wuwu* (55)	*dingsi* (54)	no	*wuwu* (55)	no
19th	*dingsi* (54)	*bingchen* (53)	no	*dingsi* (54)	no
20th	*bingchen* (53)	*yimao* (52)	no	*bingchen* (53)	no
21st	*yimao* (52)	*jiayin* (51)	no	*yimao* (52)	no

2.3 Both "4th month, *jishengba*, day *dingyou* (34)" and "1st year, 6th month, *jiwang*, day *yihai* (12)" are in the same year

In this case, if both the fourth and fifth months are long, the first days of both the "4th month" and the "6th month" will be the same. If either the fourth or fifth month is a short month, then the first day of the "6th month" will be one day earlier than the first day of the "4th month."

Here the "6th month, *jiwang*, day *yihai* (12)" falls within a certain number of days after the full moon, and the "4th month" has no day *dingyou* (34). Therefore, the results for *jishengba* obtained from the possible sequential relationships between the two calendar dates on the *Hu ding* are two: (i) if "4th month, *jishengba*, *dingyou* (34)" is in the year preceding the "King's first year," then the possible range of days for "*jishengba*, *dingyou* (34)" is between the first and sixth days of the month; (ii) if "4th month, *jishengba*, *dingyou* (34)" is in the year following the "King's first year," then the possible range of days for "*jishengba*, *dingyou* (34)" is between the thirteenth and fifteenth days of the month.

3. Jin Hou Su *zhong*

In all, six of the calendar dates on the *Jin Hou Su zhong*, contain lunar phases:

It being the King's 33rd year
1st month, *jishengba*, day *wuwu* (55)
2nd month, *jiwang*, day *guimao* (40)
2nd month, *jisiba*, day *renyin* (39)

3rd month, *pangshengba* (旁生霸)
6th month, *chuji*, *wuyin* (15)
dinghai (24)
gengyin (27)

Among these, *pangshengba* is not followed by a sexagenary day, so it cannot be used to discuss the scope of the lunar phases. Because the *Jin Hou Su zhong* contains all four of the principal lunar phase expressions, and each is followed by a sexagenary day-date, this inscription is extremely important for research on the Western Zhou lunar phase terms. As a result many scholars have discussed it, although these will not be individually cited here.[14] Previous discussions, for the most part, place Jin Hou Su into a particular historical chronology to see where each of the inscription's lunar phase dates ought to fit. The present study adheres to the relative relationship principle, and does not attempt to place Jin Hou Su in a specific, dated historical context. Here only the constraints imposed by the relationships among the inscribed calendar dates are taken into consideration, in order to discuss the possible range of days represented by the four lunar phases on the *Jin Hou Su zhong*.

Many scholars have already pointed out that, because they appear to be out of sequence, at least one of the two dates "2nd month, *jiwang*, day *guimao* (40)" and "2nd month, *jisiba*, day *renyin* (39)" must contain an error. Given that the meaning of *jiwang* is clear, let us first assume that "2nd month, *jiwang*, day *guimao* (40)" is the correct alternative, to see what the result is.

3.1 Assuming "2nd month, *jiwang*, day *guimao* (40)" is correct

If "2nd month, *jiwang*, day *guimao* (40)" is correct, given our working definition of sixteenth to twenty-first days for *jiwang*, we can derive the possible range for "1st month, *jishengba*, day *wuwu* (55)" and "6th month, *chuji*, *wuyin* (15)."

3.1.1 THE RELATIONSHIP BETWEEN "2ND MONTH, *JIWANG*, DAY *GUIMAO* (40)" AND "1ST MONTH, *JISHENGBA*, DAY *WUWU* (55)"

The first month could be a long month, or it could be a short month. Hence the relationship between "2nd month, *jiwang*, day *guimao* (40)" and "1st month, *jishengba*, day *wuwu* (55)" can be shown as in Table 6 below—in

14. See, for example, Wang Shimin 王世民 et al., "*Jin Hou Su zhong* bitan" 晉侯蘇鐘筆談, *Wenwu* 3 (1997), 54–66. Ni Dewei 倪德衛 (David S. Nivison) and Xia Hanyi 夏含夷 (Edward L. Shaughnessy), "Jin Hou de shixi ji qi dui Zhongguo gudai jinian de yiyi" 晉侯的世系及其對中國古代紀年的意義, *Zhongguo shi yanjiu* 1 (2001), 3–10.

order to better display the trend, the range for "2nd month, *guimao*" is here expanded to the period from the fifteenth to the twenty-third day.

If we take the range of days for *jiwang* as between the sixteenth and twenty-first days, then the possible range of days for "1st month, *jishengba*, day *wuwu* (55)" is from the first to the sixth day of the month.

3.1.2 RELATIONSHIP BETWEEN "2ND MONTH, *JIWANG*, DAY *GUIMAO* (40)" AND "6TH MONTH, *CHUJI*, DAY *WUYIN* (15)"

From the first day of the "2nd month" to the first day of the "6th month" is four months, of which two could be either long or short (no back-to-back long months, or back-to-back long months and a short second month), or one month could be short and the other three long (back-to-back long months, and the second month is also long). The relationship between "2nd month, *jiwang*, day *guimao* (40)" and "6th month, *chuji*, day *wuyin* (15)" is shown in Table 7 below.

It is evident that, if we assume "2nd month, *jiwang*, day *guimao* (40)" is correct, and that *jiwang* falls within the few days following the full moon, then there is no day *wuyin* (15) in the 6th month. Therefore, from this it follows that between the two dates "2nd month, *jiwang*, day *guimao* (40)" and "2nd month, *jisiba*, day *renyin* (39)" it must be the former that is erroneous.

3.2 Relationships among the possible calendar dates for the Jin Hou Su *zhong* and their constraints

3.2.1 RELATIONSHIPS AMONG ALL THE CALENDAR DATES

The calendar dates implicated in the Jin Hou Su zhong are these six: "1st month, *jishengba*, day *wuwu* (55)," "2nd month, *jiwang*, day *guimao* (40)," "2nd month, *jisiba*, day *renyin* (39)," "6th month, *chuji*, *wuyin* (15), *dinghai* (24), *gengyin* (27)." Because the two dates in the 2nd month do not conform to each other, some scholars have suggested that day *guimao* (40) should be changed to *xinmao* (28) or *guisi* (30).[15] Others have suggested the dates should be emended to "2nd month, *jiwang*, day *renyin* (39)," "2nd month, *jisiba*, day *guimao* (40)."[16] Below I list all these calendar dates together in order to display their mutual relationships. Shown here are: the sequence of the first day of the "1st month" and "1st month, day *wuwu* (55)" in the first month; the sequence of the four dates: first day of the "2nd month," "2nd month, days *xinmao* (28), *guisi* (30), *renyin* (39),

15. For example, Zhang Peiyu, in "*Jin Hou Su zhong* bitan".

16. Ma, "Jin Hou Su bianzhong"; Ni Dewei (David Nivison) and Xia Hanyi (Edward Shaughnessy), "Jin Hou de shixi jiqi dui Zhongguo gudai jinian de yiyi".

Table 6: Relationship between "2nd month, *jiwang*, day *guimao* (40)" and "1st month, *jishengba*, day *wuwu* (55)"

		1st month long		1st month short	
2nd month, *jiwang, guimao* (40)	2nd month, 1st day	1st month, 1st day	1st month, *jishengba, wuwu* (55)	1st month, 1st day	1st month, *jishengba, wuwu* (55)
15th	*jichou* (26)	*jiwei* (56)	no	*gengshen* (57)	no
16th	*wuzi* (25)	*wuwu* (55)	1st	*jiwei* (56)	no
17th	*dinghai* (24)	*dingsi* (54)	2nd	*wuwu* (55)	1st
18th	*bingxu* (23)	*bingchen* (53)	3rd	*dingsi* (54)	2nd
19th	*yiyou* (22)	*yimao* (52)	4th	*bingchen* (53)	3rd
20th	*jiashen* (21)	*jiayin* (51)	5th	*yimao* (52)	4th
21th	*guiwei* (20)	*guichou* (50)	6th	*jiayin* (51)	5th
22nd	*renwu* (19)	*renzi* (49)	7th	*guichou* (50)	6th
23rd	*xinsi* (18)	*xinhai* (48)	8th	*renzi* (49)	7th

Table 7: Relationship between "2nd month, *jiwang*, day *guimao* (40)" and "6th month, *chuji*, day *wuyin* (15)"

		2 short months, 2 long		1 short month, 3 long	
2nd month, *jiwang, guimao* (40)	2nd month, 1st day	6th month, 1st day	6th month, *chuji, wuyin* (15)	6th month, 1st day	6th month, *chuji, wuyin* (15)
15th	*jichou* (26)	*dinghai* (24)	no	*wuzi* (25)	no
16th	*wuzi* (25)	*bingxu* (23)	no	*dinghai* (24)	no
17th	*dinghai* (24)	*yiyou* (22)	no	*bingxu* (23)	no
18th	*bingxu* (23)	*jiashen* (21)	no	*yiyou* (22)	no
19th	*yiyou* (22)	*guiwei* (20)	no	*jiashen* (21)	no
20th	*jiashen* (21)	*renwu* (19)	no	*guiwei* (20)	no
21th	*guiwei* (20)	*xinsi* (18)	no	*renwu* (19)	no
22nd	*renwu* (19)	*gengchen* (17)	no	*xinsi* (18)	no
23rd	*xinsi* (18)	*jimao* (16)	no	*gengchen* (17)	no
24th	*gengchen* (17)	*wuyin* (15)	1	*jimao* (16)	no

guimao (40),"; first day of the "6th month"; and sexagenary days *wuyin* (15), *dinghai* (24), *gengyin* (27) within the "6th month." Because the long and short months may be different, the relations among these calendar dates will also vary. Here the possible variations are grouped, with the following three results:

i. The "1st month" is a long month, and regardless of whether there are successive long months, from the first day of the 1st month to the first day of the 6th month there are three long months and two short months; the first day of the 2nd month being 30 days later than the first day of the 1st month; and the first day of the 6th month being 28 days later than the first day of the 1st month.

ii The 1st month is a short month, and between the first day of the 1st month and the first day of the 6th month there are back-to-back long months for a total of three long months and two short months; the first day of the 2nd month is 29 days after the first day of the 1st month; the first day of the 6th month is 28 days later than the first day of the 1st month.

iii. The 1st month is short and there are no successive long months between the first day of the 1st month and the first day of the 6th month, for a total of three short months and two long months; the first day of the 2nd month is 29 days after the first day of the 1st month; the first day of the 6th month is 27 days later than the first day of the "1st month."

Any of the four sexagenary dates "2nd month, days *xinmao* (28), *guisi* (30), *renyin* (39), *guimao* (40)" could all be *jiwang*. To simplify reading, in the tables 8, 9 and 10 the range sixteenth to twenty-first days is shaded for these four day-dates. In each case the horizontal row in the shaded portion represents the result when that sexagenary day-date is *jiwang*. For example, in Table 8 below, "2nd month, day *guisi* (30)", when within the range of sixteenth to twenty-first days the position is shown by shading, then the six such rows correspond to the six rows when the first day of the 1st month is between *wushen* (45) and *guimao* (40). Thus, these six rows are when "2nd month, *guisi* (30)" is *jiwang*. The rest follow this pattern.

Tables 8, 9 and 10 below show the three situations:

Days *guimao* (40) and *renyin* (39) are only one day apart. From the tables above one can see that regardless of whether "2nd month, *jiwang*" is *guimao* (40) or *renyin* (39), the "6th month" will not have a day *wuyin* (15), and the corresponding "1st month, *jishengba*, *wuwu* (55)" will fall between the first and seventh day of the month. If the "2nd month, *jiwang*" is *xinmao* (28), the corresponding range for "1st month, *jishengba*, *wuwu* (55)" is between the twelfth day of the month and the eighteenth, and the range for "6th month, *chuji*, *wuyin* (15)" is between the fourth day and the tenth. If *jishengba* is not allowed to extend past the full moon, then the range of "1st month, *jishengba*, *wuwu* (55)" is between the twelfth and the fifteenth days, and the range of "6th month, *chuji*, *wuyin* (15)"

is between the fourth day of the month and the seventh. If "2nd month, *jiwang*" is *guisi* (30)," then the range of days for "1st month, *jishengba*, *wuwu* (55)" is between the tenth day of the month and the sixteenth, and the range for "6th month, *chuji*, *wuyin* (15)" is between the second day of the month and the eighth.

If one assumes that "2nd month, *jisiba*, *renyin* (39)" is not wrong, then "2nd month, *jiwang*, *guimao* (40)" is wrong. Whatever the meaning of *jisiba*, if one only posits that the "2nd month" must contain day *renyin* (39), then from the three tables above one can see that for "2nd month, *jiwang*," whether *xinmao* (28) or *guisi* (30), the corresponding range of days for "1st month, *jishengba*, *wuwu* (55)," "2nd month, *jisiba*, *renyin* (39)," and "6th month, *chuji*, *wuyin* (15)" will be as follows:

2nd month, *jiwang*, *xinmao* (28)	1st month, *jishenba*, *wuwu* (55)	2nd month, *jisiba*, *renyin* (39)	6th month, *chuji*, *wuyin* (15)
16th–19th	12th–16th	27th–30th	4th–8th
2nd month, *jiwang*, *guisi* (30)	1st month, *jishengba*, *wuwu* (55)	2nd month, *jisiba*, *renyin* (39)	6th month, *chuji*, *wuyin* (15)
16th–21st	10th–16th	25th–30th	2nd–8th

In addition, from the tables one can also see that, if one disregards the two suggestions of *xinmao* (28) and *guisi* (30) as proposed by some scholars, as long as the 2nd month contains sexagenary dates *renyin* (39) and *guimao* (40), then the range of days for "1st month, *jishengba*, day *wuwu* (55)," "2nd month, *jiwang*, day *guimao* (40)," "2nd month, *jisiba*, *renyin* (39)/*guimao* (40)," and "6th month, *chuji*, *wuyin* (15)" are all constrained within very narrow limits. This can be seen just from the limits on the range of days possible for the first day of the 1st month. Taking the first table (Table 8) as example, the specific constraints are:

i. Given a "1st month, *wuwu* (55)," this requires that the first day of the "1st month" must fall between *wuwu* (55) and *jichou* (26); i.e., 26, 27 . . . 55.

ii. Given a "2nd month, *renyin* (39)," this requires that the first day of the "1st month" must fall between *guimao* (40), and *renshen* (9) i.e., 40, 41 . . . 60, 1, 2 . . . 9.

iii. Given a "2nd month, *guimao* (40)," this requires that the first day of the "1st month" must fall between *jiachen* (41) and *guiyou* (10), i.e., 41, 42 . . . 60, 1, 2 . . . 10.

iv. Given a "6th month, *wuyin* (15)," this requires that the first day of the "1st month" must fall between *xinsi* (18) and *gengxu* (47); i.e., 18, 19 . . . 47.

Table 8: "1st month" is a long month; from the first day of the 1st month to the first day of the 6th month there are three long months and two short months

1st month		2nd month						6th month		
1st day	(55)[a]	1st day	(28)[b]	(30)[c]	(39)[d]	(40)[e]	1st day	(15)[f]	(24)[g]	(27)[h]
jiwei (56)	no	*jichou* (26)	3rd	5th	14th	15th	*dinghai* (24)	no	1st	4th
wuwu (55)	1st	*wuzi* (25)	4th	6th	15th	16th	*bingxu* (23)	no	2nd	5th
dingsi (54)	2nd	*dinghai* (24)	5th	7th	16th	17th	*yiyou* (22)	no	3rd	6th
bingchen (53)	3rd	*bingxu* (23)	6th	8th	17th	18th	*jiashen* (21)	no	4th	7th
yimao (52)	4th	*yiyou* (22)	7th	9th	18th	19th	*guiwei* (20)	no	5th	8th
jiayin (51)	5th	*jiashen* (21)	8th	10th	19th	20th	*renwu* (19)	no	6th	9th
guichou (50)	6th	*guiwei* (20)	9th	11th	20th	21st	*xinsi* (18)	no	7th	10th
renzi (49)	7th	*renwu* (19)	10th	12th	21st	22nd	*gengchen* (17)	no	8th	11th
xinhai (48)	8th	*xinsi* (18)	11th	13th	22nd	23rd	*jimao* (16)	no	9th	12th
gengxu (47)	9th	*gengchen* (17)	12th	14th	23rd	24th	*wuyin* (15)	1st	10th	13th
jiyou (46)	10th	*jimao* (16)	13th	15th	24th	25th	*dingchou* (14)	2nd	11th	14th
wushen (45)	11th	*wuyin* (15)	14th	16th	25th	26th	*bingzi* (13)	3rd	12th	15th
dingwei (44)	12th	*dingchou* (14)	15th	17th	26th	27th	*yihai* (12)	4th	13th	16th
bingwu (43)	13th	*bingzi* (13)	16th	18th	27th	28th	*jiaxu* (11)	5th	14th	17th
yisi (42)	14th	*yihai* (12)	17th	19th	28th	29th	*guiyou* (10)	6th	15th	18th
jiachen (41)	15th	*jiaxu* (11)	18th	20th	29th	30th	*renshen* (9)	7th	16th	19th
guimao (40)	16th	*guiyou* (10)	19th	21st	30th	no	*xinwei* (8)	8th	17th	20th
renyin (39)	17th	*renshen* (9)	20th	22nd	no	no	*gengwu* (7)	9th	18th	21st
xinchou (38)	18th	*xinwei* (8)	21st	23rd	no	no	*jisi* (6)	10th	19th	22nd
gengzi (37)	19th	*gengwu* (7)	22nd	24th	no	no	*wuchen* (5)	11th	20th	23rd
jihai (36)	20th	*jisi* (6)	23rd	25th	no	no	*dingmao* (4)	12th	21st	24th

a. *wuwu* (55). b. *xinmao* (28). c. *guisi* (30). d. *renyin* (39).
e. *guimao* (40). f. *wuyin* (15). g. *dinghai* (24). h. *gengyin* (27).

Table 9. "1st month" is a short month; from the first day of the 1st month to the first day of the 6th month there is one case of back-to-back long months, making three long months and two short months

1st month		2nd month					6th month			
1st day	(55)	1st day	(28)	(30)	(39)	(40)	1st day	(15)	(24)	(27)
gengshen (57)	no	*jichou* (26)	3rd	5th	14th	15th	*wuzi* (25)	no	no	3rd
jiwei (56)	no	*wuzi* (25)	4th	6th	15th	16th	*dinghai* (24)	no	1st	4th
wuwu (55)	1st	*dinghai* (24)	5th	7th	16th	17th	*bingxu* (23)	no	2nd	5th
dingsi (54)	2nd	*bingxu* (23)	6th	8th	17th	18th	*yiyou* (22)	no	3rd	6th
bingchen (53)	3rd	*yiyou* (22)	7th	9th	18th	19th	*jiashen* (21)	no	4th	7th
yimao (52)	4th	*jiashen* (21)	8th	10th	19th	20th	*guiwei* (20)	no	5th	8th
jiayin (51)	5th	*guiwei* (20)	9th	11th	20th	21st	*renwu* (19)	no	6th	9th
guichou (50)	6th	*renwu* (19)	10th	12th	21st	22nd	*xinsi* (18)	no	7th	10th
renzi (49)	7th	*xinsi* (18)	11th	13th	22nd	23rd	*gengchen* (17)	no	8th	11th
xinhai (48)	8th	*gengchen* (17)	12th	14th	23rd	24th	*jimao* (16)	no	9th	12th
gengxu (47)	9th	*jimao* (16)	13th	15th	24th	25th	*wuyin* (15)	1st	10th	13th
jiyou (46)	10th	*wuyin* (15)	14th	16th	25th	26th	*dingchou* (14)	2nd	11th	14th
wushen (45)	11th	*dingchou* (14)	15th	17th	26th	27th	*bingzi* (13)	3rd	12th	15th
dingwei (44)	12th	*bingzi* (13)	16th	18th	27th	28th	*yihai* (12)	4th	13th	16th
bingwu (43)	13th	*yihai* (12)	17th	19th	28th	29th	*jiaxu* (11)	5th	14th	17th
yisi (42)	14th	*jiaxu* (11)	18th	20th	29th	30th	*guiyou* (10)	6th	15th	18th
jiachen (41)	15th	*guiyou* (10)	19th	21st	30th	no	*renshen* (9)	7th	16th	19th
guimao (40)	16th	*renshen* (9)	20th	22nd	no	no	*xinwei* (8)	8th	17th	20th
renyin (39)	17th	*xinwei* (8)	21st	23rd	no	no	*gengwu* (7)	9th	18th	21st
xinchou (38)	18th	*gengwu* (7)	22nd	24th	no	no	*jisi* (6)	10th	19th	22nd
gengzi (37)	19th	*jisi* (6)	23rd	25th	no	no	*wuchen* (5)	11th	20th	23rd
jihai (36)	20th	*wuchen* (5)	24th	26th	no	no	*dingmao* (4)	12th	21st	24th

Table 10. "1st month" is a Short Month; from the First Day of the 1st Month to the First Day of the 6th Month there are Three Short Months and Two Long Months

1st month		2nd month					6th month			
1st day	(55)	1st day	(28)	(30)	(39)	(40)	1st day	(15)	(24)	(27)
gengshen (57)	no	*jichou* (26)	3rd	5th	14th	15th	*dinghai* (24)	no	1st	4th
jiwei (56)	no	*wuzi* (25)	4th	6th	15th	16th	*bingxu* (23)	no	2nd	5th
wuwu (55)	1st	*dinghai* (24)	5th	7th	16th	17th	*yiyou* (22)	no	3rd	6th
dingsi (54)	2nd	*bingxu* (23)	6th	8th	17th	18th	*jiashen* (21)	no	4th	7th
bingchen (53)	3rd	*yiyou* (22)	7th	9th	18th	19th	*guiwei* (20)	no	5th	8th
yimao (52)	4th	*jiashen* (21)	8th	10th	19th	20th	*renwu* (19)	no	6th	9th
jiayin (51)	5th	*guiwei* (20)	9th	11th	20th	21st	*xinsi* (18)	no	7th	10th
guichou (50)	6th	*renwu* (19)	10th	12th	21st	22nd	*gengchen* (17)	no	8th	11th
renzi (49)	7th	*xinsi* (18)	11th	13th	22nd	23rd	*jimao* (16)	no	9th	12th
xinhai (48)	8th	*gengchen* (17)	12th	14th	23rd	24th	*wuyin* (15)	1st	10th	13th
gengxu (47)	9th	*jimao* (16)	13th	15th	24th	25th	*dingchou* (14)	2nd	11th	14th
jiyou (46)	10th	*wuyin* (15)	14th	16th	25th	26th	*bingzi* (13)	3rd	12th	15th
wushen (45)	11th	*dingchou* (14)	15th	17th	26th	27th	*yihai* (12)	4th	13th	16th
dingwei (44)	12th	*bingzi* (13)	16th	18th	27th	28th	*jiaxu* (11)	5th	14th	17th
bingwu (43)	13th	*yihai* (12)	17th	19th	28th	29th	*guiyou* (10)	6th	15th	18th
yisi (42)	14th	*jiaxu* (11)	18th	20th	29th	30th	*renshen* (9)	7th	16th	19th
jiachen (41)	15th	*guiyou* (10)	19th	21st	30th	no	*xinwei* (8)	8th	17th	20th
guimao (40)	16th	*renshen* (9)	20th	22nd	no	no	*gengwu* (7)	9th	18th	21st
renyin (39)	17th	*xinwei* (8)	21st	23rd	no	no	*jisi* (6)	10th	19th	22nd
xinchou (38)	18th	*gengwu* (7)	22nd	24th	no	no	*wuchen* (5)	11th	20th	23rd
gengzi (37)	19th	*jisi* (6)	23rd	25th	no	no	*dingmao* (4)	12th	21st	24th
jihai (36)	20th	*wuchen* (5)	24th	26th	no	no	*bingyin* (3)	13th	22nd	25th

Simultaneously fulfilling the requirement that there be a "1st month, *wuwu* (55)," a "2nd month, *renyin* (39)," and a "6th month, *wuyin* (15)," the possible range for the first day of the "1st month," must be days *guimao* (40) through *gengxu* (47), which means that there are only eight sexagenary day-dates that meet these constraints. Corresponding to this are a "1st month, *jishengba*, *wuwu* (55)" between the ninth and sixteenth days of the month, a "2nd month, *renyin* (39)" itself between the twenty-third day of the month and the thirtieth, and a "6th month, *chuji*, *wuyin* (15)" between the first and the eighth day of the month.

Simultaneously fulfilling the requirement that there be a "1st month, *wuwu* (55)," a "2nd month, *guiyou* (40)," and a "6th month, *wuyin* (15)," the possible range for the first day of the "1st month," must be days *jiachen* (41) through *gengxu* (47), which means that there are only seven sexagenary day-dates that meet these constraints. Corresponding to this are a "1st month, *jishengba*, *wuwu* (55)" between the ninth and fifteenth days of the month, a "2nd month, *guimao* (40)" itself between the twenty-fourth day of the month and the thirtieth, and a "6th month, *chuji*, *wuyin* (15)" between the first and the seventh day of the month.

Therefore, if only one of the sexagenary day-dates in the "2nd month" is correct, no matter which lunar phase it belongs to, the resulting limitations are very strict.

Summing up the two possibilities, the "6th month, *chuji*, *wuyin* (15)" falls within the first eight days of the month, "2nd month, *jisiba*, *renyin* (39)" falls between the twenty-third and thirtieth days of the month, and "1st month, *jishengba*, *wuwu* (55)" falls between the ninth and the sixteenth of the month.

It must be noted that the discussion of both the *Zuoce Hu you* and the *Hu ding* rely on the assumption that phase *jiwang* in the inscriptions refers to a certain few days following the full moon, with a working definition as the period from the sixteenth and twenty-first days of the month. In reality, this takes the beginning of the month as the day of new moon. Here, because we cannot fully rely on the *jiwang* date, all of the relationships among the lunar phase calendar dates become a matter of their arithmetic relations, regardless of whether the month began with the new moon day or with observation of the first crescent. If one takes both alternatives into consideration, then the possible range of days for "6th month, *chuji*, *wuyin* (15)" would be, taking new moon as first day, between the first day of the month and the eighth, whereas taking first crescent as first day of the month the range would extend to the tenth day of the month. The range for "2nd month, *jisiba*, *renyin* (39)," taking new moon as first day, would be from the twenty-third to the thirtieth day of the month (taking first crescent as the first day of the month, the thirtieth day in that case would change to the second day of the next

month). For "1st month, *jishengba*, *wuwu* (55)," if the new moon day is taken to be the first day of the month, the range is between the ninth and sixteenth days (if taking first crescent as first day of the month, the sixteenth day would change to the eighteenth day). Imposing the limitation that *jishengba* cannot extend past the full moon, the result is still that, taking the new moon day as the beginning of the month, "6th month, *chuji*, *wuyin*" falls within the first eight days of the 6th month. Taking the new moon as the first day of the month, "2nd month, *jisiba*, *renyin*" falls between the twenty-third and the thirtieth, and "1st month, *jishengba*, *wuwu*" falls between the ninth and the sixteenth days of the month.

4. *Jing fang ding*

There are three calendar dates on the *Jing fang ding*:

10th month day *jiazi* (1)
8th month, *chuji*, day *gengshen* (57)
jiwang, *dingchou* (14) (8th month)

A number of scholars have also discussed the calendar dates of the *Jing fang ding*, such as Li Xueqin, who assigned the vessel to the reign of Zhou King Zhao 昭王.[17]

Here I will not consider the questions of royal reign and absolute chronology, but just discuss the relationships among the three calendar dates. Assuming no intercalary month intervened, from the first day of the "10th month" to the first day of the "8th month" the following year is ten months, and if there were no successive long months that would be 295 days. If the "10th month" were a long month, and successive long months intervened, then from the first day of the "10th month" to the first day of the "8th month" would total 296 days. Table 11 shows the relationship between the *Jing fang ding's* first day of the"10th month," the "10th month, *jiazi* (1)," and the following year's "8th month, *chuji*, *gengshen* (57)" and "*jiwang*, *dingchou* (14)."

The date "8th month, *jiwang*, *dingchou* (14)" is seventeen days after "*chuji*, *gengshen* (57)." From Table 11 one can see that, if the temporal range of *jiwang* is from the sixteenth to the twenty-first day, then the only solution for the "*chuji*" of the *Jing fang ding* would be to take the new moon day as the first day of the month and the range for "*chuji*" as between the first and fourth day of the month.

The above discussion considered the calendar dates on four bronze vessels, each of which has two or more calendar dates and lunar phases.

17. Li Xueqin, "Jing fang ding yu Zhou Zhao Wang liri".

Table 11. Relationship among the three calendar dates on the *Jing fang ding*

10th month		No back-to back long months			1 back-to-back long months		
		8th month			8th month		
1st day	*jiazi* (1)	1st day	(57)[a]	(14)[b]	1st day	(57)[a]	(14)[b]
yichou (2)	no	*gengshen* (57)	1st	18th	*xinyou* (58)	no	17th
jiazi (1)	1st	*jiwei* (56)	2nd	19th	*gengshen* (57)	1st	18th
guihai (60)	2nd	*wuwu* (55)	3rd	20th	*jiwei* (56)	2nd	19th
renxu (59)	3rd	*dingsi* (54)	4th	21st	*wuwu* (55)	3rd	20th
xinyou (58)	4th	*bingchen* (53)	5th	22nd	*dingsi* (54)	4th	21st
gengshen (57)	5th	*yimao* (52)	6th	23rd	*bingchen* (53)	5th	22nd
jiwei (56)	6th	*jiayin* (51)	7th	24th	*yimao* (52)	6th	23rd

a. *chuji, gengshen* (57). b. *jiwang, dingchou* (14).

From this discussion the possible ranges in days for the various lunar phase terms are as follows:

Zuoce Hu you: *jishengba*: taking new moon as first day of the month, from day eleven to fifteen.

Hu ding: *jishengba*, taking new moon day as first day of the month, (i) between day one and day eight, (ii) between days thirteen and fifteen.

Jin Hou Su zhong (analyzing calendar date relations, taking "2nd month, *jiwang*, *guimao*" as erroneous):

"1st month, *jishengba":* between days nine and fifteen in the calendar of the time.

"2nd month, *jisiba* between days twenty-three and thirty in the calendar of the time.

"6th month, *chuji*": between day one and day eight in the calendar of the time.

Jing fang ding: *chuji* (taking new moon day as the start of the month), between the first day and the fourth.

Besides the bronze vessels containing two or more lunar phase calendar dates, if it is possible to determine that several vessels belong to the reign of a single king, regardless of the absolute historical dates of the king in question, those vessels can comprise a group of materials. Using the same methodology as above it is also possible to discuss the range of possibilities for the lunar dates for these materials as well.

In the past, taking the Wei group of three vessels together with the *Cuo Cao ding* as a group and the three Sima Gong vessels as a group, scholars have investigated the relationships among the lunar phase calendar dates of each group. Their conclusion was:

> 西周時期（至少是西周中期）是將一個朔望月分成兩半，上半月稱既生霸，下半月叫既死霸…初吉很可能就是初幹吉日，既望的含義比滿月要擴大一些。
>
> In the Western Zhou period (at least in the middle Western Zhou period) the month was divided into two halves, the first half being called *jishengba* and the second half called *jisiba*. . . *chuji* very probably was the first auspicious stem (*gan*) day, and the meaning of *jiwang* was somewhat broader than 'full moon'.[18]

In addition, it is beyond doubt that the forty-second year and the forty-third year *Zuo ding* discovered in 2003, no matter how many different interpretations are offered by scholars, belong to the reign of a single king, hence they can also be taken as a group. Below these three groups of materials will be analyzed in detail.

5. The three Wei Group vessels plus the *Cuo Cao ding*

The three Wei Group vessels are the "3rd year *Wei he*," the "5th year *Wei ding*," and the "9th year *Wei ding*." The scholarly consensus is that these three vessels belong to the reign of King Gong. [19] There is another vessel that belongs to this reign, the King Gong standard-type vessel known as the "15th year *Cuo Cao ding*." Below let us first list the lunar phase calendar dates on these four vessels:

3rd year *Wei he* (衛盉): "3rd year, 3rd month, *jishengba*, *renyin* (39)"
5th year *Wei ding* (衛鼎): "5th year, 1st month, *chuji*, *gengxu* (47)"
9th year *Wei ding*: "9th year, 1st month, *jisiba*, *gengchen* (17)"
15th year *Cuo Cao ding*: "15th year, 5th month, *jishengba*, *renwu* (19)"

The authors of the above-mentioned *Zhongguo tianwenxue shi* already

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18. Zhongguo tianwenxue shi zhengli yanjiu xiaozu , *Zhongguo tianwenxue shi* 中國天文學史 (Beijing: Kexue chubanshe, 1981), 20–21.

19. Nivison, "The Dates of Western Chou". Liu Qiyi 劉啟益, "Xizhou jinian tongqi yu Wuwang zhi Liwang de zaiwei nian shu" 西周紀年銅器與武王至厲王的在位年數, *Wenshi* 13 (1982); also in Zhu Fenghan 朱鳳瀚 and Zhang Rongming 張榮明 eds., *Xizhou zhuwang niandai yan jiu* 西周諸王年代研究 (Guiyang: Guizhou renmin, 1998), 185–98. Ma Chengyuan, "Xizhou jinwen he Zhou li de yanjiu" 西周金文和周曆的研究, *Shanghai bowuguan jikan* 上海博物館集刊 (1982); also in *Xizhou zhuwang niandai yanjiu* (1998), 203–12.

provided a graphic illustrating the placement of these lunar phase calendar dates; below the relationships among them are shown in greater detail. Because this group includes four vessels and the time span is from the 3rd through the 15th year, to simplify matters the distribution of long and short months will not be discussed, but only the mean synodic month will be used in the calculation.

i. Between the first day of the "3rd year, 3rd month" and the first day of the "5th year, 1st month" there may or may not have been an intercalary month, so that there could have been either 22 or 23 months, for 650 or 679 days.

ii. Between the first day of the "3rd year, 3rd month" and the first day of the "9th year, 1st month" there ought to have been two or three intercalary months, so there could have been either 72 or 73 months, for 2126 or 2156 days.

iii. Between the first day of the "3rd year, 3rd month" and the first day of the "15th year, 5th month" there ought to have been four or five intercalary months, so that there could have been either 150 or 151 months, for 4430 or 4460 days.

Taking all the above possibilities into consideration, Table 12 below shows the relationships among the calendar dates on the four bronze vessels.

The lunar phases of the 3rd year *Wei he* and the 15th year *Cuo Cao ding* are both *jishengba*. From the relationship between the calendar dates on the *Wei he* and the *Cuo Cao ding* in Table 12 one can see that their day-dates in the sequence are consistently ten days apart: if the first is day one, the second is day twenty-one, if the first is the day eleven, the second is day one, if the first is the day twenty, the second is day ten. Since *jishengba* should not refer both to the first half of the month *as well as*the second half of the month, and taking into consideration that the *Jin Hou Su zhong* shows that *jisiba* is definitely in the latter half of the month, the only possible portion of Table 12 that can be accepted is that showing that the date "3rd year, 3rd month, *jishengba*, *renyin* (39)" is between the twelfth and the fifteenth days of the month, the date "5th year, *chuji*, *gengxu* (47)" is between the first day of the month and the fourth, the date "9th year, 1st month, *jisiba*, *gengchen* (17)" is between the twenty-fourth day of the month and the twenty-seventh, and the 15th year *Cuo Cao ding*'s "15th year, 5th month, *jishengba*, *renwu* (19)" is between the first and the fifth days of the month. From the relationship between the calendar dates on the 5th year *Wei ding*'s "5th year, 1st month, *chuji*, *gengxu* (47)" and the 15th year *Cuo Cao ding's* "15th year, 5th month, *jishengba*, *renwu* (19)" one can see that *jishengba* and *chuji* ought to overlap.

Table 12. Relationships among the Wei Group and Cuo Cao *ding* calendar dates

3rd year, 3rd month, 1st day	3rd year, 3rd month, *jishengba, renyin* (39)[a]	5th year, 1st month, *chuji, gengxu* (47)[b]		9th year, 1st month, *jisiba, gengchen* (17)[c]		15th year, 5th month, *jishengba, renwu* (19)[d]	
		no int. month	1 int. month	2 int. months	3 int. months	4 int. months	5 int. months
renyin(39)	1st	19th		13th			21st
xinchou(38)	2nd	20th		14th			22nd
gengzi(37)	3rd	21st		15th			23rd
jihai(36)	4th	22nd		16th			24th
wuxu(35)	5th	23rd		17th			25th
dingyou(34)	6th	24th		18th			26th
bingshen(33)	7th	25th		19th			27th
yiwei(32)	8th	26th		20th			28th
jiawu(31)	9th	27th		21st			29th
guisi(30)	10th	28th		22nd			30th
renchen(29)	11th	29th		23rd		1st	
xinmao(28)	12th		1st	24th		2nd	
gengyin(27)	13th		2nd	25th		3rd	
jichou(26)	14th		3rd	26th		4th	
wuzi(25)	15th		4th	27th		5th	
dinghai(24)	16th		5th	28th		6th	
bingxu(23)	17th		6th	29th		7th	
yiyou(22)	18th		7th	30th		8th	
jiashen(21)	19th		8th		1st	9th	
guiwei(20)	20th		9th		2nd	10th	
renwu(19)	21st		10th		3rd	11th	
xinsi(18)	22nd		11th		4th	12th	
gengchen(17)	23rd		12th		5th	13th	
jimao(16)	24th		13th		6th	14th	
wuyin(15)	25th		14th		7th	15th	
dingchou(14)	26th		15th		8th	16th	
bingzi(13)	27th		16th		9th	17th	
yihai(12)	28th		17th		10th	18th	
jiaxu(11)	29th		18th		11th	19th	
guiyou(10)	30th		19th		12th	20th	

a. 3rd year *Wei he*: 3rd year, 3rd month, *jishengba, renyin(39).*
b. 5th year *Wei ding*: 5th year, 1st month, *chuji, gengxu(47).*
c. 9th year *Wei ding*: 9th year, 1st month, *jisiba, gengchen(17).*
d. 15th year *Cuo Cao ding*, 15th year, 5th month, *jishengba, renwu(19).*

6. The Sima Gong Group Bronze Vessels

The Sima Gong Group includes four bronze vessels, the *Shi Chen ding* 師晨鼎, the *Shi Yu gui* 師俞簋 cover, the 4th year *Xing xu* 癲盨, and the *Jian gui* 諫簋. Scholars are generally in agreement that, based on the content of these bronze inscriptions, they all belong to the reign of one king. Since all four record the year in the king's reign, the calendar dates in this group of bronze vessels establish a definite relative chronology, hence the relational constraints among them can be used to investigate the range of the lunar phases. Among them, the *Shi Chen ding*'s and the *Shi Yu gui* cover's lunar phase calendar dates are the same.

Shi Chen ding: (*Shi yu gui* cover): "3rd year, 3rd month, *chuji*, *jiaxu* (11)"
Xing xu: "4th year, 2nd month, *jishengba*, *wuxu* (35)"
Jian gui: "5th year, 3rd month, *chuji*, *gengyin* (27)"

On computing the calendar days between the 3rd year and 5th year, one finds that there was no intercalary month between the 3rd and 4th years, and that between the 4th and 5th years there ought to be one intercalary month. Between the first day of the "3rd year, 3rd month" and the "4th year, 2nd month" there are eleven months, six short and five long or five long and six short, for a total of 324 or 325 days. From the first day of the "3rd year, 3rd month" to the first day of the "5th year, 5th month," there are twenty-five months, thirteen short and twelve long or twelve short and thirteen long, for a total of 737 or 738 days. Table 13 below shows the relationships among the three columns of calendar dates.

The lunar phases of "3rd year, 3rd month, *jiaxu* (11)" and "5th year, 3rd month, *gengyin* (27)" are both the same, and the "4th year, 2nd month, *wuxu* (35)" lies between them. From Table 13 one can see that by an extraordinary coincidence the place of "4th year, 2nd month, *jishengba*" in that month's sequence of days is right between those of the "3rd year, 3rd month, *chuji*, *jiaxu*" and the "5th year, 3rd month, *chuji*, *gengyin*." In other words, it is always the same as the day in the sequence of the "3rd year, 3rd month, *chuji*, *jiaxu* (11)" or else it is one day less. Moreover, compared to the day in the sequence of the "5th year, 4th month, *chuji*, *gengyin* (27)" it is either the same or one day more. As a result, judging from the lunar phases and the calendar dates on this group of bronze vessels, *chuji* and *jishengba* certainly overlap.

7. The 42nd Year and the 43rd year *Zuo ding*

The appearance of the 42nd year and 43rd year *Zuo ding* poses a challenge for the work of compiling a calendar for the bronze inscriptions, and scholars have proposed a number of hypotheses to resolve the dif-

Table 13: Relationships among the calendar dates of the Sima Gong Group bronzes

3rd year, 3rd month, 1st day	3rd year, 3rd month, *chuji, jiaxu* (11)[a]	4th year, 2nd month, *jishengba, wuxu* (35)[b]		5th year, 3rd month, *chuji, gengyin* (27)[c]	
		6 month short, 5 long	5 month short, 6 long	13 month short, 12 long	12 month short, 13 long
jiaxu (11)	1st	1st			
guiyou (10)	2nd	2nd	1st	1st	
renshen (9)	3rd	3rd	2nd	2nd	1st
xinwei (8)	4th	4th	3rd	3rd	2nd
* * * *					
bingwu (43)	29th	29th	28th	28th	27th
yisi (42)	30th	30th	29th	29th	28th

a. *Shi Chen ding* (*Shi yu gui* cover): "3rd year, 3rd month, *chuji*, *jiaxu* (11)"
b. *Xing xu*: "4th year, 2nd month, *jishengba*, *wuxu* (35)"
c. *Jian gui*: "5th year, 3rd month, *chuji*, *gengyin* (27)"

ficulties.[20] No one questions that the two vessels belong to the reign of the same king, so that we can still investigate the relative relationship between the calendar dates of the two inscriptions. First let us consider the calendar dates of the two inscriptions:

42nd year *Zuo ding*: "42nd year, 5th month, *jishengba*, *yimao* (52)"
43rd year *Zuo ding*: "43rd year, 6th month, *jishengba*, *dinghai* (24)"

The lunar phases in the two inscriptions are both *jishengba*. From the first day of the "42nd year, 5th month" to the first day of the "43rd year, 6th month," with no intercalary month, is thirteen months, either seven short and six long or six short and seven long, for a total of 383 or 384 days. If there is an intercalary month, the total is fourteen months, seven long and seven short, or six short and eight long, for a total of 413 or 414 days.

It is evident that if the *jishengba* of the 42nd year *Zuo ding* is in the first quarter of the month (i.e., first through seventh days), then "*jishengba*, *dinghai* (24)" in the 43rd year *Zuo ding* is certainly in the second quarter

20. *Wenwu yu kaogu* bianjibu 文物與考古編輯部, "Baoji Meixian Yang Jia Cun jiaocang shanshi jiazu qingtongqi qun zuotan jiyao" 寶雞眉縣楊家村窖藏單氏家族青銅器群座談紀要, *Wenwu yu kaogu* 3 (2003), 13–16. Zhang Peiyu, "*Lai ding* de wangshi yu xizhou wanqi lifa yuexiang jiri" 逨鼎的王世與西周晚期曆法月相紀日, *Zhongguo lishi wenwu* 3 (2003), 6–15. Chen Jiujin 陳久金, "*Wu Lai ding* yuexiang liri faxian de zhongda kexue yiyi" 吳逨鼎月相曆日發現的重大科學意義, *Ziran kexueshi yanjiu* 22.4 (2003), 368–73. Li Xueqin, "Meixian Yang Jia Cun qiming liri de nanti" 眉縣楊家村器銘曆日的難題, *Baoji wenli xueyuan xuebao* (Shehui kexue ban) 寶雞文理學院學報 (社會科學版) 5 (2003), 1–3. Xia Hanyi (Edward L. Shaughnessy), "Sishi'er nian sishisan nian *yu qiu ding* de niandai".

Table 14. This table needs a label

42nd year, 5th month, 1st day	42nd year, 5th month, *jishengba, yimao* (52)	43rd year, 6th month, *jishengba, dinghai* (24), no intercalary month		43rd year, 6th month, *jishengba, dinghai* (24), 1 intercalary month	
		7 months short, 6 long	6 months short, 7 long	7 months short, 7 long	6 months short, 8 long
yimao (52)	1st	10th	9th		
jiayin (51)	2nd	11th	10th		
bingshen (33)	20th	29th	28th		
yiwei (32)	21st	30th	29th		
jiawu (31)	22nd		30th	1st	
guisi (30)	23rd			2nd	1st
dinghai (24)	29th			8th	7th
bingxu (23)	30th			9th	8th

of the month (i.e., ninth through fifteenth days). Since we hold that *jishengba* cannot refer both to the first half of the month as well as the second half of the month (corresponding to the situation in the table with an intercalary month, where *jishengba* in the 42nd year *Zuo ding* would fall between the twenty-second day and the thirtieth day, and *jishengba* in the 43rd year *Zuo ding* would fall between the first day of the month and the ninth), and since the analysis of the *Jin Hou Su zhong* above showed that *jishengba* must include a certain number of days during the first half of the month, as a result, *jishengba* cannot refer to any part of the second half of the month. Therefore, the only possible choice of alternatives for the *jishengba* dates on *Zuo ding* is that they refer to the first quarter of the month or the second quarter of the month, respectively.

8. *Conclusion*

The present article uses the relational constraints among the calendar dates where two or more full dates are present on bronze vessels whose relative dating is established, in order to investigate the meaning of the lunar phase terms. First, four known bronze vessels having inscriptions containing more than one lunar phase calendar date were chosen. Following this, three groups of vessels whose relative dating to the reign of a single king is clearly established were chosen. In each individual case the result obtained for the range of days included in the lunar phase is merely the longest possible range of days for the lunar phase in the particular bronze inscription under discussion. For example, for *chuji* in the *Jing fang ding*, whose range was found to be from the first day of the

month to the fourth day, this only shows that in this particular inscription *chuji* must fall within the range given and cannot fall outside it. This definitely does not mean that *chuji* dates in all bronze inscriptions will definitely fall within this range. But if the research on these cases can point in the direction of particular ranges for particular lunar phase terms, when combined with philology and textual study, this may lead to even more interesting conclusions.

First, judging from the names *jishengba* and *jisiba* they ought to refer to the first half and second half of the month respectively, and should not extend past the full moon or overlap to any extent. Based on the discussion in the present essay, *jishengba* ought to include the entire first half of the month and it is not just the name of a lunar quarter. Correspondingly, *jisiba* ought to include the entire second half of the month.

Second, *jishengba* and *chuji* ought to overlap to some extent.

Third, five cases of *chuji* were discussed in the present article, but based on the tabulated results the range is definitely not strictly limited. On the *Jin Hou Su zhong*, *chuji* is between the first day of the month and the eighth, on the *Jing fang ding* it falls between the first and fourth day of the month, the *chuji* obtained from the three Wei Group vessels plus the *Cuo Cao ding* falls between the twenty-ninth and the fourth day of the following month, and on the Sima Gong Group vessels the two *chuji* fall in the first half of the month. Although there are scholars who consider that *chuji* is not a lunar phase, based on the above data, if *chuji* is taken to refer to a certain few days during the first half of the month, all the materials dealt with here can be accommodated. Because the results of the above research as regards *jishengba* alone demonstrate that the four-quarter interpretation of the lunar phase terms is untenable, it follows that the claim that *chuji* refers to the first quarter of the month is also without foundation. From this it appears that the interpretation of *chuji* as the first auspicious stem (*gan*) day of the month ought to be accepted.