THE DATE OF THE SHANG PERIOD

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The commonly given dates for the Shang period, 1766-1122 B.C., are derived, as is well known, not from any reliable records, but from ancient calculations. The first great Chinese history, the *Historical Memoirs* (*Shzh-ji*), by Sz-ma Tsien (lived ca. 145-ca. 86 B.C.), begins its dating of events only with 841 B.C. [1]). The date 1122 B.C. appears first in the *History of the Former Han Dynasty* (*Tsien-Han-shu*), chap. 21, "The Treatise on Measurement and Chronology", and is the result of calculations by Han scholars, codified by Liu Hsin [2]). This chronology was adopted by Ju Hsi in his *Abridged View of the Comprehensive Mirror* (*Tung-jien Gang-mu*), consequently it became the orthodox Sung Confucian view. There is however a shorter chronology, found in the *Historical Memoirs* [3]), with the date 1051 B. C. for the Jou conquest. This is also the date derived from the present text of the *Annals Written on Bamboo* (*Ju-shu Ji-nien*). But that text is not always reliable, hence a slightly different date for the Jou conquest, 1027 B.C., has been derived by Karlgren [4]) from Wang Guo-wei's collation of quotations from the original text of the *Annals Written on Bamboo*. So much for what we know about the date for the end of the Shang

1) *Shzh-ji*, chapter 14, beginning.

2) É. Chavannes, *Memoires Historiques*, I, clxxxviii-cxcvi.

3) Cf. Chavannes, *op. cit.*, I, cxciii f.

4) B. Karlgren, In *Bull. of the Mus. of Far Eastern Antiquities*, no. 17, p. 117. He sums up the earlier work on this problem.

period from literary sources. These two sets of dates, 1122 and 1051, together with 1027 B. C., are about a century apart.

Recently, Mr. Dung Dzo-bin, in his *Yin-li-pu* 殷曆譜, part B 下, chap. III, pp. 21 b-37 b, has collected the records of six lunar and one solar eclipse that he and others have found mentioned on recently excavated oracle bones. The information contained therein is of the highest importance, since these records are contemporary with those eclipses, hence are eminently reliable. His dating for these eclipses is however based upon a table calculated with great labor during the war, unfortunately by antiquated and not always reliable methods. For this circumstance, a mistake which he now admits, he is not to blame. He is not an astronomer, but a paleographer. Information concerning modern methods of astronomical calculation for ancient eclipses was not then available in China. His discovery of these records is of the highest importance, for they make possible a definite dating for the Shang period, based upon calculable astronomical events. We shall first reproduce Mr. Dung's modern transcription of these records and then endeavor to determine what interpretations are to be given to them.

Eclipse Record I. A small fragment [1]) has the characters corresponding to 旬 ... 月有食 ... 聞 ... 八月, "In the decade ... the moon was eclipsed .... It was reported [from outside the capital].... It was in the eighth month." Above the preceding inscription there is another one: 癸卯卜 ... 旬亡咎 ... 十月, "On [the day] *guei-mao* [cyclical day 40] ... it was divined whether the decade will be without calamity.... Tenth month."

1) Academia Sinica bone no. 1. 1893.0.0672. Drawing by Mr. Dung in *op. cit.* The interpretation of *wen* 聞 as "reported to the throne" is found in the *Ts'ien-Han-shu*, cf. Dubs, *History of the Former Han Dynasty*, vol. II, p. 47. That eclipses were reported from outside the capital is established in connection with the polar eclipses of 188 and 15 B.C.; cf. *ibid.*, I, 189; II, 421. Mr. Dung cites cases of *wen* as meaning "reported from outside the capital" from the *Hou-Han-shu*; cf. *op. cit.*, B. III, 24a.

Hence Mr. Dung concludes that the decade in which the eclipse occurred also began with the day *guei-mao*. I cannot however find this conclusion cogent. From the style of the characters, he states that the inscription was made in the reign of King Wu-ding or later down to the reign of Dzu-geng, i.e., during three reigns in two generations [1]).

Eclipse record II. A large plastron [2]) has the inscription 午夕月有食 "[On the day] ... *-wu*, in the night, the moon was eclipsed." Immediately after this one another follows, beginning, "[On the day] *yi-wei* [day 32]", which makes it definite that the day of the eclipse was *jia-wu* [day 31]. From the name of a diviner on this bone, Mr. Dung infers that this inscription belongs to the reign of Wu-ding [3]).

Eclipse record III. A narrow strip of bone [4]), has the inscription, 旬壬申月有食 "In [this] decade, [on the day] *ren-shen* [day 9], in the night, the moon was eclipsed." From its style of writing, Mr. Dung concludes that the inscription may be as early as the reign of Pan-geng or as late as that of Dzu-jia, six reigns in three generations, a period traditionally of 112 years [5]).

Eclipse record IV is taken from two fragments of sheep shoulder bones. One, in the Chalfant Collection now in the British Museum [6]), has the inscription 七日已未口庚申月有食 "On the seventh day [of the decade, the day] *ji-wei*, [day 56], (debated

1) *Op. cit.*, B, 22a, lower register, column 19. In spite of this explicit statement, Mr. Dung dates this eclipse in the reign of Siao-sin, the uncle and second king preceding Wu-ding (*op. cit.*, B, III, 21b).

2) Academia Sinica no. 13,0.0769-13.0.7072.

3) *Op. cit.*, B, III, 25a, lower register, column 6. But he dates the eclipse in the reign of Siao-yi, the father and predecessor of Wu-ding.

4) Published in 簠室殷契徵文, 天, 2.

5) *Op. cit.*, B, III, 27a, lower register, columns 17, 18.

6) Drawing in F. H. Chalfant and R. S. Britton, *The Couling-Chalfant Collection of Inscribed Oracle Bones*, p. 88, no. 1595. Mr. S. C. Wu of Oxford University has undertaken to publish photographs and translations of this important British Museum collection.

character [1]), [on the day] *geng-shen* [day 57], the moon was eclipsed." The other one, in the Hopkins Collection (no. 594), reads 已未夕□庚申月有食, "On [the day] *ji-wei*, in the night (a slightly different form of the same unknown character) on [the day] *geng-shen* the moon was eclipsed." Mr. Dung sets a full stop after the debated character, locating the eclipse on day 57 only. With an unknown character, it is however difficult to be sure about punctuation. The same two bones, in connection with other divinations, one for the day *guei-wei* (day 20) and the other for *bing-sü* (day 23) have the notation, "Thirteenth month 十三月", i.e., the intercalary month. Hence this eclipse occurred in the twelfth month. Mr. Dung states (*ibid.*, p. 30 b) that the notation "thirteenth month" is very common in inscriptions in the reign of Wu-ding and ceased with the reign of Dzu-geng.

The dating of this eclipse raises the problem concerning how much we know about the Shang calendar. Dr. Dung appears to go beyond the available evidence, fixing, by rules employed in Han times, the length of months, the interpolation of intercalary months, etc. for the whole later portion of the Shang period. It is however quite likely that astronomical calculations for the beginnings of months began to be used in China only about 600 B.C. [2]). Hence is it dangerous to employ a Han calendar for a period a thousand years earlier.

The occurrence of the term "thirteenth month" establishes the use of intercalary months in Shang times [3]). Hence we may safely

1) Guo Mo-ro deciphers this debated character as 蝕, taking it to denote literally a vessel of food, half eaten. Mr. L. C. Hopkins, in a personal letter, identifies it with the lidless vase, *guan* 祼, here meaning "to offer a libation." With these interpretations I cannot concur. This character seems to occur only between the notations for two cyclical days. I prefer to leave its meaning uncertain.

2) Cf. Dubs, "The Date of Confucius' Birth", *Asia Major*, N.S., vol. I, p. 140, note.

3) An intercalary month is mentioned five times in the extant inscriptions, cf. Dung, *op. cit.*, A, II, 11a.

assume that months then began with the new moon, as they have done ever since in China, and that the beginning of the year was kept approximately at the same place in a solar year, by the use of intercalary months. The Jou and Han method of determining the length of a solar year by observing on what day the shadow of a gnomon is shortest at noon (the winter solstice) is very simple and may well have been extremely ancient in China. A solstice is mentioned twice in the inscriptions [1]). We shall then not go very far wrong in assuming that the Shang year began some time soon after the winter solstice. Ancient tradition asserts that the state of Sung continued the use of the Shang calender throughout the Jou period and that it began the year a month after the Jou royal calendar, or a month before the subsequent calendar inaugurated in 104 B.C. [2]). A study of the calendars for years with intercalary months during the last two centuries B.C. indicates that this twelfth month probably occurred between 15 November and 2 January, Gregorian, or between 4 November and 26 December, Julian [3]). We must however allow a slightly wider range for this month, because of the possibility that Shang determinations of the solar year may not have been as accurate as Han ones. For Eclipse record I, a similar study indicates that the "eighth month" should be sought between 30 July and 4 October, Julian.

Eclipse record V. Of two disconnected fragments from assertedly

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1) *Op. cit.*, A, II, 11a. A solstice is mentioned once in the sixth month, thus fixing the summer solstice as normally in that month and the winter solstice in the last month of the year.

2) Cf. Havret in *T'oung Pao*, vol. 8, p. 399. This Han calendar is fundamentally the same as that employed in Tsing times, i.e., the present Chinese lunar calendar.

3) Astronomers regularly use the Julian calendar for dates B.C., because of its simplicity. This paper does likewise. In "The Date of Confucius' Birth" (cf. note 10), I however used the present Gregorian calendar, because I was discussing an anniversary. It was necessary to extrapolate the present calendar in order to secure the present day of the year corresponding to that in ancient times.

the same tortoise-shell [1]), one contains the following inscription: 三日 ... 酉夕 ... 食聞, "[On] the third day [of the decade, the day] ... *-yu*, in the night, [there was an] eclipse. It was reported [from outside the capital]." Since divination for a decade was made on a *guei* day, the "third day" of the decade was a *yi* day, so that the day of the eclipse was *yi-yu* (day 22). The other bone contains routine divinations for the days *guei-mao* (day 40), *guei-yu* (day 10), and *guei-sz* (day 30). The one for *guei-yu* is followed by the statement, "Third month 三月." The name of a diviner indicates that it came from the reign of Wu-ding or possibly from the previous reign.

Mr. Dung has reconstructed the lower half of this tortoise-shell from these two fragments. But he does not juxtapose them, so that it is difficult to decide which one was above and which below, and even to be sure whether they really both originally belonged to the same bone. Hence we cannot be sure whether the "third month" came before or after the eclipse, or even that "third month" had any relation to the eclipse. The character for *yu* is moreover represented only by its lower tip and that for *shzh* ("eclipse") by its lower half. I believe however that Mr. Dung's reconstruction of these two characters is sound. The character for "moon" is missing, but the character *si* meant "night" according to Mr. Dung, so that this record is of a lunar eclipse.

Eclipse record VI. Mr. Dung cites a passage from the *Yi-Jou-shu*, chap. 5, listing a lunar eclipse in the thirty-fifth year of Lord Sin, i.e., the last Shang king, Jou, in the first month, the day *ping-dz* (day 13). Since however this passage is not contemporary with the eclipse and so may be erroneous, we shall neglect this record. There furthermore was no lunar eclipse that easily corresponds to this statement. The early morning partial eclipse of 1014 B.C., Dec. 11,

1) In the Yenching Collection, published in the 殷契卜辭, nos. 632 and 434.

occurred presumably after Sin's death, and the eclipses on the morning of 1112 B.C., Sept. 15 and midnight of 1164 B.C., Dec. 17-18, which are the next earlier eclipses on cyclical day 13, are presumably too early. Some mistake was made in this record, making it unidentifiable.

Eclipse record VII. Two shoulder-bone fragments [1]) contain the same difficult divinations: 癸酉貞日月又[有]食隹若 and 癸酉貞日月又食口若. The meaning of the key character, here written *yüe* 月, has been debated. Wang Siang equates it with *si* 夕, which character was then written practically the same as was *yüe*, and declares that here it means, not "night", but "late afternoon" or "dusk". Thus he interprets this passage as recording a solar eclipse: "[On the day] *guei-yu* [day 10], it was divined, since the sun had been eclipsed in the late afternoon, whether there would be a favorable happening." The other divination almost surely asks whether the same phenomenon would produce an unfavorable happening [2]). The style of writing indicates, according to Mr. Dung, that this inscription is from the reign of Wu-yi or Wen-wu-ding, a period traditionally of fifteen years, beginning half a century after the death of Wu-ding.

Mr. Dung replies to Mr. Wang that in the Yin period, *si* meant "night", not "dusk" or "late afternoon", for the latter of which meanings there were other terms. He interprets the above divination, "Since the sun and moon had been eclipsed, whether there would be a favorable happening." He accordingly concludes that both a solar and a lunar eclipse occurred. Since a solar eclipse occurs only on the day of a conjunction of sun and moon (usually the last day of a Chinese lunar month) and a lunar eclipse only

1) *Yin-chi Jeng-wen, Tien* one 殷契徵文, 天一 and *Yin-chi Yi-tsun* 殷契佚存, no. 374.

2) The late Dr. Britton identifies this undeciphered character with *fei* 非, "not".

on the day of opposition (usually the fifteenth of a lunar month), it is uncertain whether *guei-yu* refers to the lunar or the solar eclipse. This inscription does not moreover necessarily state that an eclipse occurred on the day *guei-yu*, but merely that divination occurred on that day. But the divination would hardly have been postponed long after the eclipse. If then we find a suitable eclipse on the day *guei-yu*, we shall probably be safe in declaring that the inscription records an eclipse. The style of inscription indicates, according to Mr. Dung, that this divination was made in the reigns of Wu-yi or Wen-wu-ding, the third and fourth reigns before the end of the dynasty.

The dating of these eclipses depends upon the continuance of the sixty-day cycle of days from the second millennium B.C. to the present. Some persons have doubted whether this cycle has been maintained accurately during such a very long period. Chinese records of eclipses however establish that this cycle has been kept accurately ever since Han times. Eclipses recorded in the *Spring and Autumn* (*Chun-tsiu*) carry this cycle accurately back to 720 B.C. [1]). An eclipse mentioned in the *Book of Odes* (*Shzh-jing*) may carry it back to 776 B.C. [2]). During the Shang period, this cycle was maintained very carefully, for it was used to indicate the days for ancestral sacrifices to deceased Shang monarchs and personages [3]). Hence the only time that this cycle might have been broken was the three or four centuries from the downfall of the Shang government to the eighth century B.C. But this cycle had been kept carefully for at least several centuries prior to that period and had become a matter of superstitious reverence for divination,

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1) J. Legge, *Chinese Classics*, vol. III, pt. I, introduction, p. 103.

2) P. Hoang, *Catalogue des Éclipses de Soleil et de Lune*, "Variétés Sinologiques" no. 56, p. 1.

3) Dung, *op. cit.*, A, ch. III; B, ch. II.

horoscopes, etc. It is consequently highly unlikely that this cycle should have been allowed to go wrong. All the diviners in a country fond of divination probably used it and preserved it from generation to generation. We may therefore rely implicitly upon these cyclical days.

In dealing with lunar eclipses dated by cyclical days, we must make clear what was meant by a "day". For "days" have not always begun at the same time. The Babylonians began the day at sunrise; the Jews and Greeks, at sunset; the Romans, at midnight, as did also China in Han times. The fact that most of these eclipses are reported as having occurred in the "night", *si*, of a given day eliminates the Jewish and Greek "day". This fact also makes it possible that Shang China employed the Babylonian "day". Babylonia was the nearest area with a developed astronomy. Later Chinese practice however provides strong evidence that in the Shang period China used the Roman "day". Eclipse record IV confirms that probability.

Shang chronology is rendered much easier by the circumstance that the names and sequences of the Shang kings are established by the available inscriptions, which largely confirm the traditional list [1]). We are not however informed exactly how long each one reigned. The traditional list however furnishes an approximation. Our greatest uncertainty is when the Shang period ended.

Before considering the astronomical evidence, it may be well to summarize what knowledge we gain from these inscribed bones. From record I, we know merely that there was a lunar eclipse reported from outside the capital, some time between July and October in a period of 65 years, including the reign of Wu-ding.

1) Dung, *op. cit.*, A, ch. III, p. 4 b furnishes an admirable list. Cf. also R. S. Britton, *Fifty Shang Inscriptions*, p. 75, a mine of information. Dr. Britton originally called my attention to the problem of dating the Shang period by these eclipses and has constantly given me the benefit of his advice and encouragement.

From record II, there was a lunar eclipse on the night of cyclical day 31 in the reign of Wu-ding. Record III lists a lunar eclipse on the night of day 9, during a period of a little more than a century, centering about the reign of Wu-ding. Record IV mentions a lunar eclipse in connection with the night of day 56 and day 57, in the months November to January, during the reign of Wu-ding. Record V lists a lunar eclipse on the night of day 22, reported from outside the capital, in the reign of Wu-ding or the preceding king. Record VI does not constitute contemporary evidence, so must be discarded. Record VII may be of a solar eclipse on day 10 in the evening, or of a solar and a lunar eclipse following one another, one of them on day 10, about half a century after the reign of Wu-ding. In checking these reports we shall use the "Canon of Lunar Eclipses for Anyang and China, -1400 to -1000" [1]).

The data for record IV are fuller than for any other eclipse. It is therefore easiest to begin with it. The eclipses for records II, III, and V must be located in a period of about sixty years that includes the eclipse for record IV, with a wider latitude possible for eclipse III.

For eclipse IV, there are only two dates that fit the conditions. (1) The first of these, 1192 B.C., Dec. 27-28 [2]), lists an eclipse that must have been a striking event. It began at 8.48 p.m. local time at Anyang on cyclical day 56 and became total at 9.53 p.m. Totality lasted for an hour and three-quarters. The moon began to reappear at 11.37 p.m., and the eclipse ended at 42 minutes after midnight, on the morning of cyclical day 57. The debated unknown character in the record then probably means something like "midnight" or "continuing into", indicating that this eclipse endured into the morning of day 57.

1) By the present author, *Harvard Journal of Asiatic Studies*, vol. 10, Sept., 1947, pp. 162-178. For further information concerning these eclipses, cf. that table.

2) The astronomical negative years in the "Canon" must be increased by one to secure historical years B.C.

The other eclipses fit in with this date. Record V may be that for 1227 B.C., May 31-June 1, days 22-23, a total midnight eclipse, or that for 1181 B.C., Nov. 25, the night of day 22, a total eclipse, probably, because of the record, the latter one. For record II there is the eclipse of 1198 B.C., Nov. 4, day 31, a partial eclipse in which the earth's shadow covered 0.73 of the distance across the moon's disk. For record III, on the evening of 1189 B.C., Oct. 25, day 9, from 7.54 to 10.22 p.m., the moon was eclipsed to a magnitude of 0.51. For record I, on 1195 B.C., Sept. 3-4, there was a total eclipse and on 1187 B.C., Oct. 5, there was a partial eclipse, magnitude 0.69. This dating thus satisfies all the conditions imposed by the inscribed records.

(Date 2). Record IV might also, but with less likelihood, represent the partial eclipse of 1218 B.C., Nov. 15-16. It however did not occur on cyclical day 56, but after 11 p.m. on the night of day 57. It endured only 2 hours 26 minutes, reaching a magnitude of 0.40. For record II, there is, within half a century, in addition to the eclipse of 1198, only the partial eclipse of 1229 B.C., Dec. 17, after midnight on the morning of day 32. If this latter dating is accepted, Shang China must have employed the Babylonian "day". For V, there was a total eclipse on the night of 1181 B.C., Nov. 25, day 22. For III, in addition to the eclipse of 1189 B.C., Oct. 25, mentioned in connection with date 1, there was only the total eclipse of 1282 B.C., Nov. 4, on the morning of day 10, from 3.58 a.m. to sunrise at 6.28 a.m. This eclipse however is too early, so is unacceptable and we must equate III with the eclipse of 1189 B.C. For record I, there was a total eclipse on the night of 1224 B.C., Sept. 23. The eclipses connected with date 2 are however much less striking and hence much less likely to have been observed than those for date 1. This circumstance applies especially to eclipse IV, which moreover lacks any connection with cyclical day 56. Date 2

is only 26 years earlier than date 1. I believe we may be confident that date 1 is the correct one.

There are really no other suitable dates to match these eclipse records. For IV, the eclipse of 1212 B.C., Feb. 16, could hardly have represented a Shang twelfth month eclipse. The same objection holds against the total eclipse of 1119 B.C., Feb. 9, which furthermore occurred only on the morning of cyclical day 58. The sunset partial eclipse of 1068 B.C., Nov. 7, is too recent to have occurred in the reign of Wu-ding, which must have been about a century before the Jou conquest.

Mr. Dung himself picks for record IV the total eclipse of 1311 B.C., Nov. 24 [1]). But when he did so, he did not have available an accurate canon of Shang lunar eclipses. This eclipse occurred on the morning of cyclical day 58, not on day 57, from 1.38 to 5.20 a.m. With this date, it is moreover impossible to find any eclipses that fit record II. The nearest one is 1229 B.C., Dec. 17, a partial eclipse on the morning of day 32, not 31, magnitude 0.77, from about 12.25 a.m. to about 3.25 a.m. Obviously this eclipse is much too long after 1311 B.C., so that Mr. Dung's dating, in the light of fuller knowledge, is unacceptable.

Astronomical evidence then makes certain that the date of King Wu-ding must be placed about 1200 B.C. Both of the possible datings confirm this placing. In view of the fact that this date does not mark the end of his reign, which might have come after 1181 B.C. (eclipse V) and that there were six (or seven) kings after him in four generations, before the Shang dynasty ended, it is obvious that 1122 B.C., the commonly used date for the Jou conquest, is quite unacceptable. The astronomical evidence points strongly to some date like 1027 B.C.

1) *Yin-li-pu*, B, III, 27 b, 28 a, 29 a; "Yin-li-pu Hou-ji", in *Liu-tung Bie-lu* (a journal of Academia Sinica, Historical and Language Section), *jung* 六同別錄(中), 1945, Dec., p. 24.

Eclipse record VII poses different problems. Mr. Dung interprets it to imply a solar and lunar eclipse visible in China half a month apart, one of them on cyclical day 10. Search was accordingly made during the period 1300 to 1000 B.C. for such eclipses. Only three such pairs were found: (1) the solar eclipse on 1142 B.C., May 7, day 25, mag. 0.35 and the lunar appulse on Apr. 23, day 10, just after midnight of day 9, mag. -0.06; (2) the lunar eclipse on the night of 1171 B.C., Nov. 6, day 55, mag. 0.51 and the solar eclipse on Nov. 20, day 10, mag. 0.81 at 2.17 p.m.; and (3) the solar sunset eclipse of 1183 B.C., Jan. 12, day 54, mag. 0.96 at 4.48 p.m. sunset and the lunar eclipse of Jan. 28, day 10, mag. 0.42. None of these dates is however long enough after the date of Wu-ding to be suitable.

Wang Siang interprets the inscription as denoting a solar eclipse in the late afternoon of day 10. The traditional dates for the reigns of King Wu-yi and Wen-wu-ding are 1226-1210 (the earlier chronology) or 1131-1115 (the later chronology). Calculation was accordingly made of all possible solar eclipses during the years 1230 to 1200 and 1135 to 1100 B.C., to discover eclipses visible in China on cyclical day 10. Only two were found: (1) On 1124 B.C., May 15, a partial eclipse occurred on day 10, from 4.40 to 6.48 p.m., reaching mag. 0.83 at 5.52 p.m. The eclipse then decreased and the sun set as the eclipse ended, so that the sun was restored to its full size at sunset. Then the word *si* should mean" late afternoon", not "dusk", an interpretation which, however, is denied by Mr. Dung with good evidence.

(2) More interesting is the eclipse of 1129 B.C., Feb. 9, day 10. It began at 4.26 p.m. and continued to increase until the sun set at 5.12 p.m. local time at Anyang, at which time the eclipse had reached a magnitude of 0.40. This eclipse was so conspicuous that it could not have been missed by anyone who saw the sun. It more-

over obviously did not end when the sun set, but continued on into the night. Then Mr. Dung is quite correct in interpreting *si* as meaning "night". We accordingly translate the inscription to mean, "On [the day] *guei-yu* it was divined whether it was a favorable circumstance that the sun was eclipsed at night." For such a sunset eclipse, the conception that the sun was eclipsed at night is quite intelligible. It is not difficult to imagine the discussion that must have gone on in the royal court when this sunset eclipse occurred. It was known that eclipses first wax, then wane. But this one had not been perceived to wane. Hence it must have waned after the sun had set, i.e., in the night! Or the eclipse might never wane! This dating for the eclipse both makes understandable the recording and fits in with the dates we have found for the other eclipses. Our conclusion is then confirmed, that the Jou conquest occurred in the eleventh century B.C., not the twelfth, and that King Wu-ding reigned about 1200 B.C.