

THE DIVISION OF TIME IN THE HAN DYNASTY AS SEEN IN THE WOODEN SLIPS

KAN LAO

In the study of the wooden slips which was published in 1960, I denoted some ideas based on the records of the Han Dynasty and the research on the Han sun-dial by Professor Liu Fu (劉復). Some seven years later I have made a new revision of the edition contained in *Chü-yen Han chien K'ao-cheng*. An article by Mr. Chen Meng-chia (陳夢家) entitled "A Reconstruction of the Han Dynasty Calendar Based on the Han Slips" was published in *K'ao-ku Hsio-pao*, nos. 1-2, 1965. Certainly he has the right of his presentation, particularly, since he worked on the article for such a long time. But his basic thesis is that the Han division of time was divided into eighteen units per day. I find it extremely difficult to agree with his opinion. In the following I would like to prove that each day was divided into twelve units.

A. THE DECIMAL DIVISION, THE HUNDRED SECTION AND THE FIVE DIVISIONS OF NIGHT

The oldest way of recording days was the chia-tzu (甲子) system, which consisted of a combination of two series of numbers, namely, t'ien-kan (天干) and ti-chih (地支); t'ien-kan was divided into ten units and ti-chih was divided into twelve units. Matching odd with odd and even with even of the two series, they formed sixty different combinations for naming the days. The original hsün (旬) system of the Yin-Shang civilization for naming days was the decimal system; the division into twelve units may have been borrowed from another civilization. This basis may be used to explain the decimal division of a day and the hundred section for the further division of a day.

In the fifth year of Chao-Kung (Duke Chao of the State of Lu) there was a statement on the recording of time.¹ "The number of suns is ten, therefore one day contains ten hours, and it is identified as ten ranks (of state). The King ranks first, lords rank second, ministers rank third. As for a day, noon

1. "Ch'un-ch'iu Tso-Chuan", *Shih-san Ching Chu-su*, Chüan 43. Yee-wen ed. pp. 743-44

[日中 jih-chung] is the highest, dining time [食 shih] is second and day-break [旦 tan] is third." During the day two divisions preceded noon. Thus two other divisions must exist after noon. According to this method the divisions of day time must be: (1) day-break (旦 tan); (2) early dining time (食 shih); (3) noon (日中 jih-chung); (4) later dining time (餽 pu); (5) dusk (昏 hun). Hun was always the opposite of tan (dawn) according to the chapter Yüeh-ling of *Li Chi*. (禮記)。

However, there was an explanation in the commentary of Tu Yü in *Tso Chuan*. (左傳杜預注) He said the ten divisions were identified as: (1) jih-chung (日中 noon); (2) shih-shih (食時 early dining time); (3) p'ing-tan (平旦 day-break); (4) chi-ming (雞鳴 cock's cry); (5) yeh-pan (夜半 mid-night); (6) jen-ting (人定 man-settled); (7) huang-hun (黃昏 twilight); (8) jih-ju (日入 sunset); (9) pu-shih (餽時 later dining time); (10) jih-yi (日昃 sun-declined). This explanation seems to be plausible but there is a problem that was not indicated by former scholars, and that is that there were only three divisions in the interval between mid-night and noon, whereas there were five divisions in the interval between noon and mid-night. There would be no reason for the ancients to use this unequal division.

Thus far Tu Yü's idea is not a feasible one, and it must be changed into the following: (1) jih-chung (noon); (2) shih-shih (early dining time); (3) tan-shih or p'ing-tan (day-break); (4) jih-ch'u (日出 sunrise); (5) chi-ming (cock's cry); (6) yeh-pan (mid-night); (7) jen-ting (man-settled); (8) jih-ju (sunset); (9) hun-shih or huang-hun (twilight); (10) pu-shih (later dining time).

By this arrangement the divisions are divided either from noon to mid-night or from mid-night to noon. This leaves the problem of a different arrangement from that of the twelve divisions of the Han Dynasty, which had also been mentioned in the commentary of Tu Yü.¹ According to the order given in the *Tso Chuan*, jih-ch'u (sunrise) must precede p'ing-tan (day-break), but from the records of the Han and later periods, p'ing-tan follows jih-ch'u. In a similar way, the order of the ancient huang-hun (twilight) and jih-ju (sunset) would be reversed. Therefore, the order of hours for the Han Dynasty was: (1) yeh-pan; (2) chi-ming; (3) p'ing-tan; (4) jih-ch'u; (5) shih-shih; (6) yü-chung (隅中); (7) jih chung; (8) jih-yih; (9) pu-shih; (10) jih-ju; (11) huang-hun; (12)

1. Tu Yü said: "The Yü-chung (隅中) and jih-ch'u (日出) are not included in the order". These two divisions were two extra hours of the Han Dynasty.

jen-ting.

Even though the division of hours was changed in the Han Dynasty, the farther division of hours was retained in the old way. Hence one day was not only divided into twelve hours but it was also divided into one hundred sections, which could not be evenly divided between the twelve hours.

The old system divided the day time into five parts. In a similar way the nighttime should be divided into five parts. Although the record of Ch'un-ch'iu times could not be found, the division of night in Han times followed the same pattern.

The five divisions of night was called Five Nights, namely; (1) chia-yeh (甲夜); (2) yi-yeh (乙夜); (3) ping-yeh (丙夜); (4) ting-yeh (丁夜); (5) wu-yeh (戊夜). The name Five Nights was adopted from the name of t'ien-kan, or the decimal system for the arrangement of days.

These five parts were in turn used for the guards both inside the palace and outside of the frontier. Tsai Chih's *Han Yi* (蔡質漢儀)¹ said:

"In every palace, when the waterclock is finished the guards must start after the drum is beaten and rest after the bell rings. They are in place by the order of their credentials, when chia-yeh is finished they call on yi-yeh and then the five changes."

The five changes in Chinese is wu-keng, which was followed by many dynasties and was preserved in some places under the Chinese Republic.

In the slips² the system of five night was also used. An important example is: "A [beacon] fire [was seen] in yi-yeh [second section of night]; a fire in ping-yeh [third section of night]; and a fire in ting-yeh [fourth section of night]." In the *Han Shu* we find the "tiao-tou³ was beaten to warn each camp at every section of the five nights."⁴ It was to show the night guard at the

1. "Han Kuan Liu Chung", *Ssü-pu pi-yao*, Chung-hua Book Co. Taipei.

2. Slip no. 88 in the Documents.

3. Tiao-tou (刁斗) was a pan made of bronze which was used for cooking by day and for a warning gong at night.

4. It was said by Tu Chin (杜欽) in the Biography of Hsi-yü (西域) in *Han Shu* (pu-chu chüan 96, p. 1678). The commentary of Yen Shih-Ku said: "A night contains five turns (keng 更), hence the pan must be taken in turn". Cheug Hsüan's commentary in the *Ssü-wu shih* (司馬氏) of *Chou Li* (*shih-san-ching chu-su*, *Chou Li Chuan* 36, p. 549) said: "Night time means the order of hours at night like the present chia (甲) to wu (戊)". Shuai-Keng (率更) was a Han official according to Yen Shih Ku's commentary in "*Han Shu Pai-kuan Piao*" (*Han Shu Pu-Chu*, Chüan 19, p. 307). His duty was to attend the waterclock in the palace. Shuai means to lead and Keng means the turn. From the meaning of the title, "Keng" at night was quite important, therefore the system of five sections of night was retained in Han and preserved through some two thousand years.

northern and western borders

We find the materials for the five-nights through the Wei and Chin Dynasties, but by the end of the Northern and Southern Dynasties people knew the five turns only with ignorance of its origin. As Yen Chih-tui's *Yen-shih Chia-hsün* (顏氏家訓)¹ said:

"Someone asks me what is the meaning of five-turns [wu-keng] in one night. I explained in the following way: 'During the Han and Wei periods it included chia-yeh, yi-yeh, ping-yeh, ting-yeh and ping-yeh. Sometimes it was called Ku [鼓 drum], as yi-ku, erh-ku, san-ku, ssu-ku and wu-ku, or sometimes Keng [更 turn], as yi-keng, erh-keng, san-keng, ssu-keng and wu-keng. Every one of these names was divided into five sections [because there are five variations for each of the turns in direction which are pointed out by the tail of the Dipper]. Suppose the first moon is to the yin [寅 nee] and the Dipper's tail is pointing to yin [nee] in the evening sky [8 0'clock]. When day breaks [about 4 0'clock], it points to wu [午 south]. From yin to wu there are five turns [yin (寅), nee; mao (卯). cast; chen (辰), see; ssu (巳), sse and wu (午), south]. Even when the night is longer in the winter and shorter in the summer, the directions which the Dipper's tail (斗柄) points out will not be more than six nor less than four. The number of sections is always five. Keng means 'in turn,' therefore the sections of night are called five keng."

Here the explanation of the five keng or five turns is quite clear. However, it was based on a theory of later development-the duo-decimal system of twelve divisions-used to explain the old decimal system of ten divisions.

Under the decimal system, one hundred units (刻 k'e) were divided equally among the ten hours (時 shih), as in *Tso-chuan*. But in Han times, twelve hours were used under the duo-decimal system, indicating a difficulty in distributing the hundred ke equally.

The only method was to attribute to every hour (shih) eight and one-third ke. It was rendered thus:

First hour: beginning on the line and ending $\frac{1}{3}$ the distance from the last line (11 P.M.-1 A.M.)

Second hour: beginning $\frac{2}{3}$ the distance from the-limit and ending $\frac{2}{3}$ the distance from the last line. (1 A.M.-3 A.M.)

1. *Yen-shih Chia-hsün*, chüan 17, p. 38. Shih-chieh Book Co.

Third hour: beginning $\frac{1}{3}$ the distance from the limit and ending on the line (3 A.M.-5 A.M.).

Fourth hour: beginning on the line (5 A.M.-7 A.M.).

Fifth hour: beginning $\frac{1}{3}$ the distance from the limit. (7 A.M.-9 A.M.)

Sixth hour: beginning $\frac{2}{3}$ the distance from the limit and ending on the limit line. (9 A.M.-11 A.M.)

Seventh hour: beginning from the limit line. (11 A.M.-1 P.M.)

Eighth hour: beginning from $\frac{1}{3}$ the distance to the limit line. (1 P.M.-3 P.M.)

Ninth hour: beginning from $\frac{2}{3}$ the distance to the limit line and ending on the limit line. (3 P.M.-5 P.M.)

Tenth hour: beginning from the limit line. (5 P.M.-7 P.M.)

Eleventh hour: beginning from $\frac{1}{3}$ the distance to the limit line. (7 P.M.-9 P.M.)

Twelfth hour: beginning from $\frac{2}{3}$ the distance to the limit line and ending on the limit line. (9 P.M.-11 P.M.)

In Han times, time was not kept so exactly. K'e was the smallest unit for daily use. Thus the surplus $\frac{1}{3}$ at the end of the first hour, the surplus $\frac{1}{3}$ at the beginning and the end of the second hour and the surplus of $1\frac{1}{2}$ at the beginning of the third hour (and the surpluses of the other hours) would be considered as the secondarily k'e to the next k'e. From the record of the Han Slips, the ordinal number for k'e is not more than seventh.¹

This method of distribution was too complex and impractical, therefore the scholars attempted to change to the one hundred and twenty k'e to adopt it to the duo-decimal system of hours. This first change was in 5 B. C. and the second was in 9 A.D. The former was ordered by the usurper Wang Mang, but was invalid at the fall of the usurped dynasty fourteen years later. According to "T'ien-wen Chih" (Record of Astronomy) in *Sui shu* (隋書)², Emperor Liang Wu-ti (梁武帝) had changed the system from 100 k'e to 96 k'e. Unfortunately it was not used under the unification of the Sui Dynasty.

The system of one hundred sections was described in the *Wu-tai Hui-yao*: "In the fourth year of Tien-fu (天福) of Later Chin (晉), Ssu-tien Chien (An

1. In *Chü-yen Han-chien K'ao-cheng*, p. 68, the pa-feng (eighth feng or eighth ke) was recorded, but from a review of the original photograph of slips numbered 317. 27 and 56. 41 the Character Pa (eight or eighth) is unclear. Therefore there may be no eighth K'e in every hour. However, in the Han time there were no independent k'e, between two hours as that Sung calendar did. of *Chü-yen Han-chien K'ao-cheng Pu-cheng* BIHP. vol. 14, pp. 236-237.

2. The records of the institutions in *Sui Shu* refer to the dynasties from Chin to Sui.

official of Astronomy supersision) memorialized to the throne about the Book of the waterclock: 'Every day is divided into one hundred k'e, distributed among twelve shih [hours]. Every hour contains eight and one-third k'e. Every k'e contains eighty-one fen [分 minutes]¹. One hour contains eight k'e and twenty fen.'" This was a later development of the tenth century. There was no change in the seconds of the k'e system.

Up until the Catholic fathers reached China at the end of the Ming Dynasty the new system of ninety-six k'e per day was advocated. But it was only during the Ch'ing Dynasty² that it was first used. In the ninth year of K'ang-hsi(1671)the western theory was proved by the testimony of Father Ferdinandus Verbiest, and the 96 k'e system became popular. But the one hundred section system had been used intermittently for two thousand years during which time the duo-decimal system appeared.

This new system of 96 k'e is a combination of the old Chinese system and the western system, in which one shih contains eight k'e. In other words a k'e is fifteen minutes or a quarter of an hours. By this way minutes and seconds are easily adapted under the k'e. Even now, in modern Chinese, one hour (formerly hsiuo-shih or small shih) or one shih contains four k'e, which may be traced to its development during Han times.

B. THE DUO-DECIMAL DIVISION OF HOURS IN HAN TIMES

In the previous chapter, the decimal (天干 t'ien-kan) and the duo-decimal divisions (地支 ti-chih) were apparently derived from two different systems. They had been combined for use and traced to the Shang Dynasty, but each one may have been used separately.

This contradiction clearly appeared in the system of timely record. Even though the ten divisions was used in Ch'un-ch'iu times, the tendency towards the use of twelve divisions increased and became dominant in the Han Dynasty. It may have originated in the warring states period. There is no question that the standard measurement during Han was the system of twelve hours in a day.

From the Chü-yen slips come the following examples refering to the division of one day:

-
1. In Han times fen and k'e were the same thing. This was a new development of the T'ang Dynasty, influenced by the theory of India and indirectly by Greeks.
 2. "*Shih-hsien Chih*" (Record of Calendar) in *Ch'ing Shih-Kao*.

- (1) yeh-pan [mid-night].¹
yeh-pan chin-shih [the end of yeh-pan, or the end of the division of yeh-pan].²
yeh-ta-pan san-fen [the second part of yeh-pan passed three fen].³
yeh-shao-pan [the first part of yeh-pan].⁴
yeh-ta-pan [the second part of yeh-pan].⁵
yeh-hsiao-pan [hsiao=shao, the first part of yeh-pan].⁶
yeh-pan [mid-night].⁷
yeh-shih-shih [night lunch-time]...yeh kuo-pan [night passed half].⁸
yeh-kuo-pan [night passed half].⁹
yeh-shih-shih [night lunch-time].¹⁰
yeh-shih [night lunch].¹¹
- (2) Chi-ming [cock's cry]
chi-chien-ming [the beginning of the cock's cry].¹²
chi-ming [cock's cry].¹³
chi-fu-ming [cock's second cry].¹⁴
chi-ming [cock's cry].¹⁵
chi-ming [cock's cry].¹⁵
- (3) Ping-tan [day-break]

1. There are some variations of yeh-pan because on each side of mid-night there were two days referred to. In the slips yeh-hsiao-pan or yeh shao-pan might be related to the first day of the first half of yeh-pan, in which night had not passed half; and yeh-ta-pan might be related to the second day or the second half of yeh-pan, in which night had passed than half. Yeh-shih-shih (night lunch time) was indicated while people ate. Because there were only two lunch times in one day, one who watched at night must have a time for lunch and the lunch-time was more suitable at the first half of yeh-pan, for the interval from the second lunch to yeh-pan. was the same length as that from the first lunch to the second lunch

2. Slip no. 503.5 in *Documents*. H(Chü-yen an-chien K'ao-cheng, pp. 30-33)

3. Slip no. 185.3 in *Ibid.*

4. Slip no. 224.23 in *Ibid.*

5. Slip no. 317.27 in *Ibid.*

6. Slip no. 270.2 in *Ibid.*

7. Slip no. 130.8 in *Ibid.*

8. Slip no. 565.4 in *Ibid.*

9. Slip no. 523.24 in *Ibid.*

10. Slip. no. 184.24 in *Ibid.*

11. Slip no. 188.21 in *Ibid.*

12. Slip no. 503.5 in *Ibid.*

13. Slip no. 161.2 in *Ibid.*

14. Slip no. 193.11 in *Ibid.*

15. Slip no. 82.1 in *Ibid.*

16. Slip no. 157.14 in *Ibid.*

- ping-tan¹
 ping-tan²
 ping-tan³
 ping-ming [day-light].⁴
 (4) jih-ch'u [sunrise]
 jih-ch'u⁵
 jih-ch'u⁶
 jih-ch'u⁷
 (5) shih-shih [lunch-time] or tsao-shih [early lunch]
 shih [lunch].⁸
 tsao-shih [early lunch] and shih-shih [lunch-time].⁹
 tsao-shih chin [end of early lunch].¹⁰
 shih [lunch].¹¹
 tsao-shih [early lunch].¹²
 shih-shih [lunch time].¹³
 (6) tung-chung [east to noon]
 jih-tung-chung [sun rises east to noon].¹⁴
 jih-tung-chung shih [the time of sun-rise east to noon].¹⁵
 (7) jih-chung [noon]
 chung-shih [noon time].¹⁶
 jih-kuo-chung-shih [sun passed noon].¹⁷
 jih chung shih [sun at noon].¹⁸

1. Slip no 522.3 in *Ibid.*
2. Slip no. 135.3 in *Ibid.*
3. Slip no. 143.12 in *Ibid.*
4. Slip no. 127.25 in *Ibid.*
5. Slip no. 502.1 in *Ibid.*
6. Slip no. 170.4 in *Ibid.*
7. Slip no. 317.1 in *Ibid.*
8. Slip no. 506.6 in *Ibid.*
9. Slip no. 506.2 in *Ibid.* Shih-shih was divided into two parts-tsao-shih and shih-shih. It was the same in *Huang-ti Nei-ching Su-wen*. where shih-shih was given as two terms-tsao-shih and yen-shih.
10. Slip no. 170.4 in *Ibid.*
11. Slip no 239.34 in *Ibid.*
12. Slip no. 317.27 in *Ibid.*
13. Slip no. 56.37 in *Ibid.*
14. Slip no. 506.6 in *Ibid.*
15. Supplementary Slip no. 16 in *Ibid.*
16. Slip no. 484.18 in *Ibid.*
- 17.18. Slip no. 523.24 in *Ibid.* jih-kuo-chung shih meant the time just past noon, thus differing, from jih-hsi chung shih, which meant the sun had declined to west of center.

- jih chung shih [sun at noon].¹
- (8) jih tieh [sun declines]
jih-hsi chung-shih [sun passed west from noon].²
jih-hsi chung-shih [sun passed west from noon].³
jih tieh chung shih [sun declines from noon].⁴
jeh tieh [sun declines].⁵
- (9) hsia-pu [later lunch]
hsia-pu shih [later lunch time].⁶
jih-pu shih [later lunch-time during the day].⁷
hsia-pu [later lunch].⁸
hsia-pu [later lunch].⁹
hsia-pu [later lunch].¹⁰
hsia-pu [later lunch].¹¹
hsia-pu [later lunch].¹²
- (10) jih-ju [sunset]
jih-ju shih [sunset time].¹³
jih-ju-shih [sunset time].¹⁴
jih-ju [sun set].¹⁵
- (11) hun-shih or huang-hun [twilight]
hun-shih [twilight].¹⁶
jih hun-shih [sun at twilight].¹⁷
hun-shih [twilight].¹⁸

1. Slip no. 143.12 in *Ibid*
2. Slip no 187.23 in *Ibid*.
3. Supplementary Slip nos. 126.40 and 332.5 in *Ibid*.
4. Slip no. 132.17 in *Ibid*.
5. Slip no. 56.41 in *Ibid*.
6. Slip nos. 506.16 and 506.17 in *Ibid*.
7. Slip no. 288.30 in *Ibid*.
8. Slip no. 212.2 in *Ibid*.
9. Slip no. 132.17 in *Ibid*.
10. Slip no. 229.34 in *Ibid*.
11. Slip no. 157.14 in *Ibid*.
12. Slip no. 3.22 in *Ibid*.
13. Slip no. 495.19 in *Ibid*.
14. Slip no. 383.99 in *Ibid*.
15. Slip no. 161.16 in *Ibid*.
16. Slip no. 505.6 in *Ibid*.
17. Slip no. 506.19 in *Ibid*.
18. Slip no. 502.3 in *Ibid*.

The Division of Time in the Han Dynasty as Seen in the Wooden Slips

yeh hun-shih [evening twilight].¹

hun-shih[twilight].²

huang hun-shih [twilight].³

(12) jen-ting [humans settled]

jen-ting shih [humans settled time].⁴

jen-ting [humans settled].⁵

Looking at the above records, there are clearly twelve divisions the same as those applied for the last two thousand years.

From Wang Chung's *Lun-heng*⁶, *Huang-ti Nei-ching Su-wen* (黃帝內經素問)⁷ and the T'ang Folk songs from *Tun-huang Chui-so* 敦煌綴瑣⁸ the order of time will be arranged as follows:

<i>Han slips</i>	<i>Lun-heng</i>	<i>T'ang Folk songs</i>
1. yeh-pan (夜半)	yeh-pan (夜半)	yeh-pan tzu (夜半子)
2. chi-ming (雞鳴)	chi-ming (雞鳴)	chi-ming chou (雞鳴丑)
3. ping-tan (平旦)	ping tan yin (平旦寅)	ping-tan yin (平旦寅)
4. jih-ch'u (日出)	jih-ch'u mao (日出卯)	jih-ch'u mao (日出卯)
5. shih-shih (食時)	tsao-shih (朝食)	shih-shih chen (食時辰)
6. tung-chung (東中)	yen-shih (宴食)	yü-chung ssu (隅中巳)
7. jih-chung (日中)	jih-chung (日中)	cheng-nan wu (正南午)
8. jih-tieh (日昃)	jih-tieh (日昃)	jih-tieh wei (日昃未)
9. hsia-p'u (下舖)	hsia-p'u(yen-pu)(下舖)	p'u-shih shen (哺時申)
10. jih-ju (日入)	jih-ju (日入)	jih-ju yu (日入酉)
11. hun-shih (昏時)	huang-hun (黃昏)	huang-hun hsü (黃昏戌)
12. jen-ting (人定)	jen-ting (人定)	jen-ting hai (人定亥)

The terms from Han to T'ang are the same. The problems are (1) How the terms originated and (2) How the coincidence with ti-chih (i.e., tsu, chou, yin, mao,) began. ?

Turning to the first problem, we find that five of the twelve terms appeared in the *Tso chuan*, which means that the terms had been created when the

1. Slip no. 505.22 in *Ibid.*

2. Slip no. 495.28 in *Ibid.*

3. Slip no. 185.25 in *Ibid.*

4. Slip no. 505.19 in *Ibid.*

5. Slip no. 484.18 in *Ibid.*

Lun-heng, Chien-shih pien, Shih-Chieh Book Co., Taipei 1955, p. 2 31.

6. *Huang-ti Nei-Ching su-wen*, Chüan 4.22 and 65.

7. Liu Fu. *Tun-huang Chiu-so*, Chüan 35. Acadimia Sinica, peking.

decimal system was in use. Hence the terms for time were used at the beginning of Han and were recorded in the *Shih chi* (史記) :

"K'ang Hsiang attacked Han from Hsiao in the morning. When he went to Peng Chen he beat down the Han troops at jih-chung."¹

"The King entertained soldiers and met on the battlefield at tan."²

"The later first year, fifth moon, ping-hsü, the earth quaked; at tsao-shih the earthquaked again."³ 'you, boy, can be taught,' he said. After five days come here at ping-ming. [chang] Liang was astonished, but kneeled and said, 'yes'. Five days later, at p'ing-ming, the old man come before Liang arrived, saying, 'why would [you] ge so late, come earlier in another five days.' On that very day Liang came at chi-ming, but the senior was still there. He Ordered Liang to come earlier in another five days. Liang came there at yeh-pan and the old man succeeded. After a while he gave Liang a bundle of books, saying, 'Be a tutor of the real king with them.'⁴

"Han Hsin reached the Chin-hsing pass. He started on his march at yeh-pan. At ping-tan he went from that pass with the banner and drum of the chief general."⁵

In the above, yeh-pan, chi-ming, p'ing-ming (ping-tan) and tsao-shih were the same as that of the slips. Particularly according to the story of Chang Liang,⁶ the three divisions—jih-pan, chi-ming, p'ing-ming—were connected, which showed that the divisions were unchanged from the beginning of the Han Dynasty. In other words, the duo-decimal system had existed at the beginning of the second century.

Of course there was the other system in the "T'ien-wen Pien" (天文篇) of *Huai-Nan Tzu* (淮南子)⁷ which divided the day into fifteen divisions instead of the popular nine divisions. The fifteen divisions are: chen-ming (jih-ch'u), fei-ming (new), tan-ming (p'ing-tan), tsao-shih, yen-shih (both taken from shih-shih), yü-chung (yü chung or tung-chung), cheng-chung (jih-chung), hsiao-chien (new), pu-shih (pu-shih or hsia-pu), ta-chien, ta-ch'ung, hsia-ch'ung (all three were taken from jih-tieh), hsüan-chü (jih-jn), huang-hun (huang hun or hun-

1. *Shih Chi*, Chüan 7, Yee-wen Book Co., p. 153.

2. *Ibid.*, Chüan 8, p. 169.

3. *Ibid.*, Chüan 11, p. 205.

4. *Shih Chi*, Chüan 55, pp. 812-13.

5. *Ibid.*, Chüan 92, p. 1060.

6. It was perhaps not a true story, but it was told before the time of Ssu-ma Ch'ien.

7. *Huai-Nan-Tzu*, Chüan 3, Shih-chieh Book-Co. Taipei, 1955, p. 44.

hih), ting-hun (new). These divisions were from the *Huai-Nan Tzu* only; they were not used by the Han astronomer. Therefore we do not consider them as belonging to a practical system.

The division of time into twelve units was fixed at the beginning of the Former Han Dynasty. Naturally these were easily attributed to the twelve ti-chih. But at the end of the Former Han, the time was called "chia" (加) (to add) to some of the ti-chih, such as, "jin chia mao" or "jih chia shen", etc., and not "mao shih" or "shen shih". It means a position referring to that day and not the name of a position which was also the name of the time.

A combination of ti-chih and the time division may be traced to the astrologist Yi Feng (翼奉) in his biography in *Han shu*.¹ "In the second year of Ch'u-yüan of Ch'eng-ti [48 B. C.], he was called to court. Then he memorialized to the throne, saying that 'the day Kuei-wei (癸未) of the First Moon² [the day plus shen]³ there was a tornado from the south-west..... It indicated that some wicked servants were by the side of the ruler.' One year later, in the third year of Ch'u-yüan of the Fourth moon, on the day yi-wei pai-hao kuan [White Crane Hall] of Wu-ti's tomb was burned. Feng memorialized again, saying, 'the Pai-hao Kuan was burned in the Fourth moon on the day yi-wei, and the time was the day plus mao, your servant had confidence in his theory.'"

This was the first time that the duo-decimal divisions of the day had been combined with the "plus" of the ti-chih, and it must have been created by Yi Feng, an eminent confucian astrologist. Hence that method may be very easily accepted by other scholars.

"Seventeen years later, in the third year of chien-shih [30 B.C.] in the reign of Ch'eng-ti, on the first day wu-shen of the Twelfth moon, the sun was eclipsed at the time of 'plus wei.'" as quoted from the memorial of Tu ch'in.⁴ In a similar case, "in the second year of Chien-p'ing under Ai-ti [5 B.C.] the sun was eclipsed on the First day of the Fourth moon. Li ch'in memorialized to the throne, saying that 'the time was day plus ch'en.'" Both of these showed that the combination of time with ti-chih had been gradually accepted.

The San-t'ung Li (三統歷 calendar of the Three Dynasties), which was a

1. *Han Shu*, Chüan 75, p. 1401-1404.

2. According to the Commentary, Kuei-wei was the twenty-second day, because there was no Kuei-wei in the First moon of the first year of Chu-Yüan.

3. In the text it was "jih chia shen", which means the day plus shen. It indicates the ninth time division and is identified as "hsia-pu".

4. *Han Shu*, "wu-hsing chih", Chüan 27, p. 655. Yee Wen edition.

new creation of a systematic calendar by Liu Hsin at the end of the Former Han Dynasty, as quoted by Pan Ku in the "Lu-li chih" (律歷志) of *Han shu*, did not give any significance to the combination of time and ti-chih.¹ This means that Liu's calendar was based on the traditional pattern without the ti-chih combination of hour-divisions. He by nomeans opposod the latter system. In fact he was the designer of the cultural institutions of the usurper Wang Mang, whose order of the reform of the calendar was based on the ti-chih combination system.

Nine A. D. was the first year of Shih-chien-kuo of Wang Mang, (王莽) the date in which he changed the Han Calendar system into his own system.² He changed the Twelfth moon of the former year into the First moon of the new year (to use the moon of chou as the beginning of the year) and changed chi-ming (the second division of a day) to the chou hour. These reforms showed that Wang considered the "earth-virtue" to be his lucky element, and the ti-chih chou was one representative order of the earth. under that arrangement ch'ou (丑) was not only a "plus-number" to chi-ming but it was also chi-ming itself. It would be the first time that this trend was used-tzu-shih, (子時) ch'ou-shih, (丑時) yin-shih, (寅時) etc. For yeh-pan, chi-ming, ping-tan, etc.

Comparing the "Wu-hsing Chih" (五行志) of *Han Shu* (漢書) and that of *Hou Han Shu*, (後漢書) there is a great difference. In the *Han Shu*,³ jih-chung, pu-shih and hsia-pu were used for recording time in the reign of Han Wu-ti, whereas in *Hou Han Shu*, shih-jih chia-mao (時日加卯 day time plus mao), which means jih-ch'u (the fourth hour) is used for recording time in the reign of Hou Han Kuang-wu-ti.

Wang Ch'ung's *Lun Hung* (論衡) was completed in the second year of Chang Ho (88 A.D.) (the reign title of Chang-ti). It was later than the time of Chien Wu. He said in "Lan-shih pien" (調時篇) 'of his book'.⁴ "One day is

1. Chen Meng chia guoted the beginnings of heaven, earth and man as they were related to the order of ti-chih. He considered they were the time of day, but the evidence is very weak. This is because they were the applications of ti-chih extended from its use for days to months to years, etc., and finally to the universe as a whole, which would not be referring to the divisions of a day.

2. "Biography of Wang Mang", *Han Shu Pu-Chu*, Chüan 99, p. 1728.

3. "Wu-hsing Chih", *Han-Shu Pu-Chu*, Chüan 27, p. 654 gives the first Year of Yüan-Kuang and the fourth Year of Cheng-ho of Han Wu-ti, *Hou Han Shu Chi Chieh*, Chüan 18, "Wu-hsing Chih", p. 1215 Gives the Seventh Year of Chien-wu of Han Kuang-wu-ti in the Commentary quoted in Ku-chin chu.

4. *Lun Heng*, "Chien Shih Pien", p. 231. Shih-Chieh Book Co.

divided into twelve shih [hours], namely, ping-tan yin, jih-chu mao, etc. Twelve moons are 'set-up' as yin, mao, etc. They are the same as that of the 'hour-plus'." It is clear that the term "plus-hour" had become very popular by the beginning of the Latter Han Dynasty.

To name an hour with ti-chih as chia-shih (加時 plus-hour) was too awkward. Men preferred to use ti-chih for shih directly. Hence in the Chin Dynasty (third century) this direct method was used. In the Chin Slip from Lop Nor the following is recorded:¹ "The meeting will be on the twenty-fourth day of this month at mao-shih. According to the information this letter arrived at shen-shih."

Mao shih had been called jih-ch'u and shen-shih had been called hsia-pu in the Han Dynasty. But in that time it was changed for the purpose of simplicity, and it has been followed through more than two thousand years to the present day.

C. SUNDIAL AND WATERCLOCK

The beginning of a day, except when Wang Mang changed from chi-ming for a short time, in the Han period and the following dynasties began at the center of yeh-pan, that is the day always starts from zero o'clock on the twenty-four hour clock.

There was no reliable evidence for the beginning of a day before the calendar reform of Tai ch'u (太初 104 B.C.). During Tai-ch'u, however, it was standardized and continued for many centuries, that is, the day began from the center of mid-night. In the "Li-shu" (歷書) of *Shih Chi*,² the first year of Tai-ch'u was said to be a standard year because the winter solstice was at the center of midnight and that day was chia-tzu (甲子 the first day of the sexagenary cycle).

The difference between the Former and Later Han dynasties was that the system of time division was more refined in the Later Han. According to the slips, the "fen" is the smallest unit and is identified as "k'e". But from the

1. *Lin Shan Chin-chien*, Chüan 2, Pu-shu No. 29, pg. 8.

2. *Shih Chi*, chüan 26, pg. 499, Yee-wen ed. —According to Huan T'an's Hsin Lun (桓譚新論) from Yen K'o-chün (嚴可均): Ch'üan Hou-Han Wen (全後漢文); Chüan 15, pg. 2. Shih-chieh Book Co. ed, Taipei), the beginning of a system of the Calendar was always based on the winter solstice in the *mid-night* of the day Chia-tszü. In the Lü-li Chih of Ssuma Piao's Hsü Han Shu (pg. 1108, Yee Wen ed), it is said that the day of a system of calendar would be beginning from *yeh-pan tzü*. Hence the *mid-night* or *yeh-pan* as the order of ti-chih in tzü area is always the beginning of a day and the beginning of a year and even a system of a calendar.

"Lü-li chih" of *Hou Han Shu*,¹ a fen is one-tenth of a "K'e". Thus the term fen has different meanings at different periods in history.

The system of the Former Han was seen in the pieces of Han Chiu-yi,² and that of the Later Han was seen in the Lü-li Chih. They may be compared in the following manner:

<i>Time of Year</i>	<i>K'e of Day</i>	<i>K'e of Night</i>
Winter Solstice { F. Han	41	59
{ L. Han	45	55
Beginning of Spring { F. Han	46	54
{ L. Han	48.6	51.4
Beginning of Summer { F. Han	62	38
{ L. Han	62.4	37.6
Summer Solstice { F. Han	65	35
{ L. Han	65	35
Beginning of Autumn { F. Han	62	38
{ L. Han	62.3	37.7
Beginning of Winter { F. Han	46(?)	54(?)
{ L. Han	48.2	51.8

This means that one-tenth of a k'e was seen from the water clock during the Later Han Dynasty.

But this so-called day or night was a standard issued by the government for the purpose of changing water twice a day, of course the Chinese territory of that time was an area between twenty and fifty degrees latitude. Thus it was impossible to use the same standard for day and night uniformly. At any rate, it would have been rather crude to use it in the northern border area.

The water clock of the Han Dynasty cannot be traced through archaeological means. It is only based on pottery bottle with a pottery basin. Under the bottom of the bottle a small hole was drilled for the purpose of allowing water to drip through. Along the wall of the pottery basin marks must be carved to indicate k'e or minutes. However there were the records of the design of the T'ang and the Sung dynasties; they were the sets containing some boxes to make sets of waterclocks. They were probably used in the imperial palace to show the complex decoration in which the significance of the astrologers was seen.

1. *Hou Han Shu Chi-chieh*, chüan 3 of Chih, pg. 1108, Yee-wen ed.

2. Han Chin-yi means the old system of the Han Dynasty. *Han-Kuan Liu-Chung*, Ssü-pu Pi-yao, Chung-hua Book Co. Han-Chia-yi Pu-yi, Chüan 2, pg. 1.

But for daily use at the frontier, simple and practical ones were required, not complex.

In every office, whether at the frontier or inland, there were one set of waterclocks, one for day and one for night. In the wooden slips and in the "Lü-li chih" of *Hou Han Shu* chou-lou (晝漏 day waterclock) and jih-lou (夜漏 night waterclock) were differentiated as one set of time according to the seasons. When day began night ended, and when night began day ended. It means that one set of waterclocks were changed in turn everywhere.

The sun-dials of Han had been disorced, although no more waterclocks are found. The three dials can be based, for purposes of comparison, on the time units of Han. One was owned by Tuan Fang (端方), as recorded in *T'ao-tsai Ts'ang-shih chi* (匋齋藏石記)¹ (and now is in the Historical Museum of Peking), another was owned by Chou chin (周進), and recorded in *Chü-chen Tsao-t'ang Han-chin Shih-yin* (居貞草堂漢晉石影)² and finally, the third is owned by the Toronto Museum of Canada, and was photographed by Liu Fu (劉復) for his article entitled "The Sun-Dials of Western Han" in the *Bulletin of Chinese Studies* of Peking University.³

The sun-dial, according to its spaces, may be divided into one hundred degrees. But only Sixty-nine degrees (or k'e) are shown by inscriptions of lines and marked with numbers. That dial may be used in Ai-hun city in Helungchiang in the summer solstice, as described by Professor Liu Fu. In many places on the Chinese mainland, many k'e are not required even in the Summer.

The pole in the center of a dial must be adjusted on an angle according to the latitude of the position in question⁴, and the main central line must point north. A stick is then erected at its center, the shadow of which shows the time on a given degree around the circle. In the following are the times⁵ referring to the numbers of the circle:

1. *T'ao-tsai Ts'ang-shih Chi* Chüan 1. pg. 3-8.

2. *Chü-chen Ts'ao-t'ang Han-Chin Shih Yin*, pg. 2.

3. Peking University: Kuo-hsio Chi-K'an. Vol. 3, No. 4 (1932) 573-610, and Joseph Needham: "Science and civilization in China" Vol. 4, pp. 261-298.

4. It might be by the way of adjusting the inclination of the central pole in the sundial. That pole was controled by four ropes at the four corners of the dial.

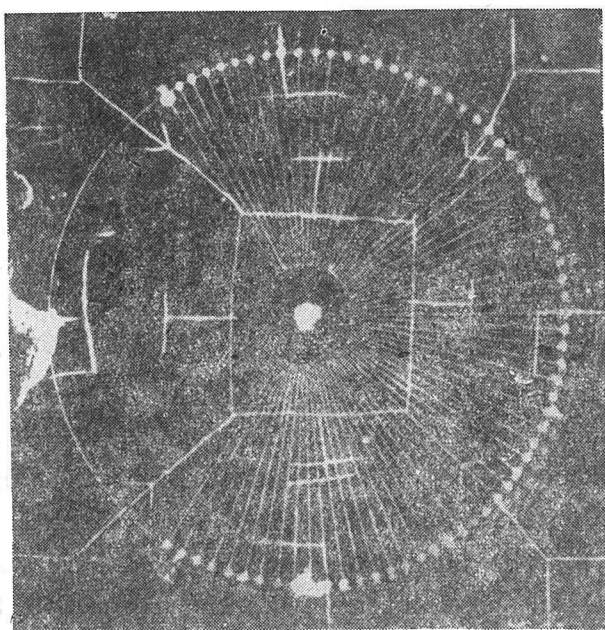
5. Here it indicated the central time in Chinese way as mao-cheng (卯正) which meant mao had passed a half, and wu-cheng (午正) meant wu had passed a half. Since mao began at 5 A. M. and ended at 7 A. M., the 6 A. M. was called mao-cheng. In similar way the 12 O'clock noon was called wu-cheng.

The Division of Time in the Han Dynasty as Seen in the Wooden Slips

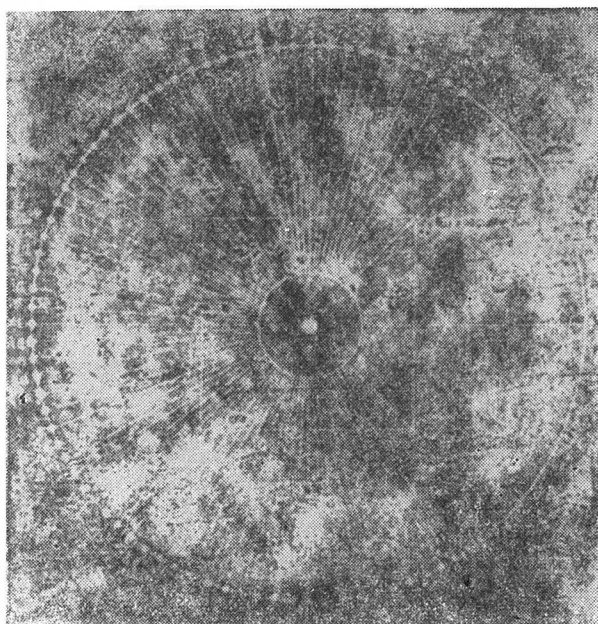
<i>Time</i>	<i>Number</i>
ping-tan (yin, 4 A.M.)	11 $\frac{1}{2}$
jih-ch'u (mao, 6 A.M.)	10
tsao-shih (ch'en, 8A.M.)	18 $\frac{1}{2}$
tun-chung (ssu, 10 A.M.)	26 $\frac{1}{2}$
jih-chung (wu, 12 noon)	35
jih-yi (wei, 2 P.M.)	43 $\frac{1}{2}$
hsia-pu (sheng, 4 P.M.)	55 $\frac{1}{2}$
jih-ju (yu' 6 P.M.)	60
huang-hun (hsü, 8 P.M.)	68 $\frac{1}{2}$

The use of the sun-dial was limited to the day-light hours and good weather. It should be accompanied by the waterclock which was the main recorder of time in the palace, office and watch-tower. The dial was used to adjust the accuracy of the waterclock. Since the waterclock was so fragile, none remain today. The method of recording time must be found from the inscriptions on the dial and compared with the information from books and slips. However it is very clear that there may be some later developments, such as the application of the term "ti-chih" to the name of the time. The main duo-decimal system still remained through the various dynasties.

PS. Many thanks are due to Mr. Walter Switkin for his help in the work of this article.



(1) Han Sun-dial from Suiyüan



(2) Han Sun-dial from Honan

漢簡中的記時法（中文提要）

勞 榦

中國記時法，商代的制度不詳，可能是只有旦夕等名稱卻不是把一日分成一定的時區，不過據左傳上的記載，春秋時已把一日分作十時了，這種十進制的計時法，正是把一日分爲百刻的基本來源。

從漢代的材料中，顯然的可以看出來把它從十進制改爲十二進制，這或者和十二方位有關。依照淮南子天文篇，十二支分配到二十八宿，那就在漢初，或者更早至戰國時期，十二方位已經分配定了。日晷的日影和栺上十二支的方位是有關係的，那就一日分十二時比較一日分爲十時，就日晷的關係上說，更爲切實。何況十二的數目，可以用三除盡，可以用四除盡，在工作分配上更有它方便的地方。

居延漢簡中所用的記時法是十二進制的。有時一時會分爲前後兩個小單位，但並不妨礙十二時的計算法。淮南子天文篇雖然有一種十五分法的名稱，但這是以白天時爲限的，也就是從卯初至酉末爲七時，加倍爲十四時，再加上入夜的桑榆，總爲十五時。倘若把日夜都加倍，就成爲二十四時，還是十二進制。

十二時制和百刻制是不能互相配合的，即每時合 $8\frac{1}{3}$ 刻。西漢沒有刻以下的名稱，但從西漢的日晷來看，卻可能有半刻的算法。那就三分之一刻可能就按半刻去算。東漢以後一刻再分爲十分（依照漢簡，西漢刻就是分），那就三分之一刻就可以三刻半來計算了，這種算法雖然奇零，卻也簡單。不像宋代在每時八刻之外，每隔三時還有一個獨立的刻，作爲『加時』，再每月變更『加時』的位置。這實在太複雜了，直到清初才有一日分爲九十六刻的改革。

從漢簡計時法牽涉到的是日晷用法的問題。日晷上的指針不可以直放的，必需有一個傾斜度數，依照當地緯度及季節來調整。漢代的日晷，依照漢栺的構造來比較，大致是平放的。調整的應當專以中心的標桿（表）爲限。這個標桿依照漢代日晷及淮南子中的材料，是用四條繩（四維）繫著的。標桿的傾斜度就由四條繩來調整。

調整時一定要有標準。除去對準當地北極星的方向，還應當把標桿照出日影的長短記到日晷上，然後再按時調整。旬齋藏石記那塊日晷，除去原有刻度以外，後來記上的刻畫十分顯明，這就表示依照各地特殊情形，記到日晷上的事實。日晷上的符號普通被稱做 T L V（和 T L V 式漢鏡相同），其中 V 是代表四維的，T 的橫畫應當表示夏至的日影。L 的橫畫應當表示冬至的日影。只要日晷上有這兩種記錄，標桿應當調整的傾斜度，就容易解決了。