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The Bulletin of SUNG-YUAN Studies 21

THE MEASURES LI AND MOU DURING THE SONG, LIAO, AND JIN DYNASTIES

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The complexity of China's ancient system of weights and measures is widely known. Indistinct at best is the picture we have today of the many official attempts throughout the traditional era either to standardize or reform this metrology. The volatile and sometimes capricious nature of government-promulgated values for various weights and measures, as well as certain other factors, led to the formation of an unofficial or "popular" system, which, with the passage of time, has become even more difficult to sort out than the official one. As pointed out by the eminent Ming dynasty (1368-1644) musician and mathematician Zhu Zaiyu朱載堉(1536-1611), even a foot measure (chi 尺) in common use during a given period of Chinese history will inevitably reveal minor differences when meticulously compared with other, contemporary chi.[1] Extant foot measures from the ancient period and those excavated through the dynasties have consistently proven this to be the case.[2]

The same may be said for the measures li 里 and mou 畝 , both of which are closely related to chi. Although our knowledge about these measures and their uses throughout the successive eras is limited, this is especially the case with regard to the Song dynasty (960-1279). Even less is known about the same measures as they were used by the states of Liao (907-1125) and Jin (1115-1234). In this communication we will endeavor to examine and provide computations--as precise as possible--for the Song dynasty measures of li and mou, as well as to conduct a preliminary investigation of these same measures under the Liao and Jin. It is hoped that the data provided below will not only shed light upon li and mou during the Song, Liao, and Jin, but will also put into better historical perspective the measure systems used before and after those periods. While the topic of this investigation has led us to consult a wide variety of traditional sources, we have sought especially to draw relevant data from recent archeological materials.

1. The Relation Between Li and Chi During the Song

The system of measurement in which one li was equivalent to 300 bu 步, and one bu equivalent to six chi, was established, at the latest, during the Qin (221-206 B.C.). This ratio continued to be used until the Sui and Tang dynasties (581-618 and 618-907, respectively), when it was changed. Throughout the Tang, the codes (lü 律) and statutes (ling 令)--which, among other things, legally defined official weights and measures--were continually revised. Those statutes mentioned in historical sources date from the following years or periods:

Seventh year of the Wude武德 reign (624)
Eleventh year of the Zhenguan 貞觀 reign (637)
Second year of the Yonghui永徽 reign (651)
The Linde麟德 reign (664-666)

[1]Zhu makes this comment in the "Guiding Rules of Compilation" 凡例 that appear in his treatise on the measure of capacity, titled Jialiang suanjing 嘉量算經 (Wanwei biecang ed.), "Fan li," p. 10a.

[2]See, for instance, the length variations in the numerous foot measures described by John C. Ferguson in his informative article "Chinese Foot Measure," Monumenta Serica 6 (1941), especially 360-363.

The Qianfeng乾封 reign (666-668)
The Yifeng 儀鳳 reign (676-679)
The Chuigong垂拱 reign (685-689)
The Shenlong 神龍 reign (705-707)
The Taiji太極 reign (1 March 712-21 June 712)
Third year of the Kaiyuan開元 reign (715; some sources give the more general refernce of "beginning of the Kaiyuan reign")
Seventh year of the Kaiyuan reign (719; some sources give the earlier date of "716")
Twenty-fifth year of the Kaiyuan reign (737).[3]

The li system used during these eras also underwent changes, one result of which was the formation of the Tang dynasty "Big Li"大里 and "Small Li"小里 .

According to the "Monograph on Foods and Commodities" ("Shihuo zhi" 食貨志) in the Old Documents of the Tang (Jiu Tang shu 舊唐書): "The codes and statutes were first fixed in the seventh year of the Wude reign (or 624). Regarding the system for measuring a field, five chi constitute one bu; 240 square bu constitute one mou; and one hundred mou constitute one qing頃 ."[4] Thus, five "Big Chi"大 尺during the Sui and Tang replaced the six "Small Chi"小 尺 used in earlier periods. But in fact, the numerical value of each was equal, and so the length of a bu did not change.

The passage just quoted from the Jiu Tang shu does not mention how many bu constitute one li. Perhaps there is an omission in the received text. In an early Song work, compiled by the well-known scholar Qian Yi 錢易(fl. early 11th cent.) and titled A New Book from the South (Nanbu xinshu 南部新書), there is an excerpt taken from the Tang Miscellaneous Statutes 雜令 that provides an answer to this question:

> The Statutes say: "All the measures are to use the medium-size black-panicled millet秬黍of the north [as a standard]. The width of one grain of millet constitutes one fen分. Ten fen constitute one cun寸; ten cun constitute one chi (one chi, two cun constitute one Big Chi); and ten chi constitute one zhang丈 . . . . All standards of weights and measures, which follow the accumulated [measures of] black-panicled millet, are used when tuning the pitch of a bell, when calculating the [length of the] shadow of the sun, when making up prescriptions, as well as for the cap and robe

[3]These various statutes are quoted with accompanying notes and collations in Niida Noboru 仁井田陞 , comp., Tôryô shûi 唐令拾遺 (1933; rpt. Tôkyô: Tôkyô daigaku shuppankai, 1964), passim.

[4]Jiu Tang shu, 48.2088 (this and all subsequent references to the dynastic histories are to the Zhonghua shuju editions).

system.[5] On occasions other than these, government and private, the Big Chi is always used. In all the offices in the capital, as well as in all the counties, each is provided with standardized steelyards, foot measures, dou 斗, sheng 升, and ge 合,[6] all of which are made of bronze. In all measurements of land [distances], five chi constitute one bu, and 300 bu constitute one li."[7]

The Japanese legal historian Niida Noboru has recovered and assembled the texts of a Miscellaneous Statute dating from the Wude era (that is, 618-627) and the seventh year of the Kaiyuan (or 719) period, each of which states: "All measures of land [distances] shall regard five chi as constituting one bu, and 360 bu as constituting one li."[8] Niida's source for these statutes is a passage that appears in Han Yan's (fl. eighth century) Xiahou Yang Suanjing 夏侯陽算經 which, quoting a Miscellaneous Statute of the Tang, says that five chi make one bu, and 360 bu make one li.[9] But in fact, this Miscellaneous Statute is different from the Wude statute. In the "Monograph on Geography" ("Dili zhi" 地理志) found in the Sui shu 隋書, which was edited between 641

[5] In Zhou times, the expression mianfu 冕服 referred to the various caps and robes of the emperor, each of which was used on a different ceremonial occasion. See Zhou li (Sibu congkan ed.), 5.100. Here, however, the term is used in a more general sense to indicate the caps and robes worn by government officials.

[6] These are common measures of capacity. In Song times, ten ge constituted one sheng, and ten sheng constituted one dou.

[7] Nanbu xinshu (Beijing: Zhonghua shuju, 1958), p. 106. A Japanese code promulgated in the years 701-704 provides additional evidence that supports the measurements in the Nanbu xinshu. See the Taiho statute quoted in Chen Mengjia 陳夢家, "Mouzhi yu lizhi" 畝制與里制, Kaogu 1 (1966), 43. It might also be mentioned here that Qian Yi's quotation actually comprises several of the so-called Miscellaneous Statutes promulgated during the Tang. These same statutes are also cited (with some textual differences) in Niida Noboru, Tôryô shûi, pp. 841, 845, and 846. According to the Siku Catalog, the Nanbu xinshu was compiled sometime during the Dazhong xiangfu 大中祥符 reign-period (1008-1017), when Qian Yi was serving as Administrator 知 of Kaifeng. The same source reports that Qian's miscellany "records stories from the Tang and Five Dynasties. Often it registers anecdotes and trivia. Court regulations and state laws . . . are also scattered throughout the text." Ji Yun 紀昀(1724-1805) et al., ed., Heyin Siku quanshu zongmu tiyao ji Siku weishou shumu Jinhui shumu 合印四庫全書總目提要及四庫未收書目禁燬書目 (Taibei: Taiwan Shangwu yinshuguan, 1978), III, 2900. Because of a later change in the ratio of bu to li during the Tang (see below), it would not be unreasonable to assume that the Miscellaneous Statute preserved in the Nanbu xinshu dates from the early years of the dynasty.

[8] 5Niida Noboru, Tôryô shûi, p. 846.

[9] Xiahou Yang, Xiahou Yang Suanjing (Wuyingdian juzhen ed.), 1.9b.

and 656, the system in which one li comprised 360 bu had already been adopted in order to provide figures on the circumference of the walls around the Sui and Tang capitals. Thus, the regulation that "five chi constitute one bu, and 360 bu constitute one li," if it did not begin in the eleventh year of the Zhenguan reign (or 637), then it did so with the statutes promulgated in the second year of the Yonghui period (or 651). The so-called Big Li also emerged at this time. Compared with the li system used before the Sui and Tang, in form there was no change: 1,800 chi still constituted one li. The increase in the length of a chi, however, was accompanied by a corresponding increase in the length of a li.

The ratio of five chi to one bu, and 360 bu to one li, continued to be used until the late Song. As for the system of measurement wherein "five chi constitute one bu, and 300 bu constitute one li," this continued to be employed on certain occasions, such as when calculating distances related to the length of a sun shadow. Its influence even extended to the non-Han nationalities who lived in areas north of China. In fact, this was the li system adopted later by the Liao.

A clear and precise account of the li system used during the Northern Song (960-1127) is found in the "Conveyances and Clothing Monograph" ("Yufu zhi" 輿服志) in the Song History (Song shi 宋史):

> In the fifth year of the Tiansheng 天聖 reign-period (or 1027) under the emperor Renzong 仁宗 (or Zhao Zhen 趙禎; r. 1022-1063), the Inner Attendant 內侍 (or eunuch) Lu Daolong 盧道隆 offered up the designs for the Mileage-Recording Drum Carriage 記里鼓車 . . . . The ancient standard was that six chi constituted one bu, and 300 bu constituted one li. If we convert the ancient standard into the modern one, then five chi constitute one bu, and 360 bu constitute one li."[10]

The Southern Song (1127-1279) system of li and mou, which followed that of the Northern Song, is described at length in Qin Jiushao's 秦九韶(13th cent.) A Book on Mathematics in Nine Chapters (Shushu jiuzhang 數書九章) (completed in 1247). Much of the information provided by Qin is related to Southern Song social and economic activities and thus preserves a large amount of historical material related to li and mou, as well as to other measures. What is relevant to our discussion here is that the Shushu jiuzhang mentions, on no fewer than ten occasions,

[10] Song shi, 149.3493. A Mileage-Recording Drum Carriage is a two-wheeled and single-shafted vehicle equipped with a drum that was sounded once for each li traveled. Such carriages have been in existence in China for over 2,000 years, and were used by emperors as an ornament for the royal guard during trips around the empire. For additional information on the history of the Drum Carriage, see "The 'Taxicab' in China," in Herbert A. Giles, Adversaria Sinica (Shanghai: Kelly & Walsh, 1914), pp. 223-227.

that the standard for one li is 360 bu.[11] Several of these and other entries also point out: "The standard for one bu is five chi."[12] Thus, we can be reasonably sure that one li during the Song was equal to 360 x 5 chi = 1,800 chi.

It is also worth pointing out that Qin Jiushao, after citing numerous passages related to the li and mou metrology in general use during the Southern Song, often turns to "special situations" outside of the official measure system. The following examples will suffice to illustrate the complex nature of the li and mou system described in historical works and the different system used in parts of the Southern Song empire. In chapter 5 of the Shushu jiuzhang we find the following comment: "The standard for one li is 300 bu."[13] This ratio was the ancient standard. Perhaps during Qin Jiushao's time it was still used in some areas. Elsewhere in his text Qin mentions that "The standard for one li is 360 bu; the standard for one bu is five chi, eight cun."[14] And finally, on another occasion, the author remarks: "2,160 chi is used to figure one li."[15] It seems highly probable that these last two statements refer to measure systems used in various parts of Jiangnan during the Southern Song.

2. The "Big Li" and "Builder's Li" of the Song

Many types of foot measures, most of which had special names and served specific purposes, were in use during the Song. The principal ones used to calculate distances and land area include (1) the "Three Offices' Cotton and Silk Foot"三司布帛尺; (2) the "Builder's Foot"營造尺; (3) the "Zhe (or Zhejiang) Foot" 浙尺; and (4) the "Gnomonic Foot"影表尺(also known as the Liangtian chi量天尺, or "Astronomy-Measuring Foot"). Here we will only discuss the first two of these foot measures, which are related to the li system of the Song. The Zhe Foot and the Astronomy-Measuring Foot, along with their relevance to the li system, will be treated in the next section.

The most commonly used foot measure during the Northern Song was the Three Offices' Cotton and Silk Foot. This measure was first established by the government, to be used when collecting in-kind taxes in cotton and silk. At the beginning of the Song, such taxes were collected by a state finance commission headed by a "Three Offices' Commissioner"三司使. Hence, the foot measure was so named. Since the Three Offices' Cotton

[11] Shushu jiuzhang (Congshu jicheng ed.), 1.19 and passim. There is a full-length study of Qin's treatise available in English. See Ulrich Libbrecht, Chinese Mathematics in the Thirteenth Century: The Shushu chiu-chang of Ch'in Chiu-shao (Cambridge: The MIT Press, 1973).

[12] Shushu jiuzhang, 7.161 and passim.

[13] Shushu jiuzhang, 5.127.

[14] Shushu jiuzhang, 1.19.

[15] Shushu jiuzhang, 13.342.

and Silk Foot was also supervised by the Grand Treasury Court太府寺(an agency responsible for managing the central government's non-grain receipts and disbursements), it was also known as the "Grand Treasury Cotton and Silk Foot"太府布帛尺. Sometimes it was also called the "Department Foot"省尺 ("Department" here designates the Accounting Department計省, which was another name for the Three Offices) or the "Official Foot"官尺.

By examining textual sources and excavated objects we shall now attempt to determine the length of the Three Offices' Cotton and Silk Foot. According to Cai Yuanding's 蔡元定 (1135-1198) New Treatise on the Standard Musical Tubes (Lülü xinshu律呂新書), the Grand Treasury Cotton and Silk Foot was equivalent to the "Pre-Tsin Foot" 晉前尺, which measured one chi, three cun, five fen.[16] The Song dynasty scholar Cheng Jiong 程迥, in his monograph on weights and measures titled Illustrations and Explanations of the Three Measuring Vessels (Sanqi tuyi三器圖義), remarks that: "Recently, Sima Bei司馬備 engraved a likeness of this foot (that is, the 'Zhou Foot') into stone." Later, Cheng goes on to say: "In recent years Sima Bei has made engravings of the Zhou Foot . . . . The Three Offices' Cotton and Silk Foot carved by Sima Bei was equal to one chi, three cun, and five fen of his Zhou Foot."[17] Wang Yinglin 王應麟 (1223-1296), in his encyclopedia Yuhai玉海, also says the Grand Treasury Cotton and Silk Foot "is equivalent to the Zhou dynasty chi of one chi, three cun, five fen."[18] According to the "Monograph on Pitches and Chronometry" ("Luli zhi"律曆志) in the Tsin shu晉書, in the ninth year of the Taishi reign-period (or 273) under the Tsin, the Secretariat Supervisor中書監, Xun Xu荀勗, ordered the Editorial Director著作郎, Liu Gong劉恭, to make an "ancient foot measure"古尺based on descriptions in the Zhou li周禮.[19] This "ancient foot measure" (or "Zhou Foot") was also known as the "Pre-Tsin Foot" and the "Xun Xu Foot."

Now, from the fifteen categories of chi listed in the "Monograph on Pitches and Chronometry" in the Sui shu, we discover that the length of a "Pre-Tsin Foot" was equal to the "Liu Xin Bronze Hu Foot"劉歆銅斛尺 used during Wang Mang's 王莽 (43 B.C.-A.D. 23) time.[20] From the graduations on a surviving Astronomy-Measuring Foot of the Ming dynasty, the modern scholar Yi Shitong伊世同has determined that one Wang Mang Bronze Hu Foot measured 23.05 cm.[21] Thus, we know that the length of

[16] Lülü xinshu (Siku quanshu zhenben ed.), 2.45b.

[17] Cheng Jiong, Sanqi tuyi (Shuofu [1927 Commercial Press] ed.), 16.2a-3b.

[18] Yuhai (Siku quanshu ed.), 8.12a.

[19] Tsin shu, 16.490.

[20] Sui shu, 16.402.

[21] Yi Shitong, "Liangtian chi kao" 量天尺考, Wenwu 2 (1978), 17.

the Three Offices' Cotton and Silk Foot during the Song measured 1.35 x 23.05 cm = 31.12 cm.

In 1965, a wooden foot measure dating from the early Northern Song was excavated at "Ten Li Inn"十 里 鋪in Wuhan, Hubei, which measured 31.2 cm in length, 2.3 cm in width, and 0.5 cm in thickness.[22] The length of this chi is almost exactly the same as the Three Offices' Cotton and Silk Foot described above, which lends support to our contention that the length of one Three Offices' Foot was approximately 31.12 cm.

Chen Mengjia speculates that the Three Offices' Foot was used in Song times for construction work and distance calculations. Then he states that it measured 31.57 cm in length.[23] Chen does not cite the source for his conjecture. Chun-shu Chang [Zhang Chunshu]張 春 樹has consulted Chen's figure and, using a length of 31.1 cm for the Three Offices' Foot, calculates one Li during the Song as measuring 1800 x 31.1 cm = 559.8 m.[24] Moreover, Chang points out: "The weights and measures before and after the Sung dynasty were often different, and variations also existed even during the Sung period."[25] This is certainly true. But more can be said about the matter. For now, the most important point is this: if you use the Three Offices' Foot to measure distance in chi, the result is actually the Big Li of the Song. For the sake of convenience, hereafter we shall refer to this as li^a, which measures 1800 x 31.12 cm = 560.16 m.

Because of chronological and geographical differences, slight variations in the lengths of various Three Offices' Foots dating from the Northern Song have been reflected in certain archeological discoveries. These variations are also reflected in sources of that period. For instance, in chapter 3 of Shen Gua's 沈 括 (1032-1096)[26] famous miscellany Mengxi bitan夢 溪 筆 談 we find the following report:

> While conducting research on the musical pitches (yuelü樂 律), I received an imperial directive to remold the Armillary Sphere. I located some weights and measures, such as dou and sheng, which predate the Qin and Han. [From my observations of these measures]

[22]This discovery is reported by the Hubeisheng Wenhuaju Wenwu gongzuodui 湖北省文化局文物工作隊 in Wenwu 5 (1966), 57.

[23]See Chen's "Mouzhi yu lizhi," 38.

[24]See Chun-shu Chang and Joan Smythe, tr., South China in the Twelfth Century: A Translation of Lu Yu's Travel Diaries July 3-December 6, 1170 (Hong Kong: The Chinese University Press, 1981), p. 25.

[25]Chang and Smythe, South China, p. 26.

[26]Shen Gua's dates of birth and death are disputed. Here we follow the chronology suggested by Wenren Jun 聞人軍 and Xu Gui 徐規 in their article "Shen Gua de qianban sheng"沈 括 的 前半 生(forthcoming in Ziran kexue shi yanjiu [Studies in the History of the Natural Sciences]).

> I calculated that . . . 2 cun, 5.3 fen of an ancient foot is more than 1 cun, 8.45 fen of a modern (or eleventh-century) foot.[27]

In other words, following Shen Gua's calculations, one Three Offices' Foot in Northern Song times measured approximately 2.53 v 1.845 x 23.05 cm = 31.61 cm. It is highly likely that three of the foot measures described in Zhongguo gutai duliangheng tuji--specifically, report no. 56, a wooden foot measure that is 31.4 cm in length; report no. 60, a wooden foot measure (with graduations in relief) that is 31.7 cm in length; and report no. 62, a gold-plated copper foot measure that is 31.74 cm in length--are, in fact, all representations of the Three Offices' Foot of the Northern Song.[28] If this is the case, then we can be sure that there was a tendency during the tenth and eleventh centuries for the Three Offices' Foot to increase in length. Two recent archeological finds that lend support to this argument are the lacquered wooden foot measure of the middle Northern Song period discovered in a woman's tomb in the suburbs of Wuxi 無錫 , Jiangsu, and the iron foot measure excavated in a late Northern Song tomb in Gong 巩 xian, Henan, both of which reach 32 cm in length.[29] Because of the inconstant situation just described, for now we shall take Shen Gua's figure as representative of the various Three Offices' Foots of the middle (or middle and late) Northern Song, which is calculated as follows: one Big Li^a1 of the Song is equivalent to 1800 x 31.61 cm = 568.98 m. After the founding of the Southern Song, the length of the Three Offices' Foot measure was shortened. Here it might be mentioned that the official length of a Cotton and Silk Foot also tended at this time to move towards the numerical value of that measure during the early Northern Song and moreover, that this change is reflected in the Lülü xinshu and Yuhai figures cited above.

The length of the Song dynasty Builder's Foot is close to that of the Three Offices' Foot. We know this to be the case because in 1921 a wooden carpenter's square 矩 尺 measuring 30.91 cm in length, 1.91 cm in width, and 1.35 cm in thickness was excavated in Julu巨 鹿 xian, Hebei, near the remains of a Northern Song city wall. This square is now housed in the Museum of Chinese History in Beijing. At this same site a wooden table and chair dating from 1104, as well as stone steles from the Qingli 慶 曆(1041-1049) and the Zhenghe 政 和 (1111-1118) reign-periods, were unearthed.[30] After examining the square, the eminent scholar Wang

[27]Hu Daojing 胡道靜 , ed., Xin jiaozheng Mengxi bitan 新校正 夢溪筆談(Hong Kong: Zhonghua shuju, 1975), 3.46.

[28]Guojia jiliang zongju 國家計量總局 , ed., Zhongguo gudai duliangheng tuji 中國古代度量衡圖集 (Beijing: Wenwu chubanshe, 1981), pp.7-8.

[29]These discoveries are reported in Kaogu 4 (1982), 389- 391, and in Kaogu 2 (1963), 71-79, 86, respectively.

[30]Zhongguo gudai duliangheng tuji, p. 7.

Guowei 王國維 (1877-1927) proclaimed: "This is a Song foot measure."[31] He also identified this as the most common measure of the Song period.[32] We believe that the carpenter's square discovered in Hebei to be a Builder's Foot of the late Song. The length of this chi is only slightly different from that of the Three Offices' Foot (which, it will be recalled, was 31.12 cm). After the revised version of Li Jie's 李誡 (ob. 1108; alt. 1110) monumental work on architecture--the Yingzao fashi 營造法式 (Models and Patterns for Building and Construction)--was published in 1103, it established the standards for building projects sponsored by the government. The position of the "Builder's Foot" was thus elevated, and its influence became more extensive.

If we use the Builder's Foot to calculate distance in chi, the result is the "Builder's Li"營造里. Hereafter we shall refer to this as li^b, which measures 1,800 x 30.91 cm = 556.38 m.

Now let us take a look at a historical example of the Song dynasty Big Li and Builder's Li. During the reign of Yangdi 煬帝 of the Sui (that is, the period 605-618), the Bian River 汴河 was made into a canal in order to provide passage between the Yellow and Huai Rivers. To say the least, it played a major role in Northern Song economic development. Shen Gua once surveyed the length of the Bian River. In chapter 25 of the Mengxi bitan, Shen provides the following report on his investigation:

> During the Xining 熙寧 reign-period (1068-1078) there were deliberations about altering the course of the Luo River 洛水, so that it would flow into the Bian [Canal]. I thus was sent out as a commissioner to investigate [the area] along the Bian Canal. [Based on my survey,] from the Supreme Goodness Gate 上善門 in the Capital City (that is, Kaifeng) to the banks of the Huai River in Si 泗 county, the length of the Bian Canal altogether measures 840 li, 130 bu.[33]

[31] This comment is reproduced by Arthur W. Hummel in his translation of Wang Guowei's "Chinese Foot-Measures of the Past Nineteen Centuries," in Journal of the North China Branch of the Royal Asiatic Society 59 (1928), Chinese text facing p. 122. See also the comments in Wang Guowei's "Ji xiancun lidai chidu" 記現存歷代尺度, which is found in his Guantang jilin 觀堂集林 (Beijing: Zhonghua shuju, 1959), 19.942.

[32] Hummel, "Chinese Foot-Measures," 122, note c.

[33] Xin jiaozheng Mengxi bitan 新校正夢溪筆談, 25.250. It is not reported how Shen Gua arrived at this precise figure. The Supreme Goodness Gate was a water gate situated on the eastern flank of Kaifeng's outer wall. It gave passage to the Bian River. In Song times Si county was located at the confluence of the Bian and Huai Rivers, just northeast of the Song-Jin border town of Xuyi 盱眙. Since the early Qing period, this area has been inundated by Hongze Lake 洪澤湖.

If we use Song dynasty li^a1 as a guide, then the total distance from the Supreme Goodness Gate in Kaifeng to the banks of the Huai River in Si county was 840.43 x 568.98 m = 478.20 km. If we use li^b, then the distance would be 840.43 x 556.38 m = 467.598 km. Now, if we retrace Shen Gua's itinerary along the Northern Song maps provided in Tan Qixiang's譚其驤 Zhongguo lishi ditu ji 中國歷史地圖集, following Tan's scale of 1:2,800,000, then the length of the Bian Canal from Kaifeng to Si county is about 460 km.[34] Although this method of calculation admittedly is imprecise, still it strongly suggests that Shen Gua used either the Song dynasty lia1 or lib when figuring his distance.

One additional observation before closing this section. According to the "Monograph on Geography" in the Song shi, the circumference of the New Wall新城 in Kaifeng was 50 li, 165 bu.[35] If we convert this figure using Song li^a, then the circuit of Kaifeng's rampart was 560.16 x 50.46 m = 28.27 km. If we calculate using Song li^a1, then the circumference of the wall measured would be 568.98 x 50.46 m = 28.71 km. Since 1981, the "Song City Wall of Kaifeng Archeological Team"開封宋城考古隊 has been carrying out exploratory drilling and test digging. As a result of their excavation work, the approximate perimeter of Kaifeng's New Wall can now be determined. The western portion of the rampart measured about 7,590 m, while the length of the eastern section was approximately 7,660 m. The lengths of the southern and northern sections were about 6,990 and 6,940 m, respectively. Thus, the circumference of the wall was approximately 29,120 m.[36] Note that the figures of 28.27 and 28.71 km calculated earlier from information in the Song shi more or less match the 29.12 km figure based on recent archeological data.

3. The "Zhe Li" and "Astronomy-Measuring Li" of the Song

During the Song, many types of foot measures were also used on the local level. The most famous of these was the "Zhe Foot." In his miscellany Register Kept After the Guests Depart (Bintui lu 賓退錄), the Southern Song writer Zhao Yushi趙與時(1175-1231) notes: "The Zhou Foot 周尺 equals less than the seven cun and five fen of a [Three Offices'] Cotton and Silk Foot. As for the Zhe Foot of today, it

[34] See especially the map on pp. 22-23 in Vol. VI of Tan's Zhongguo lishi ditu ji, published in 1982 by the Ditu chubanshe, Beijing. It might be added here that the course of the Bian River on this map is based on the research of the eminent scholar of historical geography, Zou Yilin 鄒逸麟 of Fudan University in Shanghai. Many of the details concerning Zou's research were published in two earlier articles: "Sui-Tang Bianhe kao" 隋唐汴河考, Guangming ribao (4 July 1962); and "Tang-Song Bianhe yusai de yuanyin ji qi guocheng" 唐宋汴河淤塞的原因及其過程, Fudan daxue xuebao 1 (1962), 51-64.

[35] Song shi, 85.2102. "New Wall" is another name for the outer rampart of Kaifeng.

[36] Qiu Gang 丘剛, "Bei Song Dongjing waicheng de chengqiang he chengmen" 北宋東京外城的城墻和城門, Zhongwai wenwu 4 (1986), 33; 44-47.

comprises eight cun and four fen."[37] Now, the practice established in the Sui shu of differentiating fifteen categories of chi was still followed in Song times. The so-called Zhou Foot mentioned by Zhao Yushi was the same as the Pre-Tsin Foot which, as we have already seen, measured 23.05 cm. In the eleventh century, a certain Gao Ruona 高若訥(997-1055) once fashioned a replica of this foot-measure.[38] From this figure of 23.05 cm we can calculate one Zhe Foot^a = 100/84 x 23.05 cm = 27.44 cm. Moreover, if we follow the statement in one Song work that one Three Offices' Foot is equal to one chi, one cun, and three fen of a Zhe Foot,[39] then one Zhe Foot^b = 100/113 x 31.12 cm = 27.54 cm. Thus, the average value of Zhe Foot^a and Zhe Foot^b is 27.49 cm.

Although an ancient Zhe Foot has yet to be discovered in China, a "Small Foot"小尺used locally in Fujian has been excavated. This bamboo foot measure of the Southern Song was found in a sunken boat discovered in Quanzhou Bay泉州灣 , Fujian, in 1974. The surviving portion of this chi is 20.7 cm long, 2.4 cm wide, and 0.4 cm thick. Today it is housed in the History of Overseas Communications Museum in Quanzhou. Based on the graduations found on the measure, one foot totaled 27 cm.[40] In 1975, a black-lacquered wooden foot measure bearing carved floral patterns was unearthed in a Southern Song tomb at Fucang Mountain浮倉山in Fuzhou, Fujian. It measures 28.3 cm long, 2.6 cm wide, and 1.25 cm thick.[41]

The two foot measures just described and the Zhe Foot discussed earlier all belong to the so-called Small Foot system of the Song. Although the origin and development of these measures have yet to be defined by archeological discoveries and research, there is absolutely no doubt about the existence of the Zhe Foot. If we calculate one li based on our average figure for a Zhe Foot and call this "Song lic," then one Song li^c = 1,800 x 27.49 cm = 494.82 m.

According to information in Li Jifu's李吉甫 (758-814) Illustrated Gazetteer on the Commanderies and Townships of [the] Prime Accord [Era] (Yuanhe junxian tuzhi 元和郡縣圖志) concerning the surface area of Hang county (modern Hangzhou, Zhejiang), "From east to west it is 554 li; north to south it is 89 li."[42] The figures for the same area provided by Yue Shi樂史 (930-1007) in his Records Encompassing the

[37] Bintui lu (Shanghai: Shanghai guji chubanshe, 1983), 8.102.

[38] Song shi, 71.1610.

[39] This statement, taken from a work titled Jia li家禮 , is quoted in Yang Kuan 楊寬 , Zhongguo lidai chidu kao中國歷代尺度考 (Shanghai: Shangwu yinshuguan, 1955), p. 84.

[40] Zhongguo gudai duliangheng tuji, p. 8.

[41] These figures are provided in "Fuzhou shi beijiao Nan Song mu qingli jianbao" 福州市北郊南宋墓清理簡報 , Wenwu 7 (1977), 11.

[42] Yuanhe junxian tuzhi (Beijing: Zhonghua shuju, 1983), 25.602.

Universe from [the] Grand Tranquility [Era] (Taiping huanyu ji太平寰宇記) are different: "East to west it is 617 li; north to south it is 99 li."[43] Correlating these two sets of figures, we arrive at the following:

$$\frac{617}{554} \approx 1.11 \approx \frac{99}{89} \qquad \text{(Formula 1)}$$

It is evident from Formula 1 that the ratio of change of north to south, and east to west distances is almost exactly the same in the Song as it was in the Tang. This fact suggests that in Hang county the li system underwent some type of adjustment between the Tang and Song. To be more specific, Li Jifu, in his Yuanhe junxian tuzhi used the Tang dynasty Big Li to calculate the dimensions of Hang county, while Yue Shi in his Taiping huanyu ji used the Zhe Li of the Song.

Now, the Big Foot of the Tang is in fact the Official Foot used during the Kaihuang開皇reign-period of the Sui (that is, 581-601). According to the ui shu the Official Foot of the Kaihuang period was the same as the "Market Foot Measure"市 尺of the Northern Zhou (557-581) and the "Later Foot Measure"後 尺of the Northern Wei (386-534), and "actually equaled one chi, two cun, eight fen, and one li of the Pre-Tsin Chi."[44] Thus, the length of the Tang dynasty Big Foot = 1.281 x 23.05 cm = 29.527 cm. From this we calculate a Big Li of the Tang to equal 1,800 x 29.527 cm = 531.49 m. A comparison of the Tang Big Li and Song Zhe Li yields the following:

$$\frac{531.49}{494.82} = 1.074 \qquad \text{(Formula 2)}$$

The number and the length of li should be inversely proportionate. There is a small difference, however, between Formulas 1 and 2, which can be explained in the following way: the length of some of the Tang dynasty foot measures either excavated or handed down from ancient times varies from 30 to 31 cm. If we take the silver-inlaid "Iron Foot" 鐵尺 on display in the National Palace Museum in Beijing as a representative example, figuring each such chi totals 30.6 cm,[45] then

$$\frac{\text{Tang Li}}{\text{Zhe Li}} = \frac{1,800 \times 30.6}{1,800 \times 27.49} = 1.11$$

Formula 3 thus matches precisely with Formula 1.

Chen Suiying陳隨 應(Song) in his Record of the Transit Palace After the Southern Crossing (Nandu xinggong ji南度行宮記) says that the circumference of the "August Wall" 皇城 (that is, the wall around the

[43] Taiping huanyu ji (Yonghe zhen: Wenhai chubanshe, 1963), 93.700.

[44] Sui shu, 16.405. The unit of measure li mentioned in this passage equals 1/1000 of a chi.

[45] Our figure for the "Iron Foot" is taken from Zhongguo gudai duliangheng tuji, p. 7.

imperial precincts in Lin'an) was nine li.[46] If we calculate with Song li[a] or Song li[b], the circumference of the August Wall would have extended more than 5,000 m. Calculating with Song li[c], then the circumference would have been about 4,453 m. According to the recent findings of Wang Shilun王 士 倫, Head of the Cultural Relics and Archeological Research Institute of Zhejiang Province 浙江省文物考古研究所 , the length of the east to west portion of the imperial wall in Lin'an was about 1,400 m, and from north to south it was greater than 700 m.[47] The August Wall's circumference thus measured greater than 4,200 m.[47] Clearly, then, Chen Suiying's figure of "nine li" was calculated by using the Zhe Li.

In chapter 16 of Cheng Dachang's 程 大 昌 (1123-1195) Extending the Fanlu (Yan Fanlu 演 繁 露) we find the following:

> The Official Foot and the Zhe Foot are the same. They merely equal 0.8 of a Huai Foot 淮 尺 . But a Capital Foot 京 尺 is 0.2 greater than a Huai Foot. In [the] governmental and private [sectors], they are [variously] applied and used according to circumstances. . . . The Agency Foot (or Official Foot) and the Zhe Foot measures are customarily employed by the government, but for silk fabrics the Huai Foot is specially used.[48]

Many scholars have regarded Cheng Dachang's comment "The Official Foot and the Zhe Foot are the same" to be wrong.[49] We believe that rather than to say Cheng was unable to distinguish between an Official Foot and Zhe Foot (he was, after all, a leading scholar of the twelfth century), it would be better (and more accurate) to say that after the move of the Song capital to Lin'an, the Zhe Foot originally used in the area around Hang county was elevated to the status of a "Government" or "Official Foot."

During the Song, taxes were assessed by pacing off amounts of land in mou. Even for the same parcel of land, the larger the number of mou it was calculated to encompass, then the more the amount of taxes collected by the state. It was thus obviously advantageous to the Song government to use the Zhejiang Foot when figuring mou rather than the Three Offices' Foot. Moreover, at the end of the Northern Song, the practice of selling

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[46] Nandu xinggong ji, quoted in Tao Zongyi 陶宗儀 (ca. 1316 -ca. 1402), Nancun chuogeng lu 輟耕錄 (Taibei: Shijie shuju, 1971), 18.15b-16a.

[47] Wang Shilun, "Nan Song gugong yizhi kaocha" 南宋故宮遺址考察 , in Nan Song jingcheng Hangzhou 南宋京城杭州 (Hangzhou: N.p., 1985), p. 24.

[48] Yan Fanlu (Xuejin taoyuan ed.), 16.8b.

[49] For instance, see the comments in Wang Guowei, Guantang jilin, 19.938; in Yang Kuan, Zhongguo lidai chidu kao, p. 83; and in Wu Ze 吳 澤, "Lun Wang Guowei de Tang chi yanjiu" 論王國維的唐尺研究 , in Wang Guowei xueshu yanjiu lunji 王國 維學術研究論集 (Shanghai: Huadong shifan daxue chubanshe, 1985), I, 179.

Official Fields官 田 began.[50] By the early years of the Southern Song the sale of government land was to become more and more prevalent. Using the Zhejiang Foot to figure mou was clearly a pecuniary advantage to the government in its huge sale of Official Fields.

In light of the developments just outlined, it is certainly possible that the Zhejiang Foot was elevated to the status of an Official Foot. Moreover, it will be recalled that the Three Offices' Foot was originally employed when collecting in-kind taxes in cotton and silk. As we saw earlier, however, by Southern Song times, the Huai Foot was expressly used to measure silken fabrics. The Huai Foot was probably = 10/8 x 27.49 cm = 34.36 cm.[51] It was longer than the Three Offices' Foot and gave an advantage to those who ruled the empire. It might also be mentioned here that the shipbuilding industry during the Song customarily used the Huai Foot to calculate measurements.[52] It remains to be determined, however, whether the Huai Foot was ever employed to calculate distance or land area.

The chi used to calculate the length of sun shadows during the Song must have been a continuation of the Gnomonic Foot of the Tang. Its predecessor was the Iron Foot of the Northern Zhou, which measured 24.525 cm in length.[53] If used in astronomical-geodetic computations, then the li that is computed is the Song "Astronomical Li" 天 文 里 . Hereafter we shall refer to this as Song li[d]. It equals 1,800 x 24.525 cm = 441.45 m. The large-scale astronomical-geodetic computations initiated by the famous astronomer and Buddhist monk Yixing 一 行 (682-727) during the Kaiyuan period (713-742) of the Tang are well-known historical examples of actual instances where Astronomical Li were used to compute distances on earth.[54] While astronomical-geodetic surveying was not made during the Song on a scale comparable to that of the Tang, there was still probably ample occasion for use of the Astronomical Li.

The prominent twelfth-century writer Lou Yue 樓鑰 (1137-1213) once served as ambassador to the Jin. Like all Song envoys to the north, his itinerary followed a prescribed course along the Bian River. According

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[50] The term "official fields" refers broadly to land owned by the government.

[51] This figure is based on our earlier computation that an Official Foot and Zhe Foot represented 0.8 of a Huai Foot.

[52] Chen Gaohua陳 高 華and Wu Tai吳 泰 , "Guanyu Quanzhouwan chutu haichuan de ji ge wenti" 關於泉州灣出土海船的幾個問題 Wenwu 4 (1978), p. 84.

[53] Yi Shitong, "Liangtian chi kao," 17.

[54] A synopsis of Yixing's contributions to astronomy in China can be found in Joseph Needham, Science and Civilisation in China, Vol. 3: Mathematics and the Sciences of the Heavens and the Earth (Cambridge: Cambridge University Press, 1959), 202.

to information provided in his travel journal titled Daily Register of a Northern Journey (Beixing rilu 北行日錄), the distance from Si county to Kaifeng measured 1,045 li.[55] This figure far surpasses the length of the Bian River as reported by Shen Gua (that is, 840 li, 130 bu). But if we use the Song dynasty Astronomical Li to translate Lou Yue's figure of 1,045 li, the result is as follows: 1,045 x 441.45 m = 461.32 km. This number tallies almost exactly with our earlier conversions of Shen Gua's figure for the length of the Bian Canal.

4. The Mou System During the Song

It will be recalled that during the Song one bu comprised five chi. In the section on "Square Fields" 方田 in the "Monograph on Foods and Commodities" in the Song shi, we find the following report:

> Shenzong (or Zhao Xu 趙頊 r. 1067-1085) was troubled that field taxes were not equal. In the fifth year of the Xining reign-period (or 1072), the square field system was reinstated. It was rescripted that the Overseer of Agriculture 司農 promulgate the [laws concerning] 'Square Fields, Equitable Tax Regulations, and [Tax Report] Forms' in the Underheaven. From east to west, and from south to north, each [square field] is 1,000 bu, and equivalent to forty-one qing, sixty-six mou, one-hundred and sixty bu. This makes one fang 方 (or 'square').[56]

Expressed in mathematical terms, this would be 1,0002 = 240 x (41 x 100 + 66) + 160. That is to say, under the Song, 240 square bu constituted one mou. This figure is corroborated on numerous occasions in the Shushu jiuzhang, where Qin Jiushao explicitly states that "The [legal] standard for [one] mou is 240 bu".[57] Below are calculations for the surface area for one mou of land during the Song, based on the system whereby each mou was equal to 240 square bu, and wherein each bu comprised five chi:

(1) Calculating by means of the Three Offices' Cotton and Silk Foot, then Song dynasty mou^a = 240 x $(5 \times 0.3112)^2$ m^2 = 581.07 m^2; Song dynasty mou^{a1} = 240 x $(5 \times 0.3161)2$ m^2 = 599.52 m^2.

(2) Calculating by means of the Builder's Foot, then Song dynasty mou^b = 240 x $(5 \times 0.3091)^2$ m^2 = 573.26 m^2.

(3) Calculating by means of the Zhe Foot, then Song dynasty mou^c = 240 x $(5 \times 0.2749)^2$ m^2 = 453.42 m^2.

Mou^a, mou^{a1} and mou^b were used primarily during the Northern Song. Mou^c was also used during the Northern Song, especially in Hangzhou and in areas near there. In Southern Song times, its use became more widespread.

[55] Lou Yue's journal is preserved in the collectaneum Zhibuzu zhai congshu 知不足齋叢書. The figure "1,045 li" is taken from Zou Yilin, "Tang-Song Bianhe yusai," 52. We have checked Tsou's figure against information related in Lou Yue's diary entries, and in our opinion his calculation is accurate.

[56] Song shi, 174.4199.

[57] Shushu jiuzhang, 5.128, 129, 130-131, 132, and 134.

5. The Li System Under the Liao

Since there are still relatively few sources available on the system of weights and measures employed under the Liao, our findings in this section must be regarded as tentative. Although our "conclusions" are based on archeological materials and reliable written records, more evidence must come to light before any final verdict can be made concerning the li system under the Liao.

It is reported that the ruins of the Supreme Capital 上京 of the Liao are located near Lindong zhen 林東鎮 in Bairin Zuoqi 巴林左旗, Inner Mongolia Autonomous Region. The wall of the imperial city is constructed of rammed earth, the layers of which are clear and distinct. The remains of the wall stand between 6 and 10 m in height.[58] A survey of the remains of the rampart revealed the circumference of the imperial wall to be approximately 14,000 m.[59] According to the Liao shi 遼史, the Supreme Capital of the Liao was built in 918. "Its wall was two zhang high; watchtowers were not put in place [on the wall]. In area it measured twenty-seven li. . . . The wall to its north was called the 'August Wall.' It was three zhang high, and had roofless lookout turrets. Inside was the Great Interior 大內. The southern wall was called the 'Han Wall' 漢城."[60] Since the height of the imperial wall was equal to or greater than ten meters, then one Liao chi was equal to or greater than 1,000/30 cm = 33.33 cm (Formula 4). The numerical value of a Liao li can also be estimated. One Liao li^a = 14,000/27 m = 518.52 m.

The Central Capital 中京 of the Liao at Dading municipality 大定府 was first built in 1007. Its ruins are located in Daming cheng 大明城, Ningcheng 寧城 xian, Ju Ud Meng 昭烏達盟, Inner Mongolia Autonomous Region. In 1959 and 1960 the Central Capital of the Liao Excavation Commission 遼中京發掘委員會 measured the east-west section of the wall to be 4,200 meters, the north-south section to be 3,500 meters.[61] Thus, the circumference was about 15,400 meters. In the Chengyao lu 乘軺錄, an account of the Song ambassador Lu Zhen's 路振 (957-1014) embassy to the Liao in 1008, it is related that the area within the outer

[58] See "Liao Shangjing yizhi" 遼上京遺址, in Wenwu 5 (1979), 79.

[59] The results of this survey are reported in Wenwu kaogu gongzuo sanshi nian 文物考古工作三十年 (Beijing: Wenwu chubanshe, 1979), p. 78.

[60] Liao shi, 37.441.

[61] "Liao Zhongjing chengzhi fajue de zhongyao shouhuo" 遼中京城址發掘的重要收獲, Wenwu 9 (1961), 35.

wall of the Liao capital comprised thirty li.[62] If we calculate following this estimate, one Liao li[b] = 15,400/30 m = 513.33 m. The average numerical value of Liao li[a] and Liao li[b], then, is 515.93 m. For the time being, we will adopt the figure of "515.9 m" as the approximate length of a Liao li.

If we assume that in the li system under the Liao each li comprised 360 bu, and each bu comprised five chi, then one Liao chi = 51,590/1,800 cm = 28.66 cm (Formula 5). Since there is a substantial difference in the figures yielded by Formula 5 and Formula 4, it is difficult to tell which one (if any) is an accurate representation of a Liao foot measure. We suspect that the li system under the Liao was influenced by the li system used during the early Tang (this, of course, suggests that the same system might have been used in the Bohai 渤海 region[63] during the years between the Tang and Liao periods), in which each li comprised 300 bu, and each bu comprised five chi. If we calculate according to these tentative figures, then one Liao chi = 51,590/1,500 cm = 34.39 cm (which we shall round off to 34.4 cm). While the results of our computations of the Liao dynasty li and chi certainly cannot be regarded as precise figures, still they can provide historians and students of the Liao period with a general reference.

In his article "A General Account of the Foot Measure During the Successive Dynasties in China," Zeng Wuxiu 曾武秀 points out that the "Liao used the Small Li; one li was 1,500 chi."[64] This viewpoint is correct, although in his article Zeng did not set forth the grounds for his argument. It might be mentioned in passing that Zeng calculated his Liao chi based on figures of an archeological survey concerning the circumference of the remains of the wall around the Jin Central Capital (this expanded metropolis was built on the original site of the Southern Capital of the Liao, also known as Xijin 析津 municipality). In our opinion, this is not the best approach to solving the question at hand (see the comments below).

Since the Liao had only recently changed from a nomadic lifestyle to one based on agriculture, there is no need to consider the mou system here.

6. The Li and Mou Systems Under the Jin

[62] Lu Zhen's description is preserved in Jiang Shaoyu 江少虞 (12th cent.), Songchao shishi leiyuan 宋朝事實類苑 (Shanghai: Shanghai guji chubanshe, 1981), 77.1012.

[63] In Tang times, the heart of the Bohai (or Parhae) region was situated in what is now Eastern Heilongjiang province and the lower Amur River area. This was the territory of a people of Tungusic stock known as the Malgal (Chinese = Mohe 靺鞨). Later this area was controlled by the Khitan (or Qidan 契丹) people, who founded the state of Liao.

[64] Zeng's article, "Zhongguo lidai chidu gaishu" 中國歷代尺度概述, appeared in Lishi yanjiu 3 (1964), 175.

There is a relatively large bulk of source materials confirming that the Jin, as soon as they took control of China, modified the li and mou system used by their predecessors, the Liao. Although the Jin system was heavily influenced by that of the Liao, we cannot eliminate the possibility of influence from the Tang and Song systems of li and mou as well. Describing the field system, the Jin shi relates that: "In measuring [the size of] a field, one uses the Builder's chi. Five [such] chi constitute a bu. [An area] one bu in breadth, and 240 bu in length, constitutes a mou. One hundred mou constitute a qing."[65] The same information is also found in the Xu Tongdian 續通典.[66] The Jin shi and Xu Tongdian, however, do not discuss the li system of the Jin period. In other words, neither of these works considers the number of bu that constituted a li. Moreover, the length of a chi under the Jin still remains to be determined.

As for the chi under the Jin, many scholars have considered it to be a continuation of the Tang and Song foot measures. Chen Mengjia even went so far as to say that the Builder's chi of the Jin might be equal to the Three Offices' Cotton and Silk Foot of the Song,[67] but this view has been proven to be incorrect (see the comments below).

Recently, Gao Qingshan 高青山 and Wang Xiaobin 王曉斌 have determined the approximate value of a Jin dynasty chi by investigating official government seals (guanyin 官印) of that period. According to the "Hundred Offices Monograph" ("Baiguan zhi" 百官志) in the Jin shi, the size of the imprint left by an official's government seal was determined by that official's grade (or rank) in the bureaucracy. As a general rule, the higher the office, the larger the imprint. In 1156, the following official seal system was promulgated by the Jin:

> The Three Preceptors (sanshi 三師), the Three Dukes (sangong 三公), the Imperial Princes (qinwang 親王), and Director of the Imperial Secretariat (shangshu ling 尚書令) use the gold seal, which is two cun square. . . . The seal of a first-grade [official] is one cun, six-and-a-half fen square. . . . The seal of a fifth-grade [official] is one cun, four fen square. . . . The seal of a ninth-grade [official] is one cun, one fen square.[68]

Based on their examination of eighty-nine Jin seals, all bearing reign-year designations, Gao Qingshan and Wang Xiaobin concluded that:

> There are seventy-eight seals indicating that one Jin dynasty chi was 40 to 45 cm in length. There are ten seals indicating that one Jin dynasty chi was less or greater than 40 to 45 cm in length. This proves that the length of a chi during the Jin period was between 40 to 45 cm. Among these seventy-eight official seals,

[65] Jin shi, 47.1043.

[66] Xu Tongdian (1886 Zhejiang shuju ed.), 2.16a.

[67] Chen Mengjia, "Mouzhi yu lizhi," 38.

[68] Jin shi, 58.1337.

there are forty-three that indicate that one Jin chi equaled or approximated 43 cm. We thus believe that one chi during the Jin period was about 43 cm."[69]

More than twenty years ago, a Jin dynasty "Laibin Township Mile-Marker"來賓縣里堠 stele was unearthed in Shahe xicun沙河西村, Suizhong綏中 xian, Liaoning province. This stele was probably erected sometime between 1143 and 1195. During the Jin period, Laibin township was under the jurisdiction of Rui瑞 county. According to the inscription on the stele, the township (in Jin times) "Extends to the west thirty-five li to the single mile-marker west of the county."[70] The area 15,000 meters west of the place where the mile-marker stele was unearthed today is known as Qianwei Village前衛村. This is, in fact, the original site of Rui county under the Jin.

A hou, or "mile-marker," is just that: a sign that marks distances in li. Five li intervals were indicated by a "single mile-marker單堠"; every ten li one found a "double mile-marker"雙堠. "Extends to the west thirty-five li to the single mile-marker west of the county" is the same as saying: Rui county is about thirty li to the west, which means that the length of one li under the Jin was around 500 meters.

In his Chronicled Essentials of the Quarters and Domains [Encountered] in Reading History (Dushi fangyu jiyao 讀史方輿紀要), Gu Zuyu顧祖禹 (1631-1692) relates the following:

> The old Gazetteer [says]: Liao Taizong太宗, or Yelu Deguang耶律德光, elevated You county幽州to be the Southern Capital南京. It was also called Yanjing燕京. [The Liao] rebuilt the metropolis wall. Its site was southwest of the present city wall. The inner portion constituted the August Wall. Its circumference was seven li, 103 bu. It had five gates . . . . The outside rampart constituted the Metropolis Wall. It was thirty-six li in circumference. It had eight gates. The deposed Jin sovereign Wanyan Liang完顏亮 changed [the name of] Yanjing to Zhongdu中都 (lit., "Central Metropolis"), and ordered that the Metropolis Wall be expanded. (The Interior Wall was nine li, three bu in circumference . . . .) It had thirteen gates.[71]

There are three points in this passage worth discussing. First, according to the itinerary of Xu Kangzong's 許亢宗 (Jinshi ca. 1115) 1124 embassy to the Jin, which is outlined in juan 40 of the Monograph on the Great Jin State (Da Jinguo zhi大金國志), "the circumference of the wall [in Yanjing] was twenty-seven li. The tower walls were forty chi high. The number of towers was reckoned to be 910. There were three rows of moats, and eight gate openings in the city wall."[72] The Jin metropolis of Yanjing, as it is here described, is in fact the original Liao Southern Capital at Xijin municipality. The circumference of its outer wall was only twenty-seven li. It did not measure thirty-six li. The figure "thirty-six li" must refer to the circumference of the outer wall after 1151, which is when Wanyan Liang ordered Zhang Hao張浩 and others to expand the city wall. The "Monograph on Geography" in the Jin shi does not mention the circumference of Zhongdu's outer wall. The comment in the Monograph on the Great Jin State that Yanjing's "Metropolis Wall was about seventy-five li all the way around"[73] is clearly wrong. Moreover, the editors of the Liao shi have mistakenly taken the circumference of the Southern Capital at Xijin municipality to be thirty-six li,[74] which is the figure Gu Zuyu followed.

Second, according to the Monograph on the Great Jin State, the interior city wall of Zhongdu during the Jin was "nine li, thirty bu."[75] In the Dushi fangyu jiyao this figure is mistakenly quoted as "nine li, three bu."[76]

Third, the Monograph on the Great Jin State says that Zhongdu had twelve gates, each of which was apportioned into three [smaller] gates.[77] A different figure is provided in the Dushi fangyu jiyao. It says there were thirteen gates.[78] It is possible that one of the gates had more than one name, which later chroniclers might have mistakenly counted as two separate portals, thus accounting for the number "thirteen."

The circumference of the outer wall of the Liao Southern Capital at Xijin municipality has never been estimated. In 1958, when the ruins of the Jin capital at Zhongdu were investigated, the outer west wall of Zhongdu was found to measure approximately 4,530 meters. The southern wall measured about 4,750 meters; the eastern wall approximately 4,510

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[69] Gao Qingshan and Wang Xiaobin, "Cong Jindai de guanyin kaocha Jindai de chidu" 從金代的官印考察金代的尺度, Liaoning daxue xuebao 4 (1986), 74. The authors wish to thank Professor Hok-lam Chan for bringing this article to their attention.

[70] The inscription is reproduced in Feng Yongjian馮永謙, "Liaoning Suizhong xian Jindai 'Laibin xian lihou' beikao" 遼寧綏中縣金代來賓縣里堠碑考, Kaoku 3 (1983), 268.

[71] Dushi fangyu jiyao (Guoxue jiben congshu ed.), 11.473-474. The note in parentheses at the end of this passage is that of Gu Zuyu.

[72] Da Jinguo zhi (Guoxue jiben congshu ed.), 40.302. The number "910" in this reference may be an error.

[73] Da Jinguo zhi, 33.244.

[74] Liao shi, 40.494.

[75] Da Jinguo zhi, 33.244.

[76] Dushi fangyu jiyao, 11.474. Gu Zuyu does not identify his source for this figure.

[77] Da Jinguo zhi, 33.244. Two of these smaller gates were for incoming and outgoing traffic. The third (or middle) one was reserved for the emperor's exclusive use.

[78] Dushi fangyu jiyao, 11.474.

meters. It was also estimated that the north wall should have measured around 4,900 meters.[79] The differences between these four figures are not great. The circumference of the outer wall, then, was about 18,690 meters. Calculating with this figure, one Jin dynasty lia = 18,690/36 m = 519.17 m.

Also, according to the Ming Veritable Records 明實錄, on wuzi day of the eighth month in the first year of the Hongwu 洪武 reign (or 2 October 1368), Major General Xu Da 徐達 (1332-1385) dispatched the Adjutant on the Right 右丞 Xue Xian 薛顯 and the Vice Administrators 參政, Fu Youde 傅友德 (ob. 1388) and Lu Ju 陸聚 (ob. 1388), to lead troops and take Datong 大同 by force. He [also] ordered the Army Commander 指揮 Ye Guozhen 葉國珍 to measure and calculate the [circumference of the] Southern City 南城 in Beiping 北平. Altogether, the circumference measured 5,328 zhang. The Southern City is the former site [of Zhongdu] during the Jin.[80] The unit of measurement used to figure distances at that time was the Baochao 寶鈔 chi, which measured 34.02 cm in length.[81] Figuring by means of the Ming Dynasty Baochao Foot, then, the circumference of Zhongdu = 53,280 x 34.02 cm = 18,125.86 m. Thus, one Jin li^b = 18,125.86/36 = 503.50 m. The average value of Jin li^a and li^b is 511.3 m. For now we shall adopt "511.3" as an approximate figure for a li during the Jin, which does not conflict at all with the information found on the "Laibin Township Mile-Marker" stele.

As mentioned earlier, the precise nature of the li system used during the Jin is unclear. If we assume that it was a continuation of the Liao system, then one Jin dynasty chi equaled 511.3 / 1500 m = 34.1 cm. This figure obviously differs significantly from that of Gao Qingshan and Wang Xiaobin who, it will be recalled, calculated the length of a Jin dynasty chi to be about 43 cm. In his Nancun chuogeng lu, Tao Zongyi reports that the circumference of the wall around the Yuan dynasty capital at Dadu 大都(modern Beijing) measured 60 li. He also mentions that 240 bu constitute one li.[82] If we assume that the li system under the Yuan was a continuation of the Jin system, and that 240 bu comprised one li under the Jin, then one li during the Jin period equaled 240 x 5 chi = 1,200 chi. From this figure we can calculate that one Jin dynasty chi = 511.3/1,200 m = 42.6 cm ≈ 43 cm, which tallies exactly with the figure that Gao and Wang came up with after investigating the sizes of more than eighty government seals. From this it is clear that one li under the Jin constituted 240 bu, one bu constituted five chi, and that one chi was approximately 43 cm in length. We can thus calculate that: one Jin

[79] See Yan Wenru 閻文儒, "Jin Zhongdu" 金中都, Wenwu 9 (1959), 9.

[80] Mingshi lu (Taibei: Zhongyang yanjiuyuan, Lishi yuyan yanjiusuo, 1968 [photocopy of an early Qing hand-copied edition]), 34.11b-12a.

[81] Our source for the length of a Baochao Foot is Zhongguo gudai duliangheng tuji, p. 9.

[82] Tao Zongyi, Nancun chuogeng lu, 21.297.

dynasty li = 0.43 x 1200 m = 516 m, and one Jin dynasty mou = 240 x (5 x 0.43)^2 m^2 = 1,109 m^2.

Although the figures provided above on the Jin dynasty li, chi, and mou cannot be regarded as precise figures, they may be useful for reference purposes.

7. General Table of the Measures Li and Mou under the Song, Liao, and Jin

For the reader's convenience, the numerical results of the preceding discussions are reproduced in the table on the following page. The table may also serve as a summary of the findings of this investigation.

GENERAL TABLE OF THE MEASURES *Li* and *Mou* UNDER THE SONG, LIAO, AND JIN

Dynasty	Measure Name	Length of one *chi* (cm)	Number of *bu* in one *li*	Number of *chi* in one *bu*	Number of *chi* in one *li*	Length of one *li* (m)	Number of square *bu* in one *mou*	Area of one *mou* (m^2)	Comments
Song	Three Offices' Cotton and Silk *chi* 三司布帛尺	31.12	360	5	1800	560.16	240	581.07	
Song	Three Offices' Cotton and Silk *chi* (Northern Song)	31.61	360	5	1800	568.98	240	599.52	
Song	Builder's *chi* 營造尺	30.91	360	5	1800	556.38	240	573.26	
Song	Zhe *chi* 浙尺	27.49	360	5	1800	494.82	240	453.42	
Song	Gnomonic *chi* 影表尺	24.525	360	5	1800	441.45	–	–	
Liao	Liao *chi* 遼尺	approx. 34.4	300	5	1500	approx. 515.9	–	–	These figures are tentative and provided for reference purposes only.
Jin	Jin *chi* 金尺	approx. 43	240	5	1200	approx. 516	240	approx. 1109	These figures are tentative and provided for reference purposes only.

BUDDHIST INSTITUTIONS IN THE LOWER YANGTZE REGION DURING THE SUNG DYNASTY

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Most historians who study Chinese Buddhism concern themselves with its development before the Sung, especially during the T'ang Dynasty, which is considered the heyday of Buddhism. By the time of the Sung, according to those historians, Buddhism had already declined as a religion. No doubt Buddhism as a spiritual force and social institution did change during the Sung Dynasty. Following repeated government persecutions during the late T'ang and the cessation of contact with India, Buddhism did decline in some respects. It certainly ceased to dominate the intellectual life of China's elite, the discipline of the monastic community seems to have lost its former vigor, and Buddhism may have become more susceptible to the absorption of popular Chinese beliefs. However, as this paper will attempt to show, Buddhism lost none of its importance as a popular religion nor as a socio-economic institution during the Sung. Since most available materials for this study -- the local histories and monastery histories -- are from the region of the Lower Yangtze valley, I shall concentrate on that region.

Historical Setting

After the political chaos of the late T'ang and the Five Dynasties, a new demographic pattern and cultural trend emerged. Political and economic centers shifted east; with the rise of tribal powers in Northwest China, cultural exchange with and trade through Central Asia decreased. At the same time communication and sea trade with the outside world flourished along the east and southeast coasts. This trend began in the early Sung and accelerated when northern invasions forced the Sung capital south.

Meanwhile, Buddhists emphasized the significance of religious service for people's future lives and their deceased family members' welfare, and served more and more lay people. With all these modifications, Buddhist monasteries reflect Chinese Buddhisms' adaptation to new circumstances. In spite of the Buddhist doctrine stipulating that monks were to be recluses from the secular world, from its very beginnings in India, the Buddhist sangha was closely associated with commercial and urban life; monasteries tend to be located around big cities and major trade arteries. For example in Lo-yang, which was located at the very end of the Silk Road and was an important city for both domestic trade and trade with Central Asia, the urban elite often donated their houses to Buddhist monks.

In the following centuries the fate of Buddhist monasteries was closely connected with the rise and decline of urban centers. While the Lower Yangtze Valley under study was one of the best developed regions at the beginning of the Sung, it also nourished a great number of monks. With the increase in the political and economic significance of the region during the Sung, the influence of Buddhist monasteries increased