

Why the Sciences of the Ancient World Matter 3

Daniel Patrick Morgan
Damien Chaussende *Editors*

Monographs in Tang Official Historiography

Perspectives from the Technical Treatises
of the *History of Sui* (*Sui shu*)

With the collaboration of Karine Chemla

 Springer

Why the Sciences of the Ancient World Matter

Volume 3

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More specifically, this volume is the product of a collaborative project conceived in 2012 within the framework of the ERC project SAW (Mathematical Sciences in the Ancient World) and inaugurated by two eponymous workshops organised by Karine Chemla, Damien Chaussende and Zhu Yíwen on 1 December 2012 and 22–23 November 2013 at Université Paris Diderot. The idea for this project was born out of an interest to explore the historiographic writings of Li Chunfeng 李淳風 (602–670 CE), a prolific figure in the history of science who, in addition to his own legacy in mathematics, astronomy and omenology, has left us with histories of those subjects in the form of the *Jin shu* 晉書 (220–420 CE) and *Sui shu* 隋書 (502–618 CE) treatises on *tianwen* 天文 'heavenly patterns', *lüli* 律曆 harmono-metrology and mathematical astronomy, and *wuxing* 五行 'five-agents' omenology. Of course, the historiography of technical subjects in the *zhi* 志 'treatise' genre is one of equal interest to historians of ritual, music, economics, law, administration, geography, bibliography, etc., so in the spirit of Li Chunfeng's polymathy, the project was conceived to bring as wide an array of subjects and historians together under a common *problématique*.

The idea was Karine's. She brought the two of us on board at a later date to help her realise it, but this is Karine's project, and this is very much Karine's book. Karine chose the contributors, she organised and presided over the editorial meetings where it was determined what direction to give individual authors' drafts, and she decided such minutiae as formatting, harmonisation policy, and when and how to write the authors. Unfortunately, as Karine was equally implicated in dozens of other collaborative volumes of the same magnitude stemming from the project SAW, ours was effectively put on hold from 2015 to 2018, until which time Karine decided it would be better to leave its completion to us than risk losing of any further momentum. It is foremost to Karine, therefore, that we must offer our thanks, for her direction, for this opportunity and for everything that it has taught

us. We are grateful, moreover, for the confidence she has shown us in ultimately leaving her project to us, and we hope that the decisions we have had to make in her absence do not stray too far from her vision.

Additional thanks on the subject of unofficial members of our editorial board go to Howard L. Goodman and Alexis Lycas, each of whom graciously donated their time to reviewing and editing a chapter herein. Their work is appreciated, as is the alacrity, rigour and selflessness with which they went about it.

After Karine, this volume owes its existence foremost to those who did the writing—the eight authors who gave us such great material to work with from the very start and worked patiently with us to rework over the years into the organic whole that we had envisaged. Our thanks again to Howard and Alexis, to Zhu Yiwen, Li Liang, Michael Nylan, Béatrice L'Haridon, Frédéric Constant and Pablo Ariel Blitstein.

Lastly, we would like to thank our two anonymous reviewers who, in addition to their kind words about our submission as it was, gave us solid, detailed advice about how to make it better, and to the scientific committee of the series for the promptness and clarity of their instructions, the impeccable organisation of the process, and the patience and understanding shown to us when we did things wrong.

More than anyone, however, we must thank Zhu Yiwen. The very idea for this volume would not have been possible were it not for Yiwen's groundbreaking work on the parallels between Kong Yingda and Li Chunfeng's respective commentarial careers, nor would we have been able to see this volume to press without his unwavering support and seeming availability at any hour of the night by phone. Zhu Yiwen, you are a true brother in arms, and it is to our brotherhood that we dedicate this book.

Daniel Patrick Morgan
Damien Chaussende

Contents

1	Introduction	1
	Daniel P. Morgan and Damien Chaussende	
Part I The Work of Li Chunfeng		
2	The Life and Intellectual World of Li Chunfeng (602–670)	29
	Howard L. Goodman	
3	Numbers with Histories: Li Chunfeng on Harmonics and Astronomy	51
	Daniel P. Morgan and Howard L. Goodman	
4	Scholarship and Politics in Seventh Century China from the Viewpoint of Li Chunfeng’s Writing on Histories	89
	Yiwen Zhu	
5	The Compilation of the Astronomical Portion of the ‘Treatise on Harmono-Metrology and Mathematical Astronomy’ and Its Impact	117
	Liang Li	
6	Heavenly Patterns	143
	Daniel P. Morgan	
7	The ‘Treatise on the <i>Wuxing</i>’ (<i>Wuxing zhi</i>)	181
	Michael Nylan	
Part II The Anonymous Treatises		
8	The Treatise on Economics and Its Influences	237
	Béatrice L’Haridon	
9	The Treatise on Law	259
	Frédéric Constant	

10 Intertextuality, Customs and Regionalism in the ‘Geographical Treatise’ 287
Alexis Lycas

11 The Art of Producing a Catalogue: The Meaning of ‘Compilations’ for the Organisation of Ancient Knowledge in Tang Times. 323
Pablo Ariel Blitstein

12 Epilogue: Treatises According to Tang Historian Liu Zhiji 343
Damien Chaussende

Index. 359

List of Figures

Fig. 1.1	The twelve <i>lü</i> 律 pitch-regulator pipes	18
Fig. 1.2	Metrological units, their equivalencies and origins according to Liu Xin 劉歆 (<i>ca.</i> 50 BCE–23 CE) as preserved in the <i>Han shu</i> ‘Lü-li zhi’	19
Fig. 1.3	The twenty-eight lodges (<i>xiu</i> 宿)	20
Fig. 5.1	Relations of inheritance between Sui–Tang period <i>li</i>	131
Fig. 5.2	Displacement of the motion of the sun in various <i>li</i> systems (horizontal: twenty-four solar terms; vertical: displacement for the motion of the sun)	133
Fig. 5.3	Equation of the sun in various <i>li</i> systems (horizontal: twenty-four solar terms, vertical: equation of the sun)	133
Fig. 6.1	Character distribution in Li Chunfeng’s ‘Tianwen zhi’	160
Fig. 6.2	Distribution of observed phenomena, <i>Sui shu</i> versus <i>Han shu</i> ‘Tianwen zhi’	166
Fig. 6.3	Distribution of luminary phenomena (includes multi-luminary events), <i>Sui shu</i> versus <i>Han shu</i> ‘Tianwen zhi’	166
Fig. 6.4	Distribution of omen interpretations (int.) and correspondent events (cor.), <i>Sui shu</i> versus <i>Han shu</i> ‘Tianwen zhi’	167
Fig. 6.5	Mars holding Heart _{L05} in 549. Image modified from <i>Alcyone Ephemeris</i> v3.2	169
Fig. 7.1	Number of omens by year in the <i>Sui shu</i> ‘Wuxing zhi’	228

List of Tables

Table 1.1	The treatises of Ban Gu's <i>Han shu</i> (fin. ca. 111 CE)	8
Table 1.2	The treatises of Fan Ye's modern <i>Hou Han shu</i> (fifth century)	8
Table 1.3	The treatises of Wei Zheng et al.'s <i>Sui shu</i> (fin. 656)	9
Table 1.4	The heavenly stems, earthly branches and sexagenary cycle . . .	17
Table 3.1	<i>Han shu</i> 'Lü-li zhi' table of contents	80
Table 3.2	<i>Sui shu</i> 'Lü-li zhi' table of contents	81
Table 4.1	Li Chunfeng's $l\ddot{u}_{HM}-li_{MA}$ system	102
Table 4.2	Li Chunfeng (602–670) and the main information about his official career and activities	108
Table 4.3	Textual comparison of the <i>Jin shu</i> and <i>Sui shu</i> 'Lü-li zhi'	110
Table 4.4	Comparison of the <i>Han shu</i> , <i>Hou Han shu</i> , and <i>Sui shu</i>	114
Table 5.1	Astronomical systems recorded in 'Lü-li zhi' prior to and in the <i>Sui shu</i>	121
Table 6.1	Heavenly patterns treatise composition	145
Table 6.2	Li Chunfeng's 'eight schools' of cosmology as listed in <i>Yisi zhan</i> (645)	155
Table 6.3	Distribution of <i>Sui shu</i> annals phenomena by dynasty	165
Table 6.4	Luminary omnia	167
Table 6.5	<i>Sui shu</i> 'Tianwen zhi' table of contents	173
Table 7.1	Table of omens in the <i>Sui shu</i> 'Wuxing zhi'	185
Table 7.2	Categories used in the 'Wuxing zhi'	204
Table 7.3	Categories not in the <i>Sui shu</i> 'Wuxing zhi' (excluding <i>huangji</i> and <i>xin bu rui</i>)	229
Table 8.1	Analytic table of contents of the <i>Sui shu</i> 'Treatise on Economics'	253
Table 9.1	<i>Sui shu</i> 'Xingfa zhi' table of contents	283
Table 10.1	Table of contents of the <i>Sui shu</i> 'Geographical Treatise'	318
Table 11.1	<i>Sui shu</i> 'Jingji zhi' table of contents	339
Table 12.1	Thematic grouping of the 'inner' and 'outer chapters' of the <i>Shitong</i>	345

Chapter 1

Introduction



Daniel P. Morgan and Damien Chaussende

Then why rely on him? Why not go to Arcturus and study the remains for yourself?

Lord Dorwin raised his eyebrows and took a pinch of snuff hurriedly. ‘Why, whatevah foah, my deah fellow?’

To get the information firsthand, of course.

But wheah’s the necessity? It seems an uncommonly woundabout and hopelessly wigmawolish method of getting anywheahs. Look heah, now, I’ve got the wuhks of all the old mastahs—the gweat ahchaeologists of the past. I wigh them against each othah—balance the disagveements—analyze the conflicting statements—decide which is pwobably cowwect—and come to a conclusion. That is the scientific method. At least’—patronizingly—‘as I see it. How insuffewably cwude it would be to go to Ahctuwus, oah to Sol, foah instance, and blundah about, when the old mastahs have covahed the gwound so much moah effectually than we could hope to do.

Hardin murmured politely, ‘I see’.

—Asimov, *Foundation*, Volume 1.

Abstract The brief introduction to this volume begins by introducing the sources, authors and questions with which the subsequent chapters will be dealing, namely the ten ‘treatises’ (*zhi* 志)—histories of technical subjects—now contained in the *History of Sui* (*Sui shu* 隋書)—a state history of the Sui dynasty (581–618) written

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in 636—three of which we know to be written by Li Chunfeng 李淳風 (602–670). After that, it explains how the book is structured and the four underlying themes uniting the contributors' chapters: (1) the recycling of sources and the question of reliability and objectivity in pre-modern history-writing; (2) the tug of war between conservatism and innovation as regards generic exemplars; (3) the imposition of the author's voice, worldview and personal and professional history in writing a history of some field of technical expertise in a state history; (4) the degree to which the modern historian is implied in the same cycle of writing histories from older histories to speak to her own milieu and ideological contentions. Lastly, we introduce the conventions, symbols, etc., adopted in the following chapter.

Résumé La brève introduction de ce volume débute par une présentation des sources, des auteurs et des questions qui seront abordés dans les chapitres qui suivent, à savoir les dix « traités » (*zhi* 志)—des histoires consacrés à des sujets techniques—contenus actuellement dans l'*Histoire des Sui* (*Sui shu* 隋書), une histoire officielle de la dynastie des Sui rédigée en 636. Nous savons que trois de ces traités furent composés par Li Chunfeng 李淳風 (602-670). L'introduction se poursuit en exposant la structure du livre ainsi que les quatre grand thèmes unifiant les chapitres: 1. le recyclage des sources et la question de la fiabilité et de l'objectivité dans l'écriture de l'histoire à l'époque prémoderne; 2. les tensions entre conservatismisme et innovation par rapport aux modèles fondateurs des différents genres; 3. la place occupée par la subjectivité, la vision du monde et les arrières plans personnel et professionnel de l'auteur lorsqu'il rédige, dans une histoire officielle, une section consacré à un domaine technique; 4. l'importance avec laquelle l'historien moderne se retrouve pris dans le même cycle d'une écriture de l'histoire fondée sur les histoires de ses prédécesseurs avec comme but l'affirmation de sa propre idéologie par rapport à son propre milieu. L'introduction se termine avec la présentation des conventions, symboles, etc. adoptés dans le reste de l'ouvrage.

Keywords Historiography · *History of sui* (*Sui shu* 隋書) · Li chunfeng 李淳風 (602–670)

1.1 History, Historiography and the History of Historiography

We scholars of pre-modern China—We the Sinologists—suffer from an embarrassment of riches compared to our colleagues in Indology, Assyriology and even Classics when it comes to writing social histories of technical knowledge. Be it in astronomy, metrology, geography, music, ceremonial, law, administration, economics, omenology or bibliography, for starters, we tend to have substantial historical documentation going back essentially uninterrupted to the founding of the first Chinese empire—the Qin 秦, whence 'Chin-a'—in 221 BCE. This is thanks in part to Sima Qian 司馬遷 (*ca.* 145–*ca.* 86 BCE) and his father Tan 談 (d. 110 BCE), the *shu* 書 'monographs' section of whose *Shiji* 史記 (*Records of the Grand Historian*, fin. *ca.* 91 BCE) represent the first

true *histories* of such subjects east of Hellas.¹ It is thanks, perhaps more importantly, to the dozens of state histories written in the centuries thereafter on the Simas' *ji zhuan zhi biao* 紀傳志表 'annals–biography–treatise–table' model. And within those that have stood the test of time—the so-called 'state histories' (*guoshi* 國史), 'dynastic histories', 'Standard Histories' (*Zhengshi* 正史) or 'Twenty-four Histories' (*Ershisi shi* 二十四史)—it is to the biographies and treatises in particular that any such twenty-first-century history is the most indebted.

As to why the Chinese equivalent of a Strabo (64/63 BCE–ca. 24 CE) or an Āryabhaṭa (b. 476 CE) would receive a biography in a *state history*, it is because geography, astronomy and so on were, in China, matters of state. In his biography of one of the Han 漢 dynasty's (206 BCE–220 CE) founding fathers, Zhang Cang 張蒼 (d. 151 BCE), Sima Qian devotes a paragraph to telling us about the former's glorious beginnings as an accountant:

遷為計相，一月，更以列侯為主計四歲...張蒼乃自秦時為柱下史，明習天下圖書計籍。蒼又善用算律曆，故令蒼以列侯居相府，領主郡國上計者。

[In 201 BCE, he] was transferred to the post of chancellor of finance [for the Kingdom of Dai 代國] and, one month [later], further made [imperial] comptroller for a period of four years upon his enfeoffment as marquis [of Beiping 北平]. ... Zhang Cang had served as a palace archivist since the time of the Qin, and he was brilliantly studied in all the world's charts and books, accounts and registers. [Zhang] Cang was furthermore good at using mathematics/counting rods, harmono-metrology and mathematical astronomy, and thus was Cang ordered as a marquis to occupy the ministerial office in charge of the [annual] accounts sent up from the commanderies and kingdoms.²

It makes sense why this is important to his biographer in the context of a state (or state-centred) history: what indeed could be more important to the state than its finances and ensuring a steady stream of grain, labour and statistics flowing from the provinces? It makes sense, moreover, because Sima Qian was a technocrat like Zhang—the heritor of the prefectorship of the Office of the Grand Clerk (Taishi ling 太史令), charged, among other things, with harmono-metrology, mathematical astronomy and the accounting of signs sent *down* from *Heaven*.

Of course, not everyone who contributed to the history of administrative geography or mathematical astronomy in early imperial China did so because it was their job. Most of the big names in these fields were amateurs in the sense of their being motivated by little more than their *hao* 好 'fondness/curiosity' for a given subject. As Prefect Grand Clerk, Sima Qian was the head of what we might call 'the Astronomical Bureau', but when called upon by the emperor to lead the famous calendar reform of 104 BCE, one notes that his team *declined*, citing that they 'couldn't do the maths'.³ Compare this to Zhang Zixin 張子信 (fl. 526–576), one of the most important figures in the history of Chinese astronomy, who had his

¹On the Simas and their *Shiji*, see Hardy (1999). On the origins of the historiography of *technē* on the other side of Eurasia, see Zhmud (2006).

²*Shiji*, 96.2676.

³不能為算, *Han shu*, 21A.975.

breakthrough ‘going into hiding on a sea isle where he devoted himself for more than thirty years to the observation, by means of [armillary] sphere instrument, of data on the differences and changes in the sun, moon and five [planets]’.⁴ Still, Zhang Zixin earns himself an official biography in the histories of the Northern Qi 北齊 (550–577) and Northern Dynasties (386–618) nonetheless on account of his Classical learning, his career in medicine and his reputation in court circles as a diviner.⁵ In short, it is because those who contributed to technical fields like Zhang Zixin, Zhang Cang and Sima Qian are so complex—so irreducible to the titles, respectively, of doctor, statesman and astronomer—that their lives often end up sufficiently entangled in a dynasty’s story to merit inclusion in its history.⁶

But far more precious for the history of these fields, sticking to ‘heavenly patterns’ (*tianwen* 天文) and the ‘earthly order’ (*dili* 地理), are the eponymous treatises dedicated to their histories in the Twenty-four Histories. It is there where the state of the field, so to speak, is presented every several centuries in a standard format as if some sort of civilisational progress report punctually demanded by a higher power. It is there where the state of the field is presented with an acute awareness of where we have come from and where we are heading. It is there, moreover, where we see the voices of the amateur and the professional, the court and its subjects, brought together in harmony and discord around questions of precision measures with real-world effects. Numbers mattered, and not just in the limited capacity of *Rubriques emblématiques* of a metaphysical order of closed, eternal cycles of correlative sets to which Granet (1934 [1968]) would have us reduce *la pensée chinoise*. They mattered first and foremost in the quantitative sense that kept someone inclined to such whimsy otherwise dry, safe, fed, educated, properly socialised, politically loyal, on time and economically productive.

The treatise, as a genre, is all about numbers. For as limited as is their scope and length compared to the contemporary expert literature in these fields, the standard history treatises leave a record of such numbers that is truly unprecedented in human history. We have *census data* every so many decades going back to 202 BCE, and it is from such data as preserved in the ‘Dili zhi’ 地理志 that we can say, for example, that the Sui 隋 (581–618) at its height in 609 CE possessed a population of 46 019 956 people divided into 8 907 546 households with 55 854 041 *qing* 頃 (≈420 million hectares) of cultivated, tax-bearing land.⁷ In the ‘Tianwen zhi’ 天文志, moreover, we have a sometimes *daily* observational record in astronomy going back to the same beginnings that is so long, meticulous and unbroken that modern physicists can use it to solve questions about minute, long-term changes in the earth’s rotation.⁸ It is in numbers that the economic treatises treat the flow

⁴隱於海島中，積三十許年，專以渾儀測候日月五星差變之數，*Sui shu*, 20.561.

⁵See *Bei Qin shu*, 49.680, and *Bei shi*, 89.2941.

⁶On the subject of polymathy in and following the Han, see Goodman (2005, 2010), Cullen (2009), Lien (2011) and Morgan (forthcoming).

⁷*Sui shu*, 29.808.

⁸E.g. Stephenson (1997) and Zhuang (2009).

of cash and goods *between households, under heaven*, and it is in numbers that the bibliographic treatises measure and divide the storehouses of the empire's more abstract forms of riches. And so too do the treatises on law, like those on metrology, ultimately deal with weighing the particular on a public scales against generalised legal standards qua *étalons* (lǜ 律). Everything in this genre boils down to *quantities*, and if we the Sinologists do not give them the attention they deserve it is perhaps because what we call 'Chinese thought' or 'Chinese cosmology' denies them any place in the Oriental mind. According to Granet...

... L'idée de quantité ne joue autant dire aucun rôle dans les spéculations philosophiques des Chinois. Les Nombres, cependant, intéressent passionnément les Sages de l'ancienne Chine. Mais, – quelles qu'aient pu être les connaissances arithmétiques ou géométriques de certaines corporations (arpenteurs, charpentiers, architectes, charrons, musiciens...), – nul Sage n'a accepté de les utiliser, si ce n'est dans la mesure où, sans jamais contraindre à des opérations dont le résultat ne se pût commander, ce savoir facilitait des jeux numériques.⁹

If this were true, which it is not,¹⁰ it would be so if only for the reason that the Sages are fairy-tale kings who hadn't real empires to run.

As rich in data and as sometimes devoid of stories and judgements as the standard history treatises can be, historians have a tendency to draw from them uncritically. It is Étienne Balazs who first reminded us that our historiographical sources are also the products of historiography, arguing that they were written 'by officials for officials... conceived as being guides to administrative practice' (Balazs 1964: 135–137). Peeling back further layers of the onion, B. J. Mansvelt Beck's monograph-length study of the Later Han treatises reveals how we are now effectively writing histories from histories written from other histories borrowed from another history as per the vision of archaeology championed by Lord Dorwin in the epigraph. What is more, he shows how *those histories*, which found themselves

⁹Granet (1934 [1968]: 127); c.f. Benjamin Schwartz, who coins the term 'correlative cosmology' as a stand-in for Granet's *la pensée chinoise* and analogue to Lévi-Strauss' (1962) *la pensée sauvage*, offering that 'the crucial categories associated with correlative cosmology—the concept of *yin* and *yang*, the five element categories, and others—will remain a universally accepted language for talking about nature and about many aspects of human life. They penetrate deeply into the popular culture and dominate the language of medicine, geomancy, and other accepted "sciences" without major challenge. One is thus again tempted to ask why the Chinese did not with some minor exceptions conceive of alternate categories for understanding the structure of the natural world. One would have to reply again that their basic concerns may have lain elsewhere. ... In the words of Nathan Sivin, anyone who rigidly imposes his own questions on the thought of another culture "may never discover that the problems his sources aimed to solve lay in quite another direction"' (Schwartz 1985: 381–382).

¹⁰One notes that the very first act of the very first Sage King in the very first chapter of the very first Classic is quite literally to order his subordinates to tend to the astral sciences: 'And so [Yao] charged Xi and He: "In reverent accordance with prodigious heaven, [thou shalt] *li* 曆 and *xiang* 象 the sun, moon and stars and respectfully grant the seasons of man"' 乃命羲和: 「欽若昊天, 曆象日月星辰, 敬授人時」 (Shangshu zhushu, 2.21a). As to how this was understood, *Shiji*, 1.16, translates Yao's first commandment as to 'number and model the sun, moon and stars' 數法日月星辰. As to how to understand Granet's dictums apropos *les Sages* and *les Chinois*, see Needham (1956: 217).

appended to Fan Ye's 范曄 (398–446 CE) *Hou Han shu* 後漢書 as taken from Sima Biao's 司馬彪 (ca. 240–ca. 306) *Xu Han shu* 續漢書 as reworked from independent treatises written by the latter's contemporaries and predecessors in the previous century, were conceived in relation to yet another history:

When Sima Biao was writing his history, historiography itself was already an old art, governed by traditions, models, precedents, and, like any art, ultimately kept alive by innovation. Sima Biao left us in no doubt about the model he followed: by styling his work *Continued Book of Han* he indicated that he saw it as a continuation of the *Book of Han Hanshu* (henceforth: HS). This was the first true dynastic history, covering the first half of the Han dynasty (206 BC–AD 23), usually called the Earlier or Former Han. Although traditionally the whole work is ascribed to Ban Gu 班固 (32–92), certain parts are by others. Its influence on XHS [the *Xu Han shu*] is twofold. Sima Biao took up the story where Ban Gu had left it, at the glorious Restoration of the Han dynasty in AD 23; he also adopted for his own work the division of HS into Annals, Biographies, Treatises, and Tables (although he omitted the Tables).¹¹

In this book, we will be plunging two centuries later, and dozens of histories deeper, into the treatises of the *Sui shu* 隋書.

1.2 Treatises for the Sui, Treatises for the Five Dynasties

One rather curious thing that the *Sui shu* has in common with the *Hou Han shu* is that the treatises now found therein did not originally belong thereto. They too began as part of a different project.

The compilation of a history of the Sui (581–618) began amid a variety of reforms and cultural undertakings ordered by Tang Taizong 唐太宗 (599–649, r. 626–649) to strengthen and establishing an identity for the fledgling regime he had inherited. Taizong's reign marks a turning point in official historiography in that it produced a definitive vulgate of the history of the early medieval period. Even if the program of writing the histories of the previous century started soon after the founding of the Tang by Taizong's father, Emperor Gaozu 唐高祖 (566–635, r. 618–626), it was only under Taizong's reign that the five official histories of the so-called 'Five Dynasties' 五代 period (502–618) were brought to fruition.¹² Appointed to lead the commission were the scholar ministers Fang Xuanling 房玄齡 (578–648) and Wei Zheng 魏徵 (580–643), who assigned the history of the southern dynasties of Liang 梁 (502–557) and Chen 陳 (557–589) to Yao Silian 姚思廉 (557–637) and that of the Northern Qi (550–577) to Li Baiyao 李百藥 (565–648). The remaining histories were composed collectively: that of the Northern Zhou 北周 (557–581)

¹¹Mansvelt Beck (1990: 12).

¹²Note that the 'Five Dynasties' of Tang times is not to be confused with the period following the Tang in 907–960 to which modern scholars now refer by the same name.

supervised by Linghu Defen 令狐德棻 (583–666), and that of the Sui led by Wei Zheng himself.¹³

Presented to the throne in 636,¹⁴ these five histories—the *Liang shu* 梁書, *Chen shu* 陳書, *Bei Qi shu* 北齊書, *Zhou shu* 周書 and *Sui shu*—comprised but an imperial annals and biographies.¹⁵ That they lacked treatises was perceived as a flaw, and, in 641,¹⁶ Taizong formed a new commission under Chu Suiliang 褚遂良 (ca. 596–ca. 658) [then by Linghu Defen and by Zhangsun Wuji 長孫無忌 (d. 659)] to compile the requisite technical treatises. The supplement was completed in 656, under the reign of Gaozong 高宗 (628–683, r. 649–683),¹⁷ at which time it was integrated into the *Sui shu* for the simple reason that the Sui was the last of the five dynasties concerned. Given their origin and scope, these treatises were referred to in later tradition as the *Wudai shizhi* 五代史志 or ‘historical treatises of the Five Dynasties’.¹⁸ Also like the *Hou Han shu*, the number, selection, titles, contents and organisation of the *Sui shu* treatises are clearly modelled upon those of the *Han shu* (see Tables 1.1, 1.2 and 1.3).

The question of the authorship of the *Sui shu*/*Wudai shizhi* treatises is, unfortunately, difficult answer. We know from his *Jiu Tang shu* 舊唐書 biography that that Prefect Grand Clerk Li Chunfeng 李淳風 (602–670) was responsible for the ‘Lü-li zhi’ 律曆志, ‘Tianwen zhi’ 天文志 and ‘Wuxing zhi’ 五行志 as he was, also, for the history of the Jin 晉 (265–420).¹⁹ Liu Zhiji 劉知幾 (661–721), in his *Shitong* 史通, mentions four other authors, without specifying who did what: Yu Zhining 于志寧 (588–665), Wei Anren 韋安仁, Li Yanshou 李延壽 and Linghu Defen, the last on the list having participated also in compiling the annals and biographies of the *Zhou shu* (above).²⁰ Based on their prominent role in compiling *The Tang Code and its Commentaries* (*Tanglü shuyi* 唐律疏議), Balazs and Frédéric Constant believe Yu Zhining and Zhangsun Wuji to have likely

¹³Ng and Wang (2005: 118), cf. McMullen (1988: 165–168).

¹⁴*Jiu Tang shu*, 3.45, *Tang huiyao*, 63.1287–1288 (貞觀十年).

¹⁵Actually, it is difficult to say if the *Wudai shi* 五代史, i.e. the five histories, were written from the beginning to form one only book (a *History of the Five Dynasties*) or five separate books, as they are now, and as they are listed in *Jiu Tang shu*, 46.1990.

¹⁶This date (貞觀十五年) appears in the biography of Li Chunfeng, *Jiu Tang shu*, 19.2718. *Bei shi*, 100.3343, gives instead the date of 643 (貞觀十七年).

¹⁷According to *Tang huiyao*, 63.1288, and *Jiu Tang shu*, 4.75, the treatises were presented to the throne by Zhangsun Wuji 長孫無忌 in 656 (顯慶元年).

¹⁸In *Shitong tongshi*, 12.345, claims that this expression was but a ‘popular designation’ 俗呼. On the compilation of the *Wudai shizhi* treatises and their circulation independent of the *Sui shu*, see Zhang (2012) and Chap. 2, this volume.

¹⁹See *Jiu Tang shu*, 79.2718 (biography of Li Chunfeng) and 66.2463 (biography of Fang Xuanling); cf. Chap. 2, this volume. More specifically, *Junzhai dushu zhi*, 5.192, in the entry on the *Sui shu*, tells us that ‘the *tianwen*, *lü-li* and *wuxing* treatises—the three of them—were written by [Li] Chunfeng alone’ 天文、律曆、五行三志，淳風獨作 (emphasis added).

²⁰*Shitong tongshi*, 12.345.

Table 1.1 The treatises of Ban Gu's *Han shu* (fin. ca. 111 CE)

No	Title		Source	juan
1	<i>lü-li</i> 律曆	Metrology and Math. Astronomy	Liu Xin	2
2	<i>liyue</i> 禮樂	Rites and Music	???	1
3	<i>xingfa</i> 刑法	Law	???	1
4	<i>shihuo</i> 食貨	Economics	???	2
5	<i>jiaosi</i> 郊祀	Sacrifices	???	2
6	<i>tianwen</i> 天文	Heavenly Patterns	Ban Zhao and Ma Xu	1
7	<i>wuxing</i> 五行	Five Phases Omenology	Liu and Liu et al.	5
8	<i>dili</i> 地理	Geography	Liu Xiang and Zhu Gan	2
9	<i>gouxu</i> 溝洫	Waterways	???	1
10	<i>yiwen</i> 藝文	Bibliography	Liu and Liu et al.	1

'???' signals that the author is unknown. On the role of Ban Zhao 班昭 (44/49–118/121 CE), Liu Xiang 劉向 (79–8 BCE), Liu Xin 劉歆 (ca. 50 BCE–23 CE), Ma Xu 馬續 (fl. 111–141 CE) and Zhu Gan 朱贛 (fl. 28–24 BCE) in these treatises' genesis, see the treatise prefaces and Mansvelt Beck (1990). Note that this table does not take the extensive overlap between the *Han shu* and *Shiji* into account as concerns sources, as there is some question about the direction of borrowing in this regard

Table 1.2 The treatises of Fan Ye's modern *Hou Han shu* (fifth century)

No	Title		Source	juan
1	<i>lü-li</i> 律曆	Metrology and Math. Astronomy	Liu and Cai	3
2	<i>liyi</i> 禮儀	Rites	Qiao Zhou?	3
3	<i>jisi</i> 祭祀	Sacrifices	Cai Yong?	3
4	<i>tianwen</i> 天文	Heavenly Patterns	Cai and Qiao	3
5	<i>wuxing</i> 五行	Five Phases Omenology	Ying, Dong and Qiao	6
6	<i>junguo</i> 郡國	Geography	Fu and Huang	5
7	<i>baiguan</i> 百官	Administration	???	5
8	<i>yufu</i> 輿服	Chariots and Robes	Dong Ba	2

On the role of Cai Yong 蔡邕 (133–192 CE), Dong Ba 董巴 (fl. 220–226 CE), Fu Wuji 伏無忌 (fl. 151 CE), Huang Jing 黃景 (fl. 151 CE), Liu Hong 劉洪 (fl. 167–206 CE), Qiao Zhou 譙周 (199–270 CE) and Ying Shao 應劭 (ca. 140–ca. 204 CE) in these treatises' genesis, see the treatise prefaces and Mansvelt Beck (1990)

contributed to the 'Xingfa zhi', but the evidence there is admittedly circumstantial.²¹ A seventh name—Jing Bo 敬播—is mentioned in connection with the project in Li Yanshou's *Jiu Tang shu* biography, but here again we do not know for certain what parts he may have written.²²

It is the figure of Li Chunfeng that lies at the origins of this book and at the centre of how it is structured. Unlike Mansvelt Beck (1990), who rather logically devotes a chapter to each treatise of the *Xu Han shu*, plus one on its compiler and

²¹See Balazs (1954: 3) and Chap. 9, this volume.

²²*Jiu Tang shu*, 73.2600.

Table 1.3 The treatises of Wei Zheng et al.’s *Sui shu* (fin. 656)

No	Title		Source	juan
1	<i>liyi</i> 禮儀	Rites	???	7
2	<i>yinyue</i> 音樂	Music	???	3
3	<i>lü-li</i> 律曆	Metrology and Math. Astronomy	Li Chunfeng	3
4	<i>tianwen</i> 天文	Heavenly Patterns	Li Chunfeng	3
5	<i>wuxing</i> 五行	Five Phases Omenology	Li Chunfeng	2
6	<i>shihuo</i> 食貨	Economics	???	1
7	<i>xingfa</i> 刑法	Law	Yu and Zhangsun?	1
8	<i>baiguan</i> 百官	Administration	???	3
9	<i>dili</i> 地理	Geography	???	3
10	<i>jingji</i> 經籍	Bibliography	???	4

On Yu Zhining 于志寧 (588–665) and Zhangsun Wuji 長孫無忌 (597–659) as likely contributors to the ‘Xingfa zhi’, see Balazs (1954: 3) and Chap. 9, this volume

another on the treatise genre, this volume consecrates no less than three chapters to the *Sui shu* ‘Lü-li zhi’ and not a one to its ‘Liyi zhi’ 禮儀志, ‘Yinyue zhi’ 音樂志 or ‘Baiguan zhi’ 百官志. The reason for this is in part because the chapters of this volume, like the *Sui shu/Wudai shizhi* treatises themselves, were written by a team of experts rather than a single author, and because *this team*, unfortunately, could not conscript the experts needed to fill those particular gaps. More importantly, we believe that Li Chunfeng and his history writing merit the extra space afforded by these lacunae.

We believe Li Chunfeng to merit this extra space—his own Part I of two—because he is a distinguished figure in the history of science and because his own writings as a *historian of science*, so to speak, are by far the least studied aspect of his oeuvre. For those unfamiliar with the name, one could say that Li Chunfeng was the Kong Yingda 孔穎達 (574–648 CE) of mathematics. [The two knew each other, one notes, being contemporaries and having bonded over mathematical astronomy and a common affinity for the latter’s master, Liu Zhuo 劉焯 (544–610 CE)].²³ Whereas Kong Yingda supervised the canonisation and subcommentary of but *five classics* to serve as the standard for the national curriculum, however, Li Chunfeng did so for *ten*.²⁴ Like Kong Yingda, who rose to become Chancellor of the Directorate of Education (Guozijian jijiu 國子監祭酒), Li Chunfeng rose to the prefectorship of the state astronomical office, and as an *astronomer* his works were as celebrated as his contributions to mathematics. We believe that it is not inconsequential to our understanding of his figure, therefore, that we also possess

²³On the comparison of Li Chunfeng and Kong Yingda’s work, see Zhu (2016a, b; 2017); on their professional relationship and ties to Liu Zhuo, see Morgan (forthcoming).

²⁴Referring to Kong et al.’s *Correct Meaning of the Five [Confucian] Classics* (*Wujing zhengyi* 五經正義) of 653 CE versus Li et al.’s *Ten Mathematical Classics* (*Suanjing shishu* 算經十書) of 656 CE.

no less than *six histories* that he wrote on these subjects covering the four centuries leading up to his day.

Conversely, it is because we know Li Chunfeng to be the author of these three treatises—and because we know quite well from his two biographies and four-volume collected works who Li Chunfeng is—that we believe that the case of *this author* is particularly valuable for the light it stands to shed on the general circumstances of the others. Indeed, if Balazs and Constant are right about Yu Zhining and Zhangsun Wuji's involvement in the treatise on law, there could be no better parallel than Li Chunfeng: Yu and Zhangsun, like Li, were *canonisers* who established classical models for the future of their field, and it was *they*, by no mean coincidence, who were invited to write the official version of its past. And maybe the other treatises came about differently, by very different hands, but they did at least come about in the *same milieu*—a milieu into which Li's life gives us some perspective.

It is to this end that we have dedicated Part I to Li Chunfeng and given it a rather different form than that which follows. Namely, we begin in Chap. 2, by Howard L. Goodman, with an intellectual and political biography of Chunfeng *the man* that is designed to serve as an anchor-point to which to tie off the threads of his thought—threads that we shall follow as they weave variously through the fabric of harmonics, metrology, astronomy and celestial and terrestrial omenology in the chapters to follow. Dedicated each to one of his treatises, the chapters to follow will obviously engage with the *form* and *contents* of these histories and how they speak to contemporary issues within the relevant subspecialisation of sinology. On 'heavenly patterns' (Chap. 6) and 'five phases' omenology (Chap. 7), for example, Daniel P. Morgan and Michael Nylan will naturally introduce the reader to those respective fields in tackling the editorial realisation of Li Chunfeng's historical vision thereof in the context of state history. Before coming to these two, however, Morgan and Goodman, Zhu Yiwen, and Li Liang each tackle Li Chunfeng's 'Lü-li zhi' in Chaps. 3–5 from a different angle and as viewed in relation to his parallel treatise in the *Jin shu* 晉書. In short, Zhu Yiwen explores how Li's vision of Five Dynasties mathematics, metrology and astronomy was coloured by his politics; Li Liang examines how it was coloured by his personal history; and Morgan and Goodman by his 'philosophy of science', for lack of a better word.

With Part I's transversal approach to the *Jin shu* and *Sui shu* treatises, the same study of Li Chunfeng the historiographer could just as easily be found in a book on the former, so it is only really in Part II, dedicated to the anonymous treatises, that our reasons for privileging the *Sui shu* come to the fore. The *Sui shu/Wudai shizhi* treatises are special. They tell the history of a domain like economics, in Béatrice L'Haridon's Chap. 8, not through one dynasty but through *five*—and not through a single timeline but through *two*, and sometimes *three*, unfolding north and south of the Yangtze, east and west of the Taihang Mountains. They tell the story of the *maintenance of civil order* and the *expansion of the rule of law*, in Frédéric Constant's Chap. 9, in a time of more or less constant division, war and

political upheaval. They tell the story of those territories swapped between rival empires under a single sky, in Alexis Lycas' Chap. 10, and of the divisions *internal thereto* between the peoples of the valleys, mountains, forests and wastes that atomise their expanse. They tell the story of the continuity, exchange, flourishing and reconceptualisation of writing, in Pablo Ariel Blitstein's Chap. 11, as told from the perspective of libraries built in a world on fire. As pieces of writing themselves, lastly, these treatises demand attention for the rather curious way they came about—as an afterthought to a finished history project—and, more than anything, for their *quality*—a quality as attested by the fact of their independent circulation at the time and their impact upon official history writing for centuries thereafter.

Across the divide between Part I and Part II—the divide between those treatises whose authors are known and those who are not; between the history of science and where sinologists are oft more wont to wander—each of our invited papers is essentially dealing with the same set of questions. These transversal questions of technical-subject history-writing are, in essence, four.

The first is the question of to what degree the *logos* of history is churned without thought from the text of previous histories. This question comes to the fore in Li Chunfeng's writings, where we might innocently ask how much of his histories of *tianwen*, *lü-li* and *wuxing* a busy man like him recycles between his treatises for the Wei–Jin 魏晉 (220–420) and Five Dynasties. Comparing the first two word for word, Morgan and Goodman (Chap. 3), Zhu Yiwen (Chap. 4) and Morgan (Chap. 6) find that the answer is rather stark: wherever he can, Li recycles so much of his presentation from one treatise to the next that it is more informative to read them for what he *does not* copy-and-paste than for what he does. Looking beyond his own writings, furthermore, Morgan (Chap. 6) shows how his 'Tianwen zhi' are furthermore recycling text from his *predecessor*, Shen Yue 沈約 (441–513), who took *his treatise* from He Chengtian 何承天 (370–447), and that in doing so, curiously, Li reworks his sources' histories into an argument against them, omitting their name from his otherwise conscientiously sourced writing *except*, that is, by way of the occasional harangue about their incompetence. If history is a mirror, as the saying goes, Li Chunfeng effectively snatched one from his rival's hands and smelted it into a knife by which to stab him in the back.

This discovery leads quite naturally to the topic of *bias* and *reliability* as equally at the centre of Mansvelt Beck's (1990) work on the *Sui shu/Wudai shizhi*'s predecessors. In the case of *legal history*, as Constant explains in Chap. 9, the dearth of primary sources for this period means that such treatises are all we have to understand the immediate lead up to the celebrated legal canon of the Tang. And as to *bibliography*, as Blitstein is forced to concede in Chap. 11, we can never know for certain what relationship a catalogue like the 'Jingji zhi' 經籍志 bears to the written catalogue or physical institution of a library like the Sui Imperial Documents Department (Bishu sheng 秘書省). As to the lay of the land, Lycas reminds us in Chap. 10 that it can be *assumed* that pre-modern geographers did not travel to all the places about which they wrote, reviewing what we

do know about the sort of contemporary data collection and geographical writing of which the Standard History treatise is but a second-, third- or fourth-hand synthesis. Quite rightly, Nylan (Chap. 7), following Morgan (Chap. 6), questions the ‘world-making’ going on in the observation, selection and interpretive motives surrounding the catalogue of extraordinary phenomena recorded in the omenological treatises. That said, the latter reassures us, lastly, that as least as far as calculable lunar, solar and planetary phenomena go, what the *Sui shu* ‘Tianwen zhi’ contains does for the most part seem to be a reliable record of contemporary reality.

The second question around which each chapter turns is how these histories, churned from the words of previous sources, are fashioned in the image of—and with the mind to surpassing—the exemplars of what came before. In short, like Mansvelt Beck (1990), this is a book that is as much about our *Sui shu* treatises as it is about those of the *Han shu* and ‘the tug of war between tradition and innovation’.²⁵ L’Haridon underscores the peculiarities of this tug of war in a recurrent, core treatise like that on economics, reflecting in Chap. 8 on how the genre experiences macro-level shifts, e.g. the treatise’s very rise in priority from the bottom of Sima Qian’s list, while subsequent compilers admit no other predecessors but the *Shiji* and *Han shu*. Lycas undertakes an equally far-ranging analysis of exemplars in Chap. 10, showing how there the *Han shu* model is itself modelled somewhat artificially upon the Classics and how *that model* was at once replicated and adapted, both progressively and back and forth, across the five extant treatises between those of the *Xu Han shu* and *Wudai shizhi*.

Perhaps nowhere is the weight of the *Han shu* in this tug of war more evident, however, than as concerns the *ruptures* in a given tradition. The *Sui shu/Wudai shizhi* treatises are the first in six centuries to resurrect the *bibliographic treatise*, for example, as Blitstein writes about in Chap. 11, and yet the organisation of that treatise is at once radically different, reflective of the paradigm shift that the categorisation of written knowledge had undergone in the meantime. As concerns metrology and mathematical astronomy, Zhu Yiwen (Chap. 4) and Morgan and Goodman (Chap. 3) treat a similar tension: the effort to resurrect the joint *lü-li* treatise by supplying it with a new philosophical basis in the face of change. On the topic of change in Li Chunfeng’s treatises on heavenly patterns and five-phases omenology, moreover, Morgan (Chap. 6) and Nylan (Chap. 7) reveal how Li expanded each genre to include emerging topics while at once pruning it of former excesses and dated notions. Lastly, still on the topic of Li Chunfeng, Li Liang (Chap. 5) examines his reception history exploring his latter-day reputation for not only curating, developing and reinventing the treatise genre but for *breaking its rules* to put his personal and scientific interests before the state’s.

The third question is how in pressing others’ words and experiences into a generic mould does the compiler of these histories impose upon them some meaning, direction or greater truth than ‘just the facts’. It is no exaggeration here to

²⁵Mansvelt Beck (1990: 37).

speak of ‘cosmology’ or, rather, *cosmologies*. As to ‘Chinese thought’ qua ‘correlative cosmology’,²⁶ Zhu Yiwen (Chap. 4) and Morgan and Goodman (Chap. 3) show how Li Chunfeng imposes a philosophical framework of mathematical ratios and *proportionality* in place of the brief, unworkable *correlative experiment* justifying the pairing of *li* metrology and *li* mathematical astronomy. On the correlative front, Morgan (Chap. 6) and Nylan (Chap. 7) explore how the same author holds the cosmic order to be at once *pre-ordained* as ‘written’, so to speak, in *tianwen*—‘heavenly patterns’ qua ‘skywriting’—operative in the metaphysics of *yin*, *yang* and the five phases, and manifest in *bian* 變—‘incidents’ or ‘dramatic changes’ qua omens. On the level of cosmic forces with which we moderns are more familiar, L’Haridon, in Chap. 8, explores how her author(s) depict *the economy* as a force of history and author of *bian* in its own right—a higher power beyond our control just as likely push a dynasty to ruin as the invisible hand of God or Nature. As concerns the *flow of time*, Morgan (Chap. 6) and Morgan and Goodman (Chap. 3) explore conflicting macro-level visions of progress and decline as projected upon different fields, as espoused by different authors, and as even issued from the same pen. As concerns the *bounds of space*, lastly, Lycas (Chap. 10) reveals the tensions inherent to the way that the real-world empire of the Han was divided into the mythical marches of the Classics, the way that that of the Han was mapped onto its successors, and the way that this vision of *tianxia* 天下—‘The Empire’ and/as its dominion over ‘all under heaven’—superseded the reality of a pluri-state China and its interactions with new peoples and lands.

Below the scale of Cosmos and of Empire, we see the authors of the *Sui shu*/*Wudai shizhi* treatises present the vision of a unity at once greater and smaller than the political dynasties that came and went in these some hundred and sixteen years: *jia* 家 ‘expert-lineages’, composed, by synecdoche, of ‘lineage-experts’. It is these *jia* and ‘men of discernment’ (*youshi zhe* 有識者) in technical aspects of cosmology that are at the centre of Li Chunfeng’s treatises on heavenly patterns and the five phases, Morgan (Chap. 6) and Nylan (Chap. 7) emphasise, having effectively outstripped the authority of Sages and ancient texts as concerns contemporary developments. Focusing on the ‘Lü-li zhi’, Zhu Yiwen (Chap. 4) explores how Li Chunfeng may too have imposed upon his histories, in typical fashion, a political teleology leading to the inevitable rise of his imperial benefactors; at a more personal level, however, Li Liang (Chap. 5) goes on to show how the same ‘Lü-li zhi’ have the preceding centuries of the history of astronomy all leading inevitably, by way of *intellectual lineage*, to Li Chunfeng himself. (If history is a mirror, as the saying goes, are we surprised that what the mathematician sees in it is but a dazzling reflection of himself?). Moving into the anonymous treatises, we read state histories centred upon other potentially less familiar sorts of protagonists. In L’Haridon’s Chap. 8 we read about how it is the *accountants*, the *engineers* and the *monetary policy advisors* who are the real arms of Sages

²⁶See Footnote 9.

Kings and imperial grace, and in Constant's Chap. 9 we encounter yet a different version of history as experienced by *law makers* and *judges*—a history defined not so much by *dynasties* as by the prolixity and simplicity of the legal code and the laxity and strictness of its enforcement. Taking up Balazs' argument, above, Lycas writes in Chap. 10 about the geographical treatise being aimed at *local administrators* and thus focused less on the Centre than the peripheries and on the most different and unassimilated of their nominal imperial subjects. In Chap. 11, lastly, Blitstein presents us with yet another version of this period's history wherein the heroes are *librarians*.

And if the reader finds this kaleidoscope of unfamiliar cosmologies and specialist perspectives on this period at all disorienting, we must ask him/her to bear in mind that at the centre of it all is the one subject that underlies more or less everything in early Chinese studies: ethics. It is one thing to nit-pick about the distinction between *ren* 仁 'humanness' and *yi* 義 'propriety', to save hypothetical children from hypothetical wells, and to pontificate about the importance of 'illustrating illustrious virtue' (!),²⁷ as one learns in reading the Classics and Warring States (480–222 BCE) philosophy at the beginning of one's gentlemanly/sinological training. It is quite another thing, however, to put such virtues into practice via concrete measures in the face of real-world circumstances beyond one's ultimate control—to keep the granaries full and the money from collapsing, as L'Haridon (Chap. 8) discusses, so as to save the *nation's children*, once again, from starvation, the elements, ignorance, social turmoil, political confusion and agricultural collapse. And as much as it is *law* that holds society together when times are tough, as Constant emphasises in Chap. 9, it is the subject of *virtue* that is at the centre of the treatise of law, because it is ultimately upon decency and common sense that we depend to hold in check the men who make and enforce the law. What the treatise on *geography* boils down to, Lycas argues in Chap. 10, is ultimately the question of how to live with and uplift one's neighbours, however different they may be. And the whole point of the imperial library and its singling out the forerunner to 'literature', Blitstein (Chap. 11) argues, was to supply the decision makers with models of both good government and the *effective communication* required for its collective realisation. Even (and especially) in the sciences does everything come down to ethics. As to *professional ethics*, we read in Morgan and Goodman (Chap. 3) about the *sporting ritual* that effectively governed astronomical testing and public debate, and we read in Li Liang (Chap. 5) about how Li Chunfeng broke the rules of the 'Lü-li zhi' genre to champion the underdogs of a state-centred history of astronomy. Indeed, it is *ethics* that is at the very root of disturbances in the cosmic order producing omens, as treated in Morgan and Nylan in Chaps. 6 and 7, and it is ultimately an expert omenologist like Li Chunfeng who is, according to the beliefs of the time, the most

²⁷'The way of the Great Learning lies in illustrating illustrious virtue' 大學之道，在明明德—the opening lines of *The Great Learning* (*Liji zhushu*, 42.983a).

authoritative voice in diagnosing the more general ethical failings of and towards the nation, how to address them, and where, if unaddressed, they will lead.

The fourth question with which the following chapters grapple is that of eternal return: How do we get back to Arcturus, so to speak, and in writing histories from histories that we know to have been culled from other's words, pressed into a generic mould and curated to convey their authors' artifices, how can we be assured that we so-called moderns are not caught in the self-same loop closed by Ban Gu after the Simas Tan and Qian? To break us out of this loop and to remind us that we are not the first to pose the question, Damien Chaussende puts the *Sui shu/Wudai shizhi* treatises in perspective as considered in Liu Zhiji's musings about history-writing written some fifty years later, in 708/710 CE. Liu Zhiji criticises the practice of copy-and-paste historiography, especially in the *tianwen* chapters, and he also denounces treatises that go beyond the period allotted (beginning with Ban Gu's 'Tianwen zhi'), which leads him to question the utility of any treatise on heavenly patterns, the five phases or books in a standard history. In their place, he suggests where the historian's efforts might be better spent.

We do not pretend that this volume will be the last word on the *Sui shu* treatises or even a full successor to Mansvelt Beck (1990), particularly given its conspicuous lacunae, but we do hope that it will be the start of a conversation—a conversation, like this book, between sinologists in Europe, Asia and the Americas about common concerns across the yet broader disciplinary boundaries that divide us.

1.3 Conventions

Before we come to all that, however, we must say a word about how to read this book and how to understand certain conventions used therein that may be unfamiliar to the outside reader, be it a reader outside of sinology or outside of whatever niche thereof a particular chapter treats.

As this volume was intended to be accessible to a non-sinologist interested in reading it from cover to cover, we went out of our way to harmonise the titles of primary sources between chapters. It was our original thought to present all of these in translation, but not everyone agrees with a given translation, and our authors helped us see how even long-standing conventions rooted in seminal texts might be confusing for an outside reader, e.g. standing Balazs' *Livre des Souei* for a *shu* 書 (literally 'writings [on]', effectively a 'history') next to Nylan's (2001) *Book of Documents* (*Shu jing* 書經) for a *jing* 經 (a 'classic' or 'canon') comprised of *shu*. Words also change: *tianwen*, now the modern word for 'astronomy', for example, means no such thing in the pre-modern world, and *that* is about all that experts can agree upon. Rather than demanding the impossible of our contributors as to accepting one or another school's philosophy on how to

translate a word like *shu* in our histories' titles, therefore, we decided to prioritise *Pinyin* Romanisation over translation except in cases where everyone could agree, namely Classics such as the *Changes* (*Yi* 易), *Documents* (*Shu* 書), *Odes* (*Shi* 詩), *Spring and Autumn Annals* (*Chunqiu* 春秋) and, no less important, *The Nine Chapters on Mathematical Procedures* (*Jiuzhang suanshu* 九章算術) and *Mr. Shi's Star Classic* (*Shishi xingjing* 石氏星經).

As a convenience to non-specialist readers, we furthermore asked our contributors to compile annotated tables of contents of the *Sui shu* treatises for which they were responsible to be placed in an appendix at the end of every relevant chapter (the first chapter, Chap. 3, as concerns the multiple chapters on the 'Lü-li zhi'). Here the idea was to furnish a reading guide to primary sources that have in most cases never been translated and to make the contents and the organisation of these treatises accessible to readers who may not have the time, language skills or technical expertise to read them in full.

Lastly, the chapters in Part I make unavoidable use of technical jargon as concerns quantities, units, co-ordinates and so on, the conventions governing which in Chinese are different from their modern European counterparts and are by no means self-evident to every sinologist. For the sake of *consistency*, we have harmonised this vocabulary throughout the book, and for the sake of *comprehension*, we offer a brief explanation of these conventions here.

As concerns the translation of exact dates, where this comes up, we will render a date like 天嘉六年正月己亥 in Y-M-D format as 'on Tianjia 6-1-*jihai*.₃₆ (3 March 565)' in lieu of a cumbersome reverse-order translation like 'on sexagenary day *jihai* of the first month of the sixth year of the Tianjia reign (560–566) [of Emperor Wen of Chen 陳文帝 (r. 559–566)]'.

In the Appendix to this chapter, furthermore, we have provided a cheat-sheet covering

- in Table 1.4, the heavenly stems (e.g., *ji*._{S06} 己), earthly branches (e.g., *hai*._{B12} 亥) and sexagenary cycle (e.g., *jihai*.₃₆ 己亥) used in various ordinal notation schemes;
- in Fig. 1.1, the pitch-pipes (e.g., HUANGZHONG 黃鐘), musical notes (e.g., *gong* 宮 DO), twenty-four *qi* (e.g., winter solstice._{Q22} 冬至) and lunar months of the civil calendar (e.g., month VIII 八月, the 'mid-autumn' 仲秋 month);
- in Fig. 1.2, units of length (e.g., *chi* 尺), capacity (e.g., *dou* 斗) and weight (e.g., *jin* 斤);
- in Fig. 1.3, the division of the celestial sphere into twenty-eight lodges (e.g., Heart._{L05} 心) and 365 1/4 *du* 度;
- and, in the pages thereafter, a glossary of key technical terms.

Table 1.4 The heavenly stems, earthly branches and sexagenary cycle

Stems	Branches	Binomes															
甲 <i>jiā</i> _{S01}	子 <i>zǐ</i> _{B01}	甲子 <i>jiāzǐ</i> ₀₁	甲戌 <i>jiāxū</i> ₁₁	甲申 <i>jiāshēn</i> ₂₁	甲午 <i>jiāwǔ</i> ₃₁	甲辰 <i>jiāchén</i> ₄₁	甲寅 <i>jiāyīn</i> ₅₁	乙卯 <i>yǐmǎo</i> ₅₂	丙辰 <i>bǐngchén</i> ₅₃	丁巳 <i>dīngsì</i> ₅₄	戊午 <i>wūwǔ</i> ₅₅	己未 <i>jǐwèi</i> ₅₆	庚申 <i>gēngshēn</i> ₅₇	辛酉 <i>xīnyōu</i> ₅₈	壬戌 <i>rénxū</i> ₅₉	癸亥 <i>guīhài</i> ₆₀	
乙 <i>yǐ</i> _{S02}	丑 <i>chǒu</i> _{B02}	乙丑 <i>yǐchǒu</i> ₀₂	乙亥 <i>yǐhài</i> ₁₂	乙酉 <i>yǐyōu</i> ₂₂	乙未 <i>yǐwèi</i> ₃₂	乙巳 <i>yǐsì</i> ₄₂	丙辰 <i>bǐngchén</i> ₅₃	丁巳 <i>dīngsì</i> ₅₄	戊午 <i>wūwǔ</i> ₅₅	己未 <i>jǐwèi</i> ₅₆	庚申 <i>gēngshēn</i> ₅₇	辛酉 <i>xīnyōu</i> ₅₈	壬戌 <i>rénxū</i> ₅₉	癸亥 <i>guīhài</i> ₆₀			
丙 <i>bǐng</i> _{S03}	寅 <i>yīn</i> _{B03}	丙寅 <i>bǐngyīn</i> ₀₃	丙子 <i>bǐngzǐ</i> ₁₃	丙戌 <i>bǐngxū</i> ₂₃	丙申 <i>bǐngshēn</i> ₃₃	丙午 <i>bǐngwǔ</i> ₄₃	丁巳 <i>dīngsì</i> ₅₄	戊午 <i>wūwǔ</i> ₅₅	己未 <i>jǐwèi</i> ₅₆	庚申 <i>gēngshēn</i> ₅₇	辛酉 <i>xīnyōu</i> ₅₈	壬戌 <i>rénxū</i> ₅₉	癸亥 <i>guīhài</i> ₆₀				
丁 <i>dīng</i> _{S04}	卯 <i>mǎo</i> _{B04}	丁卯 <i>dīngmǎo</i> ₀₄	丁丑 <i>dīngchǒu</i> ₁₄	丁亥 <i>dīnghài</i> ₂₄	丁酉 <i>dīngyōu</i> ₃₄	丁未 <i>dīngwèi</i> ₄₄	戊午 <i>wūwǔ</i> ₅₅	己未 <i>jǐwèi</i> ₅₆	庚申 <i>gēngshēn</i> ₅₇	辛酉 <i>xīnyōu</i> ₅₈	壬戌 <i>rénxū</i> ₅₉	癸亥 <i>guīhài</i> ₆₀					
戊 <i>wū</i> _{S05}	辰 <i>chén</i> _{B05}	戊辰 <i>wūchén</i> ₀₅	戊寅 <i>wūyīn</i> ₁₅	戊子 <i>wūzǐ</i> ₂₅	戊戌 <i>wūxū</i> ₃₅	戊申 <i>wūshēn</i> ₄₅	己未 <i>jǐwèi</i> ₅₆	庚申 <i>gēngshēn</i> ₅₇	辛酉 <i>xīnyōu</i> ₅₈	壬戌 <i>rénxū</i> ₅₉	癸亥 <i>guīhài</i> ₆₀						
己 <i>jǐ</i> _{S06}	巳 <i>sì</i> _{B06}	己巳 <i>jǐsì</i> ₀₆	己卯 <i>jǐmǎo</i> ₁₆	己丑 <i>jǐchǒu</i> ₂₆	己亥 <i>jǐhài</i> ₃₆	己酉 <i>jǐyōu</i> ₄₆	庚申 <i>gēngshēn</i> ₅₇	辛酉 <i>xīnyōu</i> ₅₈	壬戌 <i>rénxū</i> ₅₉	癸亥 <i>guīhài</i> ₆₀							
庚 <i>gēng</i> _{S07}	午 <i>wǔ</i> _{B07}	庚午 <i>gēngwǔ</i> ₀₇	庚辰 <i>gēngchén</i> ₁₇	庚寅 <i>gēngyīn</i> ₂₇	庚子 <i>gēngzǐ</i> ₃₇	庚戌 <i>gēngxū</i> ₄₇	己未 <i>jǐwèi</i> ₅₆	庚申 <i>gēngshēn</i> ₅₇	辛酉 <i>xīnyōu</i> ₅₈	壬戌 <i>rénxū</i> ₅₉	癸亥 <i>guīhài</i> ₆₀						
辛 <i>xīn</i> _{S08}	未 <i>wèi</i> _{B08}	辛未 <i>xīnwèi</i> ₀₈	辛巳 <i>xīnsì</i> ₁₈	辛卯 <i>xīnmǎo</i> ₂₈	辛丑 <i>xīnchǒu</i> ₃₈	辛亥 <i>xīnhài</i> ₄₈	庚申 <i>gēngshēn</i> ₅₇	辛酉 <i>xīnyōu</i> ₅₈	壬戌 <i>rénxū</i> ₅₉	癸亥 <i>guīhài</i> ₆₀							
壬 <i>rén</i> _{S09}	申 <i>shēn</i> _{B09}	壬申 <i>rénshēn</i> ₀₉	壬午 <i>rénwǔ</i> ₁₉	壬辰 <i>rénchén</i> ₂₉	壬寅 <i>rényīn</i> ₃₉	壬子 <i>rénzǐ</i> ₄₉	庚申 <i>gēngshēn</i> ₅₇	辛酉 <i>xīnyōu</i> ₅₈	壬戌 <i>rénxū</i> ₅₉	癸亥 <i>guīhài</i> ₆₀							
癸 <i>guī</i> _{S10}	酉 <i>yōu</i> _{B10}	癸酉 <i>guīyōu</i> ₁₀	癸未 <i>guīwèi</i> ₂₀	癸巳 <i>guīsì</i> ₃₀	癸卯 <i>guīmǎo</i> ₄₀	癸丑 <i>guīchǒu</i> ₅₀	庚申 <i>gēngshēn</i> ₅₇	辛酉 <i>xīnyōu</i> ₅₈	壬戌 <i>rénxū</i> ₅₉	癸亥 <i>guīhài</i> ₆₀							
	戌 <i>xū</i> _{B11}																
	亥 <i>hài</i> _{B12}																

The stems, branches and stem-branch binomes are used as ordinal position markers to divide time and space into 12 or 24 'hours', 12 or 24 directions, 12-month years, 10-day 'weeks' (*xun* 旬) and the 60-year and 60-day cycles at the core of civil timekeeping. Note that while our notation uses numbers to indicate each stem, branch and binome's position in its respective sequence, these ordinal position markers are not themselves to be confused with numbers (*shu* 數) in either the emic or the etic sense of the word

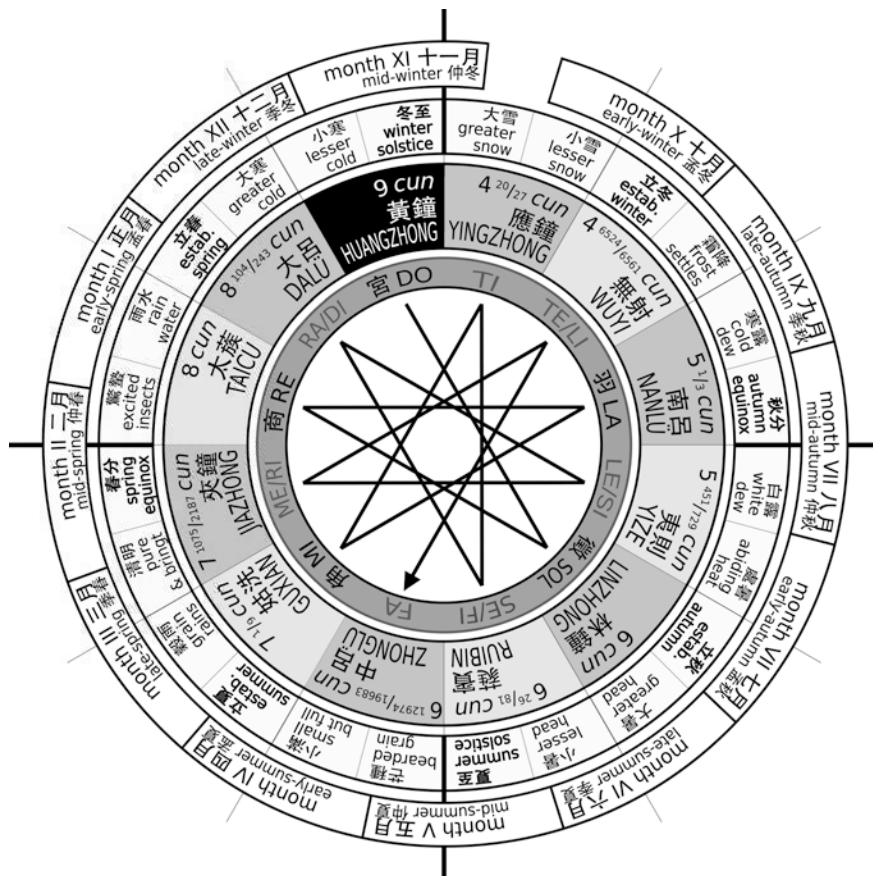


Fig. 1.1 The twelve *lü* 律 pitch-regulator pipes. In the middle ring are the twelve pitch-regulator pipes, the fundamental pipe—the HUANGZHONG—in black, the other male *lü* 律 pipes in light grey, and the female *lü* 呂 pipes in darker grey. The lengths of the pipes in *cun* 寸 are determined by multiplying down and up by $4/3$ and $2/3$, respectively—the so-called ‘diminution and increase by thirds’ (*san fen sun yi* 三分損益)—amounting to what we would call a circle of fifths (DO → SOL → RE ... FA, at the centre). In the dark grey ring at the centre are the twelve notes (*yin* 音) of the chromatic scale, within which are marked the five notes—*gong* 宮, *shang* 商, *jue* 角, *zhi* 徵, *yu* 羽—of the Chinese pentatonic scale, which represent a solfeggio that can be effectively turned vis-à-vis the pitch-regulators depending on the scale or key (*diao* 調) desired. The next ring after the pitch-regulator pipes are the twenty-four *qi* of the solar year, the pitch HUANGZHONG being associated with the winter solstice and, in the outermost ring, the eleventh, mid-winter month of the civil calendar pegged thereto. The gap between lunar months x and xi in this figure represents the ≈ 11 -day gap between the lunar and solar cycle that accumulates every three or so years into an intercalary month

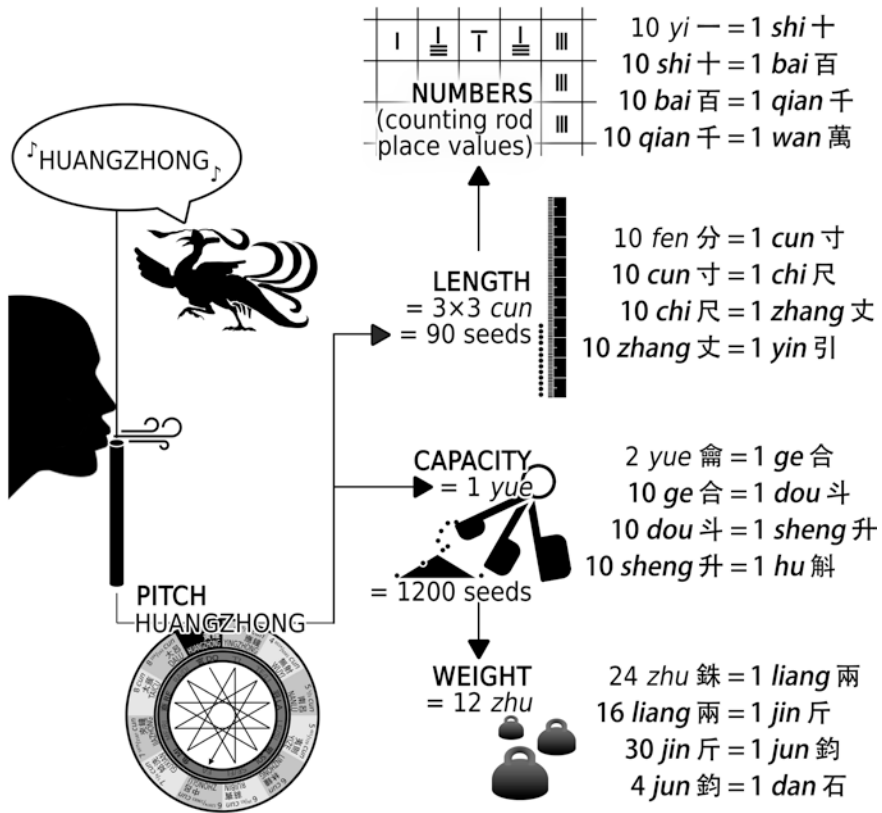


Fig. 1.2 Metrological units, their equivalencies and origins according to Liu Xin 劉歆 (ca. 50 BCE–23 CE) as preserved in the *Han shu* ‘Lü-li zhi’. The Sages created the HUANGZHONG pipe in high antiquity to match the cry of the phoenix and serve as the basis of pitch (see Fig. 1.1). Measuring in at 90 millet seeds or $3^2=9$ cun in length, the HUANGZHONG pitch pipe also serves as the basis of the Five Length Measures. The expansion of that number to a denominator of $3^9=19\,683$ in up- and down-generating the other eleven pitches therefrom as per Fig. 1.1 furthermore serves as the basis of the Five Numbers (i.e., counting rod place values). The HUANGZHONG pitch pipe, as a physical tube, holds 1 yue, which serves as the basis of the Five Capacity Measures. One yue, lastly, accommodates 1200 millet seeds, which weigh 12 zhu, which serves as the basis of the Five Weight Measures. As to how these translate into modern units, the Qin (221–206 BCE) and Han (206 BCE–220 CE) standards were roughly 1 chi = 23.1 cm, 1 sheng = 20 cl, and 1 jin = 250 g. These values experienced considerable variation over time and space, swinging between a market-driven historical trend toward inflation and classicist attempts to return to ancient benchmarks over the period in question. For exact equivalencies, see the studies of Qiu (1992), Qiu et al. (2001) and Goodman (2010, 161–214)