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Review on the Collation of Premodern Chinese Sources on Science and Technology[1]

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Abstract: As a long-standing ancient civilization with a history of several thousand years, China has contributed a large number of technological inventions and scientific discoveries to human culture. Among the vast number of printed books and other documents handed down to the present-day in China, there are many on science and technology. It is an essential task to collate these works, and thus lay a foundation for historical research into them, as well as make them more readily available to the outside world.

Keywords: scientific and technological literature, old book editing, bibliography, textual criticism

1 A survey of existing heritage and editing thereof

With the publication of *Zhongguo guji zongmu* 中國古籍總目 (Catalog of old Chinese books) in recent years, it is now possible to come up with a total of about 200,000 works and 500,000 editions as the number of extant Chinese books printed before 1912[3]. Based on this bibliography, we have made a rough calculation of the number that might be included under a heading of science and technology, classified in the following categories:

Shibu 史部 (History branch)

Dili lei 地理類 (Category of geography), *Zongzhi zhi shu* 總志之屬 (Subcategory

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[3] Despite the fact that modern Western scientific knowledge was introduced into China in the seventeenth century and China launched the modernization of industry, especially military industry, in the second half of the nineteenth century, in the Chinese bibliographic community, 1912 is generally regarded as the demarcation point between premodern and modern literature.

of comprehensive gazetteers) 444 kinds;

Zhengshu lei 政書類 (Category of statecraft and administration), *Kaogong zhi shu* 考工之屬 (Subcategory of craftsmen) 81 kinds, and *Shuili zhi shu* 水利之屬 (Subcategory of water conservancy) 314 kinds;

Zibu 子部 (Philosophers' branch)

Bingjia lei 兵家類 (Category of military treatises) ca. 230 kinds;

Nongjia lei 農家類 (Category of agricultural treatises) 467 kinds;

Pulu lei 譜錄類 (Category of books on material culture and nature studies), *Huamu niaoshou zhi shu* 花木鳥獸之屬 (Subcategory of flora and fauna) 339 kinds;

Yijia lei 醫家類 (Category of medical treatises) 6684 kinds;

Tiansuan lei 天算類 (Category of astronomy and mathematics) 1656 kinds;

Shushu lei 術數類 (Category of divination) ca. 140 kinds;

Xinxue lei 新學類 (Category of Western learning) 884 kinds;

A total of about 11,239 kinds.

As for books introduced from the West, excepting those in the *Xinxue lei* listed above, according to *Jindai hanyi xixue shumu tiyao (Mingmo zhi 1919)* 近代汉译西学书目提要(明末至 1919) (Annotated bibliography on books translated from Western learning from the 1640s to 1919), there is an estimated total of 1678 kinds, of which 25 are in psychology, 272 in geography and 1381 in natural sciences. Considering that "translated books from Western learning" and *Xinxue lei* partly overlap, we estimate that the number of extant premodern books on science and technology exceeds 12,000 kinds, making up around 6% of the total.

The fact that these premodern works were written in classical Chinese, characterized by the absence of punctuation and an abundance of different editions, has made them difficult to read and research, and called for systemic collation. Aside from punctuating and collating new editions, facsimile and digital scanning reproduction are also used to preserve and diffuse the original forms of old books. These two methods can be said to have a long history. The production of facsimiles included both tracing and engraving, while punctuating and collating also date back a long time, as can be seen from this quotation from *Jiujing sanzhuan yange li* 九經三傳沿革例 (A brief historical summary of the twelve Confucian classics) by Yue Jun 岳浚 of the Song dynasty: "The Jianyang editions (建本) first imitated the collation pattern of *Guan ge* 館閣 (central cultural institutes) and punctuated alongside the text, making it convenient for scholars to read them. Later on, the Sichuan editions with middle-sized characters (蜀中字本), and Xingguo editions (興國本) further punctuated annotations [as well] (建本始仿館閣校書式從旁加圈點，開卷瞭然，於學者爲便，然亦但句讀經文而已。惟蜀中字本與興國本並點注文，益爲周盡)" (Hu et al. 1919). The Jianyang editions, Sichuan

editions with middle-sized characters, and Xingguo editions mentioned here are probably early examples of books collated by punctuating the text. With the advent of the "New Culture Movement" in the early twentieth century, to "scientifically" "edit national cultural heritage" became a key part of the transition from traditional to modern learning. Hu Shi 胡適 (1891–1962) first advanced the slogan "study problems, introduce scientific principles, edit national cultural heritage and recreate civilization (研究問題、輸入學理、整理國故、再造文明)" in his article "'Xin sichao' de yiyi" "新思潮"的意義 (The meaning of "new trend of thought") in *Xin qingnian* 新青年 (New youth) (Hu 1919), marking the beginning of the *Zhengli guogu yundong* 整理國故運動 (Movement for Editing National Cultural Heritage). The same year, the Department of Chinese Language and Literature at Peking University established three majors—language, literature and national cultural heritage editing—to initiate the training of students in old book collation. All relevant practices in modern times have been carried out against this background. In 1920, the Ministry of Education of the Republic of China issued "Tongling caiyong xinshi biaodian fuhao wen" 通令採用新式標點符號文 (A general order on the use of new punctuation), and with the support of Hu Shi and others, Wang Yuanfang 汪原放 punctuated and paragraphed the popular traditional novel *Shuihu zhuan* 水滸傳 (All men are brothers) published by the Oriental Book Company, specifically in order to publicize the new punctuation. This was the first premodern book to be published with the new punctuation, now nearly a century ago (Wu 2011). In the same year, Hu Shi proposed in his speeches that new punctuation, paragraphing, emendation, and brief introductions and evaluations of authors and their books should be added in the collation of old books (Hu 1924). Wang Yunwu 王雲五 of the Commercial Press published *Xuesheng guoxue congshu* 學生國學叢書 (Sinological series for students) based on Hu's ideas, and brought out the collated *Xu Xiake youji* 徐霞客遊記 (The travel diaries of Xu Xiake) in 1930, which may be the earliest scientific book of premodern times to be processed using modern collation methods. We can safely draw the conclusion that the Movement for Editing National Cultural Heritage laid the foundation for the paradigm for modern editing in China in terms of conception and practice. Nevertheless, apart from facsimile editions, most of the premodern works edited during the Republic of China, including *Sibu congkan* 四部叢刊 (The four branches of literature collection) and *Congshu jicheng* 叢書集成 (A corpus of works from collectanea), were typeset in the traditional (unpunctuated) format, with only the occasional collated edition. This latter paradigm really became widespread only after the founding of New China. In 1958, *Guji zhengli chuban guihua xiaozu* 古籍整理出版规划小组 (The Planning Panel for the Editing and Publishing of Old Books) under the State Council drew up "Zhengli he chuban guji jihua cao'an" 整理和出版古籍计划草案 (Draft on editing and publishing old books), which stated in the

preface that "we should select the best version as the master copy (*diben* 底本, lit. 'base copy'), then collate it with other versions to make critical emendations. A new preface should be written criticizing and researching the work. Punctuation and an index are also very necessary" (Xu 2002). Some scholars such as Xia Nai 夏鼐 pointed out that the first step of editing was to establish an elaborately collated edition as a definitive edition (*dingben* 定本) (Xia 1982). This method could be named definitive collation (*dingbenshi zhengli* 定本式整理), and gradually gained prevalence.

Since the founding of the People's Republic of China, at a rough count by 2002 the number of collated and published premodern works had exceeded 10,000, increasing by 500 per year thereafter (Yang 2003, 5). Thus, over 7000 more should have been added in the last fifteen years, meaning that more than 20,000 have been collated since the Republic of China, accounting for about one tenth of the estimated total extant number. According to the statistics (up to 2003) in *Xin Zhongguo guji zhengli tushu zongmulu* 新中国古籍整理图书总目录 (Comprehensive catalog of old books edited in New China) (Li and Zeng 2011), there are 1876 edited premodern works on science and technology, and since only a small number of these books are collated every year, the total should now be about 2000 with the inclusion of those edited in recent years. Among these, medical and agricultural works, which are widely utilized in daily life, outnumber any other genre, while other collated scientific books are rather limited in number. It is worth stressing that a large portion of these books are merely facsimile reprints, with only a few having been punctuated and collated. For example, the number of collated agricultural books is only about one hundred (Xiao and Li 1990; Huang 2011). Arguably, the collation of such fundamental literature is a bottleneck for the study of the history of science and technology calling for urgent resolution.

2 A review of achievements

After the founding of the People's Republic of China, in order to enhance the planning of the collation and publication of traditional heritage, in 1958 the Scientific Planning Committee of the State Council established the Planning Panel of the Editing and Publishing of Old Books (PPEPOB), and formulated the "San zhi ba nian (1960–1967) zhengli he chuban guji de zhongdian guihua (cao'an)" 《三至八年（1960–1967）整理和出版古籍的重点规划》（草案） (Major plan for the editing and publishing of old books for three to eight years [1960–1967] [draft]) (Yang 2003, 3). However, this plan only included literary, historical and philosophical works, but not scientific and technological ones. Nevertheless, the onset of the "March towards Science" movement at that time encouraged the collation of the nation's scientific and technological heritage to serve society, with works on Traditional Chinese Medicine (TCM) and agriculture given top priority.

On October 26, 1954, the Leading Group of Central Cultural Committee's "Guanyu gaijin zhongyi gongzuo wenti gei zhongyang de baogao" 關於改進中醫工作問題給中央的報告 (Report to the Central Committee on improving Traditional Chinese Medicine) proposed that "works on Traditional Chinese Medicine and pharmacy should be published, and premodern and modern medical books should be collated, edited and reprinted." Complying with this instruction, the People's Medical Publishing House and others reprinted, sometimes in facsimile, a variety of premodern works on Chinese medicine, and published newly collated editions, such as *Bencao gangmu* 本草綱目 (Compendium of materia medica), *Gujin tushu jicheng yibu quanlu* 古今圖書集成醫部全錄 (Complete records of the medical section of the comprehensive corpus of illustrations and books from ancient times to the present) and so on. In order to implement the mission of "collating old books on Traditional Chinese Medicine" as outlined in "1963–1972 kexue jishu guihua gangyao" 1963–1972 年科学技术规划纲要 (National guidelines on the program for science and technology development in 1963–1972), the Ministry of Health decided to collate and annotate seven classics of Traditional Chinese Medicine, including *Suwen* 素問 (Basic questions), *Lingshu* 靈樞 (Spiritual pivot), *Nanjing* 難經 (Classic of difficult issues), *Zhenjiu jiayi jing* 針灸甲乙經 (AB canon of acupuncture and moxibustion), *Mai jing* 脈經 (Pulse classic), *Zhubing yuanhou lun* 諸病源候論 (General treatise on causes and symptoms of all diseases), and *Zhenjiu dacheng* 針灸大成 (Compendium of acupuncture and moxibustion). However, they did not appear in print until 1979–1984 as a result of the Cultural Revolution (Zhang 2012b).

In April 1955, the Ministry of Agriculture held the "Colloquia for the Editing of Agricultural Heritage." Based on the unified plan of the PPEPOB, the Ministry of Agriculture selected about 200 premodern works for the "Zhongguo gu nongshu congkan xuanti jihua (cao'an)" 中國古農書叢刊選題計劃（草案） (Plan for the selected series of old Chinese agricultural books [draft]). About 50 works were published before 1979, including *Fan Shengzhi shu jinshi* 氾勝之書今釋 (Fan Shengzhi's work on agriculture, newly annotated) edited by Shi Shenghan 石聲漢, *Fan Shengzhi shu jishi* 氾勝之書輯釋 (Fan Shengzhi's work on agriculture, recovered and annotated) edited by Wan Guoding 萬國鼎, *Zhongyi biyong* 種藝必用 (Necessary farming skills), *Simin yueling jiaozhu* 四民月令校注 (Collation and annotation of *Monthly ordinances for the four categories of the people*) and *Chen Fu nongshu jiaozhu* 陳旉農書校注 (Collation and annotation of Chen Fu's agricultural treatise) compiled and edited by Hu Daojing 胡道靜, and so forth (Zhu 2008; Xiao and Li 1990). Scientific and technological works collated at the same time included *Suanjing shishu* 算經十書 (Ten classics of mathematics) edited by Qian Baocong 錢寶琮, *Mojing jiaoquan* 墨經校詮 (Collation and explanation of *Mohist canon*) edited by Gao Heng 高亨, *Mengxi bitan jiaozheng* 夢溪

筆談校證 (Punctuated and corrected edition of *Dream Pool essays*) edited by Hu Daojing, and *Lidai tianwen lüli deng zhi huibian* 歷代天文律曆等志彙編 (Collection of astronomical and calendrical treatises) by the editorial office of Zhonghua Book Company, and so on.

Following the Cultural Revolution and with the advent of the period of reform and opening-up, the PPEPOB returned to work in 1982. It formulated the "Guji zhengli chuban guihua (1982–1990)" 古籍整理出版规划（1982–1990） (Plan for the editing and publishing of old books [1982–1990]), and made the decision that "the collation and publication of medical, agricultural, scientific and ethnic (national minority) old books will be planned by the Ministry of Health, the Ministry of Agriculture, Husbandry and Fisheries, the Chinese Academy of Sciences, and the Central Ethnic Affairs Commission." Thus, the Ministry of Health specifically produced "1982–1990 zhongyi guji zhengli chuban guihua" 1982–1990 中医古籍整理出版规划 (Plan for the editing and publishing of old books on Traditional Chinese Medicine [1982–1990]), with the goal of publishing 686 premodern works (592 collated editions and 94 facsimile editions). In addition to the publication of the annotated and translated series of 11 key medical classics, a large number of medical works were collated and compiled as well during this period. There were such high-quality facsimile reprint editions of ancient, rare and unique editions in *Zhongyi zhenben congshu* 中医珍本丛书 (Series of rare books on Traditional Chinese Medicine) by the Traditional Chinese Medical Classics Publishing House, *Zhongguo yixue zhenben congshu* 中國醫學珍本叢書 (Series of rare books on Chinese medicine) and *Zhenben yishu jicheng* 珍本醫書集成 (Collection of rare medical books) by the Shanghai Scientific and Technical Publishers, *Zhongyi jichu congshu* 中医基础丛书 (Series of basic works on Traditional Chinese Medicine) by the China Bookstore, *Zhongyi guji shanben congkan* 中医古籍善本丛刊 (Series of reliable editions of old books on Traditional Chinese Medicine) by the Shanghai Bookstore, as well as *Lidai zhongyi zhenben jicheng* 歷代中醫珍本集成 (Collection of rare books on Traditional Chinese Medicine) by the Shanghai Joint Publishing (Zhang 2012b). As for agriculture, "Nongye guji zhengli jiunian guihua (cao'an)" 农业古籍整理九年规划（草案） (Nine-year plan on the editing of old agricultural books [draft]) was developed. Under this plan, the most important was *Zhongguo nongshu congkan* 中国农书丛刊 (Series of treatises on Chinese agriculture) which, as the successor to *Zhongguo gu nongshu congkan* 中國古農書叢刊 (Series of old Chinese agricultural books), boasts almost 40 works, including *Wang Zhen nongshu* 王禎農書 (Wang Zhen's agricultural treatise) compiled by Wang Yuhu 王毓瑚, *Nongzheng quanshu jiaozhu* 農政全書校注 (Collated and annotated edition of *Comprehensive treatise on agricultural administration*) edited by Shi Shenghan, *Qimin yaoshu jiaoshi* 齊民要術校釋 (Collations and explanations of *Essential techniques for the peasantry*) and *Yuanke nong sang jiyao jiaoshi* 元刻農桑輯要校釋

(Yuan block-printed edition of collations and explanations of *Collected essentials of agriculture and sericulture*) edited by Miao Qiyu 缪启愉. As for facsimile editions of unique and rare books, only three treatises in *Zhongguo nongxue zhenben congkan* 中国农学珍本丛刊 (Series of rare books on Chinese agriculture) have been published (Zhu 2008).

In May 1992, the PPEPOB convened the third National Conference for the Plan for Editing and Publishing of Old Books. As well as formulating a comprehensive plan on the editing of premodern works on literature, history and philosophy, it also included those on science and technology, forming an overarching plan that continues to the present day (Hu 1996). The editing and publishing of premodern works on Traditional Chinese Medicine still outstrip all others, with many large-scale series. For instance, *Zhongyi guji zhengli congshu* 中醫古籍整理叢書 (Collection of reedited old books of Traditional Chinese Medicine) by the People's Medical Publishing House includes over 300 works, and there are also *Zhongyi guji guben daquan* 中醫古籍孤本大全 (Comprehensive collection of unique editions of old books on Traditional Chinese Medicine) by the Traditional Chinese Medical Classics Publishing House, *Ming Qing zhongyi linzheng xiaocongshu* 明清中医临证小丛书 (Series of Ming and Qing traditional Chinese clinical medicine) by the China Press of Traditional Chinese Medicine, and *Zhongyi guji zhenben jicheng* 中医古籍珍本集成 (Collection of rare editions of old books on Traditional Chinese Medicine) by the Hunan Science and Technology Press. The Zhonghua Book Company has also recently published *Haiwai zhongyi zhenshanben guji congkan* 海外中醫珍善本古籍叢刊 (Series of rare and reliable editions of old books on Traditional Chinese Medicine held overseas) that incorporates 427 extremely valuable and rare works that only survive overseas.

The collation and publication of premodern books on science and technology have progressed rapidly since 1979. *Zhonghua wenhua yaoji daodu congshu* 中华文化要籍导读丛书 (Guides to key works of Chinese culture series), which were planned and published by Bashu Publishing House in the 1980s, included several works on science and technology, such as *Xu Xiake youji daodu* 《徐霞客游记》导读 (Guide to *The travel diaries of Xu Xiake*) by Wu Yingshou 吴应寿, and *Kao gong ji daodu* 《考工记》导读 (Guide to *The artificers' record*) by Wen Renjun 闻人军. In the 1990s, hundreds of experts organized by the Institute for the History of Natural Sciences (IHNS), Chinese Academy of Sciences, after selecting and sorting fundamental texts on premodern Chinese science and technology, compiled *Zhongguo kexue jishu dianji tonghui* 中國科學技術典籍通彙 (Compendium of sources on Chinese science and technology). This provided facsimile reprints of 541 works, including for each a brief summary of the work and its various editions, author introduction and main contents, making it very well received by scholars both at home and abroad. Other areas of science and

technology apart from the fields of medicine and agriculture have also received attention in the form of specialized series. For instance, six treatises have been published in *Zhonghua chuantong shuxue wenxian jingxuan daodu congshu* 中华传统数学文献精选导读丛书 (Guides to selected traditional Chinese mathematical literature series) edited by Li Di 李迪. Almost 20 works have been published up to now in *Zhongguo gudai keji mingzhu yizhu congshu* 中国古代科技名著译注丛书 (Translated and annotated masterpieces on premodern Chinese science and technology series), planned by the Shanghai Ancient Books Publishing House. *Ming Qing zhiji xixue wenben* 明清之際西學文本 (Texts of Western learning of the late Ming and early Qing dynasties) edited by Huang Xingtao 黃興濤 and Wang Guorong 王國榮, and *Ming Qing zhiji xifang chuanjiaoshi hanji congkan* 明清之際西方傳教士漢籍叢刊 (Series of Chinese works by Western missionaries in the late Ming and early Qing dynasties) by Zhou Zhenhe 周振鶴 (the first two volumes of which have been published), contain over 30 Chinese works translated from Western books on science and technology, such as *Jihe yuanben* 幾何原本 (Elements of Geometry), *Kunyu gezhi* 坤輿格致 (Investigation into [the contents of] the earth), *Shixue* 視學 (Study of vision) and *Ziming zhongbiao tushuo* 自鳴鐘表圖說 (Illustrations and descriptions for making chime clocks), etc., though there are many overlaps between the two series. The first two volumes of *Zhongguo keji dianji xuankan* 中國科技典籍選刊 (Selection of classical works on Chinese science and technology) have also been issued under the editorship of Zhang Baichun 張柏春 and Sun Xianbin 孫顯斌. Recently, there have also been some new collections of documents, such as *Qingdai jiangzuo zeli huibian* 清代匠作則例彙編 (Compilation of the handicraft regulations and precedents in the Qing dynasty) edited by Wang Shixiang 王世襄, *Chouren zhuan hebian jiaozhu* 《疇人傳》合編校注 (Collated and annotated edition of *Biographies of astronomers and mathematicians*) edited by Feng Lisheng 冯立昇, and *Zhongguo shuili shidian* 中國水利史典 (Standard Chinese works on the history of water conservancy) edited by Chen Lei 陈雷, etc. Other outstanding publications include, *Yingzao fashi zhushi* 《營造法式》注釋 (Annotated *Treatise on building standards*) by Liang Ssu-ch'eng 梁思成, *Tiangong kaiwu jiaozhu ji yanjiu* 《天工開物》校注及研究 (Collated and annotated edition and studies of *The exploration of the works of nature*) by Pan Jixing 潘吉星, *Jiuzhang suanshu huijiao* 《九章算術》彙校 (Collated edition of *The nine chapters on mathematical procedures*) by Guo Shuchun 郭書春, *Jiuzhang suanshu jiaozheng* 《九章算術》校證 (Corrected edition of *The nine chapters on mathematical procedures*) by Li Jimin 李继闵, *Chongzhen lishu* 崇禎曆書 (Chongzhen reign-period treatise on calendrical science) reedited by Pan Nai 潘鼐, and *Xu Guangqi quanji* 徐光啟全集 (Complete works of Xu Guangqi) under the editorship of Zhu Weizheng 朱維錚 and Li Tiangang 李天綱.

While the collation and study of such fundamental works are inseparable, it is also

essential to compile bibliographies and summaries. Much work has been done in this regard in the fields of mathematics, medicine and agriculture. Throughout the twentieth century, scholars such as Qiu Chongman 裘冲曼, Li Yan, Qian Baocong and Yan Dunjie 严敦杰 have compiled bibliographies on traditional Chinese mathematics. Among them, Li Yan has compiled some excellent representative works, such as *Zhongsuan shulu* 中算書錄 (Bibliography of traditional Chinese mathematical treatises), *Mingdai suanxue shuzhi* 明代算學書志 (Synopses of mathematical works of the Ming dynasty), and *Jindai zhongsuan zhushu ji* 近代中算著述記 (A commentary on modern Chinese mathematics). In addition, *Li Yan shoucang zhongsuanshu mulu* 李儼收藏中算書目錄 (Bibliography of Li Yan's collection on traditional Chinese mathematics) was compiled by the IHNS, based on his collection held in the Institute's library. Li Di also compiled *Zhongguo suanxue shumu huibian* 中国算学书目汇编 (Collection of bibliographies of Chinese mathematics) based on a variety of works (Wu 2000). With regard to medical classics, representative bibliographies include *Song yiqian yiji kao* 宋以前醫籍考 (Studies of medical books in the Song and earlier) by Okanishi Tameto 岡西為人, *Yiji kao* 醫籍考 (Studies of medical books) by Taki Mototsugu 丹波元胤, *Zhongyi guji zhenben tiyao* 中医古籍珍本提要 (Descriptive notes on rare old books of Traditional Chinese Medicine) edited by Yu Ying'ao 余瀛鰲 and Fu Jinghua 傅景华, *Zhongguo yiji dacidian* 中国医籍大辞典 (Dictionary of premodern Chinese medical works) edited by Qiu Peiran 裘沛然, *Zhongguo fensheng yiji kao* 中国分省医籍考 (Studies of medical books of China by province) edited by Guo Aichun 郭靄春, *Zhongyi tushu lianhe mulu* 中医图书联合目录 (Union catalog of traditional Chinese medical books) edited by the China Academy of Chinese Medical Sciences and National Library of China, as well as *Quanguo zhongyi tushu lianhe mulu* 全国中医图书联合目录 (National union catalog of traditional Chinese medical books) and *Zhongguo zhongyi guji zongmu* 中国中医古籍总目 (Union catalog of old books of Traditional Chinese Medicine), which are continuously being updated. Representative bibliographies of agricultural works include *Zhongguo nongxue shulu* 中國農學書錄 (Annotated catalog of Chinese agricultural treatises) by Wang Yuhu, and *Zhongguo gunongshu kao* 中国古农书考 (Studies on old Chinese agricultural works) by Amano Motonosuke 天野元之助, as well as *Zhongguo gunongshu lianhe mulu* 中國古農書聯合目錄 (Union catalog of old Chinese agricultural treatises) edited by the National Library of China, *Nongye guji lianhe mulu* 农业古籍联合目录 (Union catalog of old books on agriculture) edited by the China Agricultural History Association and China Agricultural Museum, as well as *Zhongguo nongye guji mulu* 中国农业古籍目录 (Bibliography of old Chinese agricultural books) edited by the Chinese Agricultural Heritage Research Center of Nanjing Agricultural University.

In addition, the collation of Chinese scientific and technological works has also been

undertaken abroad, the research and annotation of *Mo jing* 墨經 (Mohist canon) by Angus Graham serving as one example (Graham 1978). The contribution of Japanese scholars is particularly noteworthy in this regard. For instance, the seminar on the history of science and technology in China held by the Institute for Research in Humanities of Kyoto University for many years became one of the international centers for the study of the history of science and technology in China, and one of the vital tasks of the seminar was the collective reading of premodern texts. Thus, Yabuuchi Kiyoshi 藪内清, together with other scholars, spent over 20 years collectively studying a range of fundamental works, such as *Tiangong kaiwu* 天工開物 (The exploitation of the works of nature), *Qimin yaoshu* 齊民要術 (Essential techniques for the peasantry), *Mengxi bitan* 夢溪筆談 (Dream Pool essays) and *Wuli xiaozhi* 物理小識 (A small encyclopedia of the principles of things), and so forth (Kawahara 1992). A few translated and annotated editions of the works above have also been published by Japanese scholars, such as *Tiangong kaiwu* by Yabuuchi Kiyoshi and *Mengxi bitan* by Umehara Kaoru 梅原郁. Elsewhere, six international symposia on Chinese scientific and technological books have been held in China, Germany and the United States. As a result, studies on Chinese scientific and technological works have attracted more and more attention among the international academic community.

3 Problems and arguments

In addition to providing readers with easy access to classic works on science and technology and relevant research, these efforts have made significant contributions to cultural transmission as well. Nonetheless, many works are still defective to varying degrees, due to constraints imposed by the research environment, collation aims and other factors.

First of all, there is the presence of the problem of the irregularities in the use of master-copies (*diben*) and the collation process. As Zhang Peiheng 章培恒 pointed out in his "Guanyu guji zhengli gongzuo de guifanhua wenti yi diben wenti wei zhongxin" 关于古籍整理工作的规范化问题——以底本问题为中心 (On the standardization of the collation of old books: Focusing on the problem of the master-copy), these problems include the inappropriate selection of a master-copy, faults in the punctuation added, ambiguous statements concerning the master-text used, feigned adoption of the stated master-text (i.e. it is not the one actually used), unstated textual changes of the master-text (Zhang 2012a), etc. Facsimile editions also frequently lack a clear statement of the chosen master-text. For instance, the prefatory explanation to the facsimile edition of *Zhenjiu dacheng* published by the People's Medical Publishing House in 1955 states that it is an "edition cut in the Ming dynasty," when in fact it is a combination of revised and successively revised woodblock editions of the Qing dynasty. To give

another example, the typeset version of *Zhenjiu juying* 針灸聚英 (Collected treatises on acupuncture and moxibustion), published by the Shanghai Scientific and Technical Publishers in 1961, which was stated to be based on a Japanese re-cut woodblock edition based on a previous edition, with additional reference to the very first edition of the work that dates to the Ming dynasty Emperor Jiajing's reign, is in fact different to both these editions, and quite apart from words and sentences, the chapter titles and comments in the book were all modified without any explanation. Afterwards, the above typeset version was often taken as a reference in collating acupuncture and moxibustion works from after the Ming dynasty, resulting in serious adverse effects (Huang 2008).

Another typical example illustrates all the issues Zhang Peiheng pointed out in his article. In the 1980s, the version of *Wang Zhen nongshu* collated by Wang Yuhu was published. Using editions derived from both the Ming dynasty Jiajing period edition and the copies in the *Siku quanshu*, and in general correctly pointing out the origin and development of the different versions, Wang's work could be regarded as high-caliber example among its counterparts. It had considerable influence once published; it was, for example, the basis of the text translated and annotated by Miao Qiyu (Miao 1994). However, in carrying out a new round of collation, we found that there were still many defects in Wang Yuhu's version due to the limitations of conditions at that time (Sun and You 2014). For instance, according to Wang Yuhu, the text was based on a *Siku* copy and the illustrations on the Jiajing edition. However, Wang failed to point out clearly the exact *Siku* copy used. When Wang was working on this collation, the Wenyuan Pavilion copy held in the Palace Museum in Taipei had not been published, and the Wensu Pavilion copy, held in Shenyang, was very hard to get to consult. Therefore, the copy that Wang was most likely to have seen would be the Wenjin Pavilion copy stored in the National Library of China in Beijing. Yet, when we compared Wang's text with the Wenyuan and Wenjin copies of the *Siku*, we found that there were quite a number textual differences between them, and that these differences basically matched up with editions derived from the "precious editions" (Juzhen) produced by the imperial printing house in the Hall of Martial Valor (themselves derived from the *Siku* lineage of copies). This demonstrated that the master-copy originally adopted by Wang was one belonging to the lineage of the Juzhen versions rather than a *Siku* one. In addition, although Wang later made collations using the Wenjin Pavilion copy, he did not do so very thoroughly. Indeed, there were even some bits of text different from all *Siku* lineage editions, but the same as those belonging to the Jiajing edition lineage. What is more, it is possible that the original master-copy of the Jiajing edition utilized by Wang was also a later re-cut version rather than the original one. Our review found that both text and illustrations in the Jiajing edition were superior to those of the *Siku* lineage editions, which was different from Wang's

conclusion. The shortcomings of the Jiajing edition lie in some conspicuous textual errors. Therefore, following a preliminary judgment, the conclusion can easily be made that there were large numbers of errors, and missing and confusing parts in the Jiajing edition. Fortunately, these errors, most of which were the consequence of similar character forms or pronunciation, could be rectified without too much effort. By contrast, after meticulous revision, such faults could hardly be found in the *Siku* lineage editions. However, as to the variant texts, the Jiajing version generally surpassed those of the *Siku* lineage, which were largely altered inappropriately. For example, in the sentence "Liang Junyan, a trusted follower, pleaded to tax sand fields (近習梁俊彥請稅沙田)" in the "Shatian" 沙田 (Sand field) section of "Tianzhi men" 田制門 (Land system) in *Nongqi tupu* 農器圖譜 (Illustrated monograph on agricultural implements) (Sun and You 2014, 201), *jinxi* 近習 (trusted follower),[4] which might be mistakenly deleted due to misunderstanding, is not in the *Siku* versions. In another example, "fields in the morning are neat and easy to manage, while those in the evening are unclean and overgrown with weeds which are hard to eliminate (早田淨而易治，晚者蕪蔵難出)" (ibid., 778) in the "Su" 粟 (Millet) section of *Gu pu* 穀譜 (Treatise on grain), the character *chu* 出 is replaced by *zhi* 治 in the *Siku* version, which was the same as the common version of *Qimin yaoshu*. Although the above sentence was from *Qimin yaoshu*, in fact it was quoted from the "Zhonggu" 種穀 (Grain planting) section in *Nong sang jiyao* 農桑輯要 (Collected essentials of agriculture and sericulture). Both the Jiajing version and the Yuan block-printed version of *Nong sang jiyao* give the character as 出, and even the Kanazawa Library 金沢文庫 manuscript of *Qimin yaoshu* also has it as 出 (Miao 1988). Actually, since 出 meant cleaning and eliminating, and 治 stood for managing in premodern times, it was more proper to choose 出 rather than 治 to match *wuhui* 蕪蔵 (over-grown grass and uncleanness), as well as avoiding the repetition of 治.

A further example can be found in "on a sunny day, grind the grains with an ovoid roller (惟快日用碌碡碾過)" (Sun and You 2014, 778) in the "Daxiao mai" 大小麥 (Barley and wheat) section in *Gu pu*. Miao Qiyu notes that the character *kuai* 快 was changed to *fu* 伏 in all versions by later generations. Miao also points out that according to the "Daxiao mai" 大小麥 (Barley and wheat) chapter in *Qimin yaoshu* from which the above sentence was quoted, the Northern and Southern Song versions of *Qimin yaoshu* and the "Daxiao mai" chapter in the Yuan block-printed version of *Nong sang jiyao* give it as 快, while the Hall of Martial Valor edition of *Nong sang jiyao*, which was compiled based on the *Yongle dadian* 永樂大典 (Great compendium of the Yongle era), gives it as *ying* 映. However, as Miao states, in *Yongle dadian*'s 22181st

[4] See "Yueling" 月令 (Monthly ordinances) in *Liji* 禮記 (The book of rites) and *Huangfu Gui zhuan* 皇甫規傳 (Biography of Huangfu Gui) in *Hou Han shu* 後漢書 (Book of the Later Han).

chapter "Mai" 麥 (Wheat), quoting from Wang Zhen's *Gu pu*, the character is given as 快, and was wrongly changed to 伏 and 映 by later generations, with 快 being the oral form of *hao* 好 (good) (Miao 1994, 511–512). Miao's analysis is certainly correct, but he was misled by the collated version of Wang Yuhu. In fact, 快 is in the Jiajing version and the quotation in the *Yongle dadian*, and it is likely that the *Siku* copies changed *kuai ri* 快日 (sunny day) in error due to mistaken understanding.

When one considers the reasons for this, the most important should be that, due to the limits of research conditions at that time, it was impossible to read all available versions extensively and make a truly comprehensive analysis and collation. According to scholars' research, not only discrepancies between different editions should be paid attention to, but also some key distinctions may even be revealed in different printing impressions, and such information can reveal crucial clues for studying the document (Guo 2015). As time passes, libraries are becoming more and more open, and thus more facsimiles of premodern books can be shared online in digital form. Therefore, under today's conditions, even some previously collated works need to be reevaluated.

Furthermore, whether the method used is facsimile reproduction or typesetting with punctuation and collation, each has limitations to varying degrees, yet they are complementary to each other. On the one hand, as we all know, facsimiles can retain the original appearance of the work to the maximum extent, but may not be so convenient to read and to present collations. In addition, those who have carried out collation work must all share the experience that, despite every effort to be meticulous, uncollated parts are inevitable, which may mislead readers. On the other hand, much information contained on the pages of old texts can often be lost in typeset editions. It should be said, though, that the two methods of facsimile reproduction and punctuating and collating with typesetting are significant for researchers. Hence, some experts point out that breakthroughs must be made in collating methods in order to truly meet the dual objectives of collating old texts, and preserving their original state. Currently, using the method of placing a facsimile reproduction and a collated and punctuated typeset version of the text next to one another can effectively resolve this problem, and collators can choose methods of varying difficulty according to their levels of expertise (Huang 2008, 388). This facsimile–text format has been recently adopted in the international collaboration between Zhang Baichun, Tian Miao 田淼, Jürgen Renn, Matthias Schemmel and Peter Damerow to produce *Chuanbo yu huitong qiqi tushuo yanjiu yu jiaozhu* 传播与会通：《奇器图说》研究与校注 (Transmission and integration—*Qiqi tushuo* [Illustrations and descriptions of extraordinary devices]: New research and annotated edition). With a combination of photo-facsimiles, transcriptions, and collated and annotated text, the book retains the original form of the work while offerings collations convenient for reading and research, the first time this technique has been used in China. Applying this new collating method, the IHNS has organized

and planned the publishing of *Zhongguo keji dianji xuankan*, in which Chinese scientific and technological premodern works have been collated in the facsimile-text format, thus offering reliable collations of high quality for academic research (Zhang and Sun 2014).

Finally, during our practice of collation, we found that definitive collation, generally applied by academic circles, was also limited to some degree, and that this pertained to the question of the objective of collation. In general, we hold the view that collation should be author-oriented, and aim to restore the work to its *status quo ante*. Ni Qixin 倪其心 observed that the purpose and duty of the collation of premodern works were to maintain the truth and strive to restore them to their original state, thereby offering reliable texts close to the original (Ni 1987). What Ni advocated exactly coincides with the "authorial intentions rationale" propounded and promoted by Fredson Bowers and Thomas Tanselle (Su 2009, viii–ix). Naturally, this is the necessary orientation of historical research, as we hope to restore the author's original manuscript, for only then can documents be studied with scrupulous faithfulness to the actual historical situation at that time. The point, however, is not whether we can achieve this ideal, though in fact we have no other choice but to endeavor to do so. The real issue is that this is merely a part of historical research, despite its fundamental nature and significance. Most texts undergo change during circulation, something that gives rise to the need for collation. However, each variant version will have its own influence over time, as well as its specific readers and researchers. In other words, every version possesses its own unique history of circulation and research. In this case, whether it be "genetic criticism" originating from France or the "textual sociology" theory of Jerome McGann, the goal is to rebuild the event chain for the formation of a text through empirical research, rather than establishing a final, definitive text (Su 2009, ix–x). "Author-oriented" texts, however, eliminate the textual variations generated by dissemination, so if the definitive texts serve as our main source, we would know nothing about their spread and influence, and sometimes even become baffled because of being misled. Take *Wang Zhen nongshu* as an example. This work enjoyed wide circulation and exerted far-reaching influence after being published. Through the analysis of quotations from it in over ten other important works, including *Nongzheng quanshu* 農政全書 (Complete treatise on agricultural administration), we found that the quotations were entirely based on editions derived from the Jiajing version, while the later *Siku* lineage versions barely influenced them. For instance, in the "Qutian" 區田 (Pit field) section of "Tianzhi men" of *Nongqi tupu*, the sentence "references are also drawn from *Fan Shengzhi shu* 氾勝之書 (Fan Shengzhi's work on agriculture) and *Wuben shu* 務本書 (Treatise on engagement in agriculture) (又參考《氾勝之書》及《務本書》)" (Sun and You 2014, 178) is quoted in *Nongzheng quanshu*. According to Shi Shenghan's annotation in *Nongzheng quanshu jiaozhu*, the quotation from *Wang Zhen nongshu* is actually *Wuben*

xinshu 務本新書 (New treatise on engagement in agriculture). As for "on all hills, hillsides and terraced hillocks (諸山陵、傾阪及田丘城上)" (ibid.), Shi notes that the quotation from *Wang Zhen nongshu* lacks the character of *tian* 田 before *qiucheng shang* 丘城上 (Shi 1979). Actually, Shi's judgement was based on the *Siku* lineage versions collated by Wang Yuhu, while the quotations in the lineage of the Jiajing version are identical to those in *Nongzheng quanshu*. Such examples are too numerous to detail here (Sun and You 2014). Based on the features of variant texts in quotations of *Nongzheng quanshu* from *Wang Zhen nongshu*, it can be inferred that Xu Guangqi's work drew on editions derived from the Jiajing version. Were we for the moment not to discuss the merits and demerits of the editions derived from the two versions (Jiajing and *Siku*), and only speak about the historical significance of the Jiajing version, being unclear about the full situation, we would, like Shi, because he relied solely on the versions of the *Siku* lineage, jump to the wrong conclusion about Wang Zhen's original work. Yet the Jiajing lineage of versions, which had enjoyed wide popularity, were totally overshadowed because of the publication and widespread distribution in the twentieth century of *Wanyou wenku* 萬有文庫 (Universal library series) version and the collated version by Wang Yuhu, both of which belong to the *Siku* lineage.

Through an analysis of the origin and development of different versions, selecting the most reliable version as the master-text for collation, which is also called "definitive collation," is most effective and convenient for returning to an author's original work. The origin and development of versions can bring out the essentials, and collation notes are succinct and to the point. However, the limitation is that the above method is not capable of fully presenting textual variations generated during circulation, resulting in the loss of many essential clues for studying the history of textual transmission and research. The reason is that under the paradigm of "definitive collation," it is unnecessary to list the textual variants that are wrong or of little significance in that they are not conducive to restoring original texts. However, from the perspective of "genetic criticism," for a version, especially one that was popular though not necessarily so reliable, it is still absolutely essential to analyze and record its variant wording, because features of such variants can indicate the textual forms of dissemination, and reveal the transmission and influence of different textual forms. Problems concerning "definitive collation" were pointed out by scholars long ago. For instance, Hashimoto Hidemi 橋本秀美 (喬秀巖) stated that the popular versions before the Qianlong and Jiaqing periods and after the Daoguang and Xianfeng periods of the Qing dynasty differed considerably. This was simply due to the fact that the results of a great deal of collation of old books that emerged in the Qianlong and Jiaqing periods, which were certainly not commonly used by scholars of that era, became the prevailing versions for later periods. As for the books and versions adopted by scholars after the Daoguang and Xianfeng periods, the later they were, the closer they approximate to

our current collections. For example, in *Shuowen jiezi zhu* 說文解字注 (Commentary on *Explaining radicals and analyzing compound characters*) by Duan Yucai 段玉裁, below the character *dan* 耽, "Kuafu holds his ears in the north (夸父耽耳在其北)" from "Zhuixing xun" 墜形訓 (Forms of earth) in *Huainan zi* 淮南子 (Master Huainan) was quoted to explain it. Gao You 高誘 comments that "*Daner* 耽耳 means ears hanging down on one's shoulders. 耽 is pronounced *zhe* 褶 (wrinkle) in *yizhe* 衣褶 (wrinkles of clothes). 耽 can also be taken as *she* 攝 (hold or take). (Kuafu) holds his ears, which hang down on his shoulders, with both hands (耽耳，耳垂在肩上。耽讀衣褶之褶。或作攝。以兩手攝其肩之耳也)." The last sentence of Gao's annotation is confusing, while the current popular version provides the annotation that "hold ears with both hands, and live in the sea (以兩手攝耳，居海中)" without mentioning the above variant text. Only after consulting *Huainan zi jiaoshi* 淮南子校釋 (Collations and explanations of *Master Huainan*) by Zhang Shuangdi 張雙棣 can researchers know that the versions of Wang Pu 王溥 and Zhu Dongguang 朱東光 offered the same annotation, and thus Duan Yucai referred to one of these two versions. Therefore, it is necessary to pay attention to the books and versions employed by authors (Hashimoto 2009). However, "definitive collation" has no way to resolve this requirement.

Of course, once we have the essentials of the situation regarding the origin and development of different versions, the listing of variants in the text can be efficiently laid out. There is no need to repeat variant text in the various versions, and most of the work is completed through listing the characteristic variant texts in the originating copy of each sub-lineage of different editions. Only exceptions to variants in sub-lineages of each version, which are usually few in number, need to be listed, and can be appended to the end of each chapter or the whole book for reference, instead of in the facsimile-text part.

4 Concluding remarks

The currently prevalent concept and practice of methods for the collation of old books originated from the Movement for Editing National Cultural Heritage a century ago. Since the founding of the People's Republic of China, the collation process has undergone constant theoretical planning, summing up and improvement, as well as widespread practice. Consequently, a large number of works have been edited and published, including many on science and technology. Nonetheless, a wealth of texts remain to be rooted out and collated, and theory and practice have yet to be further refined and summed up. In this period of more open and favorable academic conditions, previously collated works should also be reevaluated. Based on practical experience, a new paradigm for the collation of old books is proposed, which we call "Facsimile-Definitive Edition-Variant Collation." This new paradigm embodies "three

principles and two intentions" that we hope to follow in collation. On the one hand, the "three principles" advocate that facsimile reproduction should be used to provide images that retain the original appearance of the text to the highest degree, complemented by a corresponding punctuated and collated version of the text, with characteristic textual variants of different versions appended. On the other hand, the "two intentions" hold that collation should be author-oriented and strive to reproduce the author's original text, and that the network of textual dissemination should be fully taken into account. Only in this way can our comprehensive historical research on premodern texts be fully sustained.

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