多元文化中的科学史

第十届国际东亚科学史会议论文集

EDITED BY JIANG XIAOYUAN
江晓原 主编

HISTORY OF SCIENCE IN THE MULTICULTURE

PROCEEDINGS OF THE TENTH INTERNATIONAL CONFERENCE ON THE HISTORY OF SCIENCE IN EAST ASIA

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内 容 提 要

本书是2002年第十届国际东亚科学史国际会议论文集，内容涉及东亚科技发展史研究的各领域，包括古代数学、统计学、天文学、生物医药学、科技文化、科技哲学、工艺技术以及古今中外科技思想比较研究等方方面面，充分反映了现今学术界关于东亚科技史研究的前沿课题与水平，同时也是对过去成就的一次总结，对广大科技史研究者将有很好的参考价值。

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序

江晓原

上海交通大学1999年3月成立中国第一个科学史系后，在国内外科学史界产生了广泛影响。1999年8月，在新加坡召开的第九届国际东亚科学史会议上，各方面人士希望上海交通大学科学史系来承办第十届国际东亚科学史会议(The 10th International Conference on History of Science in East Asia，简称10th ICHSEA)。不久此事得到上海市人民政府外事办公室的正式批准(沪府外办综[2000]1557号)，并得到"国际东亚科学—技术—医学史学会"的正式授权，上海交通大学遂决定独家承办此次会议。

"国际东亚科学史会议"(ICHSEA)是有关中国科学史最重要的系列国际会议。最初名为"国际中国科学史会议"(ICHSC)，第一至第六届会议承办简况如下：

第一届，鲁汶大学，比利时，鲁汶，1982

第二届，香港大学，香港，1983

第三届，中国科学院自然科学史研究所，中国，北京，1984

第四届，悉尼大学，澳大利亚，悉尼，1986

第五届，加利福尼亚大学，美国，加利福尼亚圣迭戈，1988

第六届，剑桥大学，英国，剑桥，1990

此后分为两个系列，其一为"国际东亚科学史会议"(ICHSEA)，承办简况为：

第七届，京都大学，日本，京都，1993

第八届，汉城大学，韩国，汉城，1996

第九届，新加坡国立大学，新加坡，1999

第十届，上海交通大学，中国，上海，2002

另一个系列保留原先名称，承办简况为：

第七届，中国科学技术史学会，中国，深圳，1995

第八届，柏林工业大学，德国，柏林，1998

第九届，香港城市大学，中国，香港，2001

第十届，哈尔滨工业大学，中国，哈尔滨，2004

在上述两个系列中，以"国际东亚科学史会议"系列更为重要，举办者需经"国际东亚科学—技术—医学史学会"正式授权，通常参加者中70%左右为海外学者。而另一系列的参加者则以中国学者为多，当然也有不少海外学者参加。

历次会议已经构成丰富的学术资源，故此次上海交通大学科学史系承办第十届会议，有多方面的意义。

(1) 提高了中国科学史界的国际地位。

(2) 促进了多学科交叉研究。

(3) 促进了中国学者与国际同行进一步对话。

(4) 增进了上海交通大学在科学史界的国际声望。

第十届国际东亚科学史会议由上海交通大学科学史系主办,中国科学院自然科学史研究所(北京)和剑桥李约瑟研究所(英国)协办。会议国际顾问委员会及学术委员会包括路甬祥、席泽宗、席文、何丙郁、刘钝、谢绳武等中外著名学者。地方组织委员会由上海交通大学科学史系教师组成,江晓原教授任主席,钮卫星博士任秘书。

全部会务皆由上海交通大学科学史系教师和研究生承担(仅外聘专职翻译一人)。

经过两年的认真筹备,会议于2002年8月20日在上海光大国际会展中心隆重开幕,至23日圆满闭幕。英国剑桥李约瑟研究所所长古克礼博士(Dr. Christopher Cullen)、国际东亚科学—技术—医学史学会会长金永植教授、日本著名科学史家中山茂教授、著名科学史前辈胡道静教授(现已归道山)等,分别来自美国、英国、德国、法国、西班牙、加拿大、以色列、菲律宾、韩国、日本、中国香港和台湾等国家、地区的学者90人,以及中国大陆学者约60人,共约150位中外学者参加了会议。上海交通大学谢绳武校长致开幕辞,宣读了席泽宗院士的贺信(他因眼科手术不克前来),金永植、中山茂、胡道静在开幕式上作了讲话。江晓原教授主持了开幕式,古克礼博士主持了欢迎晚宴,刘钝教授主持了闭幕式。

虽然由于本次会议恰好和北京的国际数学家大会在同一天开幕,媒体的注意力大都被前者所吸引,但是中国中央电视台、东方电视台、《光明日报》、《科学时报》、《文汇报》、《中华读书报》、《新闻晨报》等媒体仍然纷纷对第十届国际东亚科学史会议作了报道。

第十届国际东亚科学史会议有如下四个主题:

(1) 科学在东西方文化交流中的角色。

(2) 科学的文化功能:回顾与展望。

(3) 科学史在教育中的作用。

(4) 科学史研究与大众传媒的关系。

会议地方组织委员会既考虑到地域代表性,同时又注重学术声望和质量,共安排了6次大会邀请报告。分别为:

(1) 金永植(汉城国立大学教授):《让我们思考一下基本问题》。

(2) 古克礼(剑桥李约瑟研究所所长):《以中国特色面向世界科学史》。

(3) 辛元欧(上海交通大学教授):《关于郑和宝船复原的相关思考》。

(4) 徐光台(台湾清华大学教授):《熊明遇〈绿雪楼集〉初探:以〈则草〉为重心》。

(5) 律山茂久(日本学国际研究中心):《金钱与医学史》。

(6) 刘钝(中科院自然科学史研究所所长):《中国科学史研究及其建制化》。

这些报告普遍被认为是"出乎意料的精彩"。其中上海交通大学科学史系辛元欧教授的报告,准备充分,论证有力,积极使用了多媒体展示技术,尤受好评。

除大会报告外,本次会议还收到报告论文 90 多篇,这些论文同时进行小组报告。在三个半天的讨论时间里,共有 24 个不同专题的小组,在 4 个会议厅同时进行了报告。

此次会议上还完成了国际东亚科学—技术—医学史学会首脑的换届,刘钝教授当选新一任会长。会上还宣布 2005 年第十一届国际东亚科学史会议将在德国慕尼黑举行。

会议期间,组织委员会安排了参观上海博物馆和外滩夜游两项活动,帮助各国学者领略腾飞的大上海迷人风貌,同时也提供了另一种社交的氛围,受到各国学者的热烈欢迎。

此次大会获得圆满成功,与会代表认为,大会还有两个特点值得注意。

一是新生力量闪亮登场。在此次会议上,世界各地年轻的科学史研究者纷纷亮相,介绍了他们富有生气的研究成果。由于以往出席此类会议的经常是资深学者,新秀或困于经费,或限于资历,往往得不到机会参加。此次会议致力于扭转这种状况,根据申请和提交论文的情况,地方组织委员会为来自各国的一些青年学者免除了注册费和住宿费,使他们得以前来参加盛会。这一景象,使得与会的资深学者——前面好几届会议他们都曾参加——感慨万端,发现"原来我们的事业真的后继有人"。

二是组织工作颇为完善。在会议筹备期间,地方组织委员会申请了会议专用电子信箱,并指定"SHC 频道"网站(http://shc-channel. top263. net)为会议官方信息网站。所有在此次会议上报告的论文,都事先从网上将摘要传送给会议地方组织委员会,并印刷在与会代表人手一册的会议手册中。此外大量注册、通知、订房等等会务工作,都借助网络通讯,完成了远程受理。与会各国学者普遍认为,会议组织井井有条,对于地方组织委员会所做大量细致的工作,以及全体会务工作人员的较高素质,留下了深刻印象,给予了多方好评。

此次大会的论文集,经过两年多艰苦的编辑工作,终于可以付梓了。

本次大会的秘书钮卫星博士为这部文集的编纂工作贡献了最多的心力,我要借此机会向他表示最真切的感谢和敬意。没有他的辛勤工作,就不会有这部论文集。

我也要感谢本系的关增建教授、纪志刚教授、孙毅霖教授,他们也为这部论文集的编纂做了许多工作。

2005 年 5 月于上海交通大学

目 CONTENTS 录

生物、医学 BIOLOGY AND MEDICINE

技 术 TECHNOLOGY

科技政策、文化、哲学 SCIENTIFIC POLICY, CULTURE, PHILOSOPHY

数　学

MATHEMATICS

Imperial Mathematics and Western Learning during the Kangxi Reign (1662—1722): Some New Evidence[①]

Catherine Jami (REHSEIS, CNRS & Université de Paris 7) and
Han Qi (IHNS, CAS)

The *Yuzhi Shuli Jingyun* ("Imperially Commissioned Collected Essential Principles of Mathematics", 1723) has until now been described as the outcome of ten years of work done by a number of Chinese scholars (Han and Bannermen) at the Office of Mathematics (Suanxueguan). This Office was created by the Kangxi Emperor in 1713, and supervised by his third son, Yinzhi (1677~1732). This is how its task and achievements are described in the *Da Qing Huidian Shili* (1734):

> In the fifty-second year of the Kangxi reign, an Office of Mathematics was established in the Studio for the Cultivation of the Youth (Mengyangzhai) located in the Changchunyuan.[②] A Grand Minister well versed in mathematics was put in charge of its affairs. The Emperor's Third Son was specially designated to supervise it. Young men from the honourable families of the Eight Banners were chosen to study mathematics there. In addition, Grand Ministers and Hanlin Academicians, both Manchus and Hans, were appointed to compile the *Shuli Jingyun* and the *Lülü Zhengyi* which were completed, prefaced and printed in the first year of the Yongzheng reign [1723].[③]

In this paper, we would like to provide and discuss new evidence that *the Shuli jingyun* was not merely the result of ten years of work of the scholars appointed to the Office of Mathematics. Instead, it was the final outcome of the lectures in mathematics that Kangxi received from several Jesuits since 1688, that is, 25 years before the work was commissioned, and 35 years before it was printed.

1688 was an important year in the history of Western learning (xixue) in China:

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① The research for this article was carried out as part of the project "Scientific Exchanges between Europe and China in the 17th and 18th Centuries", jointly funded by CNRS (France) and CAS (PRC). The results of this project, which are outlined here, are presented in detail in Catherine Jami and Han Qi, "The Reconstruction of Imperial Mathematics in China during the Kangxi Reign (1662~1722)", *Early Science and Medicine* 8/2 (2003), forthcoming, and Han Qi and Catherine Jami, "Kangxi shidai xifang shuxue zai gongting de chuanbo-yi An Duo he Suanfa zuanyao zonggang de bianzuan wei li", Ziran kexueshi yanjiu (2003) forthcoming.

② The imperial villa located in the outskirts of Beijing where the Jesuits used to go to teach the emperor.

③ Quoted in Catherine Jami, "Learning mathematical sciences during the early and mid-Ch'ing, " in *Education and Society in Late Imperial China*, 1600~1900, eds. Benjamin A. Elman and Alexander Woodside (Berkeley, 1994), P223~256, P238.

Ferdinand Verbiest (Nan Huairen, 1623～1688) died in January of that year, and one month later five Jesuits sent to China by the French King Louis XIV as his "Mathematicians" reached Beijing. They were in fact competitors to the Portuguese mission already settled there. Verbiest had been both the Calendar Administrator (zhili lifa) at the Astronomical Bureau (Qintianjian) and Kangxi's tutor in mathematics and astronomy. After he died, no other Jesuit combined both these positions together with an unquestioned authority within the Jesuit mission.

The late Li Yan was the first to point to the fact that the *Jihe yuanben* included in the first part of *Shuli Jingyun*, although having the same title as the translation of 1607 by Matteo Ricci (Li Madou, 1552～1610) and Xu Guangqi (1562～1633), based on the Latin edition by Clavius (1574),[①] was a different work.[②] In fact it was based on another textbook that had the same title, by Ignace-Gaston Pardies (1636～1673), who taught mathematics at the Jesuit College Louis-le-Grand in Paris.[③] It should be noted that "Elements of Geometry" were a genre in the seventeenth century, so that no one in Europe at the time would have expected a work bearing that title to be the Greek classic. After Li Yan, other historians of mathematics have discussed several aspects of the process by which Pardies's work was translated first from French into Manchu, and then from Manchu into Chinese, by Jean-François Gerbillon (Zhang Cheng 1654～1707) and Joachim Bouvet (Bai Jin 1656～1730), two of the French "King's Mathematicians", in the early 1690s.[④] It is well-known that this translation was eventually revised and edited so as to become juan 2 to 4 of the first part of *Shuli Jingyun*.

The Suanfa Manuscripts

Recently, we have found a number of mathematical manuscripts that played a role similar to that of Bouvet and Gerbillon's translation, but in the field of calculation (this seems to be the best translation of suanfa in this context, which is often rendered by "arithmetic"). We have found evidence that most if not all of them had been authored by Antoine Thomas (An Duo, 1644～1709), a Belgian Jesuit, and therefore a member of the Portuguese mission, who was Verbiest's assistant from 1685 to 1688, and then took up some of his tasks after 1688.

Before leaving for China, Thomas had taught mathematics at Coimbra, and his lecture

① On this translation, see Engelfriet 1998.

② See Li Yan, Qian Baocong, Kexueshi quanji (Shenyang, 1998, 12 vols.), vol. 6, P412～415.

③ Ignace Gaston Pardies, Elémens de géométrie, où l'on peut apprendre ce qu'il faut sçavoir d'Euclide, d'Archimède, d'Apollonius et des plus belles inventions des Anciens et des nouveaux Géomètres (Paris, 1671).

④ These include Li Zhaohua, Liu Dun, Han Qi and Catherine Jami. See e. g. Liu Dun, "Shuli jingyun zhong Jihe yuanben de diben wenti," Zhongguo keji shiliao 12/3 (1991), P88～96, and Liu Dun, "Fang Tai suo jian shuxue zhenji," Zhongguo keji shiliao 16/4 (1995), P8～21.

notes in Latin were published in 1685, when he was already in China. The title given to these lecture notes is interesting: Outline of Mathematics comprising various treatises of this science, laid out briefly and clearly for novices and candidates to the China mission. ① Clearly they were intended as a textbook for the training of candidates for the China mission. Thomas himself had applied for the mission repeatedly, putting forward his skills as a mathematician in his application letters. His years in China were all spent in Beijing, working as a mathematician and astronomer.

As to his mathematical lectures to Kangxi, we know that some of them were given at the time when Gerbillon and Bouvet were teaching geometry. Among the manuscripts we have found, we will briefly discuss the three most important ones. For two of these we have found positive evidence that Thomas was the author; the third one can be ascribed to him with much likelihood. All three titles include the word suanfa:

—*Suanfa yuanben*②
—*Suanfa Zuanyao Zonggang*③
—*Jiegenfang Suanfa*④(of which there also exists an abridged version entitled *Jiegenfang Suanfa Jieyao*⑤)

We have been able to locate several copies of each of these manuscripts, in China, Japan, and France. ⑥ There is also one manuscript in Manchu, which appears to be a translation of *Suanfa Zuanyao Zonggang*. ⑦ According to Bouvet and Gerbillon, Thomas taught in Chinese rather than in Manchu, and one of his colleagues, Tome Pereira (Xu Risheng, 1645～1708), usually acted as an interpreter during the lessons. Therefore we may suppose that Chinese was the original language of these manuscripts.

Although it is neither an extensive nor a literal translation, *Suanfa Zuanyao Zonggang* is in great part based on Thomas' Latin treatise, the Synopsis Mathematica. This is the main evidence for attributing authorship of the former to him. On the other hand, given the fact that Thomas needed an interpreter when he was teaching orally, it is more than likely

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① Antoine Thomas, *Synopsis Mathematica Complectens Varios Tractatus quo Hujus Scientiae Tyronibus et Missionis Sinicae Candidatis Breviter et Clare Concinnavit*. Douai: Mairesse, 1685.

② Bibliothèque Municipale de Lyon, France (BML), Ms 82～90 C.

③ BML, Ms 75～80 A, Ms 82～90 A.

④ BML, Ms 39～43.

⑤ BML, Ms 82～90 B.

⑥ The copies used in what follows are those mentioned in the previous footnotes. Besides the Gugong Library in Beijing, we have located other copies in various libraries in Beijiing, and at the Tohoku University, Sendai (Japan). We are grateful to Prof. Yoshida Tadashi for his help there.

⑦ The Manchu version, kept at the Bibliothèque Nationale de France, has been studied by Jean-Claude Martzloff, "The Manchu Mathematical Manuscript Bodoro arga i oyonggongge be araha uheri hesen in bithe of the Bibliothèque Nationale, Paris: Preliminary Investigations". Unpublished Communication presented to the 3rd International Conference on the History of Science in China, Beijing, August 1984.

that one or several Chinese literati helped with the writing of the treatise. This may account for the attribution of Suanfa zuanyao zonggang to Nian Xiyao (best known as the author of the first Chinese treatise on perspective); he may well have worked on it with Thomas. ①

As to *Jiegenfang Suanfa*, and its abridged version *Jiegenfang Suanfa Jieyao*, we have not been able to find a source in Latin or in a European language on which Thomas could have based himself. On the other hand there are several references to the fact that he composed a treatise of algebra in his correspondence and that of other Jesuits. One long report by Jean-François Foucquet (Fu Shengze 1665～1741), written in 1716, refers to *Jiegenfang Suanfa* as "the old algebra" (Foucquet's own treatise being entitled the "New algebra", Aerrebala xinfa). It also mentions that the treatise was jointly presented to Kangxi by Thomas and Alexandro Cicero (Luo Lishan, 1639-1703). This would have been in 1694 or 1695. To the best of our knowledge, the word aerrebala first occurs in the Foreword to *Jiegenfang Suanfa*.

The *Suanfa yuanben's* content is similar to that of Book VII of Euclid's *Elements*. ② On the other hand, it is not a straightforward translation, as the order and structure of the definitions, axioms and propositions has not been kept. In fact, like the *Shuli jingyun*, the manuscript *Suanfa Yuanben* is a sequence of paragraphs that are numbered (diyi, dier, disan...) without being given various statuses (definitions, axioms, propositions...). There is no direct evidence that Thomas is the author. Many copies of the manuscript are found as an appendix (fu) to the *Jihe Yuanben*. On the other hand, there is no Manchu version of it known to us, and Gerbillon and Bouvet who give details concerning the treatises they produced for the emperor (geometry, philosophy, anatomy) do not mention it. ③ *Suanfa yuanben* is the matching piece to *Jihe Yuanben* in a reconstruction of mathematics that gives it a dual structure: calculation (as we shall see below, this term seems more appropriate here than "arithmetic") and geometry. Thomas was the emperor's tutor in arithmetic, and it is therefore not unlikely that he may have produced the work that gives the foundations for his two other works.

Why New Treatises?

We would now like to address the question of why treatises were written in order to teach the emperor mathematics. Several reasons can be given, and the issue is best understood in context. It should be kept in mind that mathematics was only one among several subjects in which the emperor had been tutored since his youth. Lecture notes on the

① See Han Qi and Catherine Jami, "*Kangxi Shidai Xifang Shuxue Zai Gongting de Chuanbo*".

② Han Qi, *Kangxi Shidai Chuanru de Xifang Shuxue ji qi dui Zhongguo Shuxue de Yingxiang* (Beijing, PhD Dissertation, IHNS, 1991), P29～30.

③ Catherine Jami, "For Whose Greater Glory? Jesuit Strategies and Science During the Kangxi Reign", forthcoming in Encounters and Dialogues. Proceedings of the International Symposium, Beijing, P14～17 October 2001.

Four Books (Sishu, 1676) and on some of the *Five Classics* (Wujing: Shujing 1679, Yijing 1683...)[①] had already been published before 1688. It is therefore quite possible that Kangxi intended the three Jesuits' textbooks to be eventually published when they started their lessons.

When Gerbillon and Bouvet produced their translation of Pardies' treatise, they wrote a preface for it, which was left out when the *Shuli Jingyun* was compiled. It points to the reason why the need for a new geometrical textbook was felt:

> *Jihe yuanben* (It means the origin of numbers. In the one written by Matteo Ricci, because the method of composition was not clear, it was difficult to elucidate what comes first from what comes later. So we have done another translation.) is the foundation of measuring and counting the myriad things. It is the origin of astronomy, geography, and others. In general, those who study it must begin with what is easy and then reach what is difficult. Without skipping a step, they penetrate subtlety. Therefore the obvious shapes are given first, the complicated shapes afterwards. Within each proposition, the two are put together similarly: first what is easy to learn, and afterwards what is complicated. The exposition is in the right order, so that the students achieve gradual progress. When the general idea can be understood by looking at the figures, we do not seek to give the meaning and to write detailed explanations.[②]

This is the only criticism addressed to Ricci (usually praised as the "founding sage" of the Jesuit mission in China) that we know of under the brush of any Jesuit in a text written in Chinese, and this one was written for none less than the emperor. While the primacy of geometry as the foundation of the whole of mathematics is reasserted, the main theme of this preface is the proper way to write out and study geometry. The main requirement is that the order of exposition has to correspond to the student's progress in his study. This is very remote from the structure of Euclid's *Elements* (which was, of course, not originally written or understood to be a textbook). In seventeenth century Europe it was a general concern that mathematics, whose essence was to be clear, should be written out so as to be grasped as clearly as possible by the reader. Pardies had dwelt on the issue quite at length in his own preface (1671), that is, twenty years earlier, where he criticised "Euclid and ordinary [ancient] authors" as being "difficult and boring".[③]

Although it is based on an Euclidean treatise, *Suanfa Yuanben* differs fom *Jihe Yuanben* in that it is not presented as pertaining to the study of quantity. It has a rather long

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① Kent R. Guy, *The Emperor's Four Treasuries. Scholars and the State in the Late Ch'ien-Lung Era* (Cambridge, Mass., 1987), P216.

② *Jihe yuanben*. Manuscript. Gugong Library nr. Lü 835.

③ Jami, Catherine, "From Clavius to Pardies: The Geometry Transmitted to China by Jesuits (1607～1723)", in *Western Humanistic Culture Presented to China by Jesuit Missionaries* (XVII-XVIII centuries), ed. Federico Masini, (Rome, 1996), P175～199, esp. P187～188.