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Report on Research Project: Jesuit Translations of Renaissance Scientific, Technical, and Medical Knowledge to Late Ming China

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The surprising rediscovery of the believed-to-be-lost "translation" of Georgius Agricola's mining science masterpiece *De re metallica* (1556) into Chinese by the German Jesuit Adam Schall von Bell (Chinese name Tang Ruowang 湯若望; 1592–1666) in 2015 has led to increasing interest and activity in pertinent research, both in Germany and in China. Being associated with Agricola, one of the most significant protagonists and polymaths of the German Renaissance, and with Schall von Bell, the most influential China-bound German Jesuit missionary, this text is of extraordinary importance for the history of East-West relations as well as for German cultural history. It was at the University of Tübingen that a group of researchers around Hans Ulrich Vogel 傅汉思 at the Department of Chinese Studies immediately launched reading and translation efforts after the rediscovery of Schall von Bell's text. They soon decided to include other related Jesuit works in Chinese language in order to apply an intertextual approach and allow for comparative perspectives.

In 2018, the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG) granted a research project under the guidance of Hans Ulrich Vogel with the title "Translating Western Science, Technology and Medicine to Late Ming China:

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Convergences and Divergences in the Light of the *Kunyu gezhi* 坤輿格致 (*Investigations of the Earth's Interior*; 1640) and the *Taixi shuifa* 泰西水法 (*Hydromethods of the Great West*; 1612)"[1] to enable the involved scholars to fully focus their attention to the task. The core researchers are Hans Ulrich Vogel and Cao Jin 曹晋, who together have taken charge of the *Kunyu gezhi* (hereafter KYGZ) itself, and Sabine Kink 金霞笔, who began to work on the *Taixi shuifa* (hereafter TXSF), another important but thus far neglected Jesuit Chinese technical text. A number of associated scholars have been contributing with their own objectives as well.[2]

One year later, in 2019, the Institute for the History of Natural Sciences at the Chinese Academy of Sciences (CAS-IHNS) in Beijing became involved, and with funds from the Sino-German Center for Research Promotion (CDZ) and organizational support by the European Centre for Chinese Studies at Peking University (ECCS) hosted a Chinese-German conference at the CDZ on the topic.[3] This meeting became the first of many for the following years of deepened cooperation and the establishment of a joint CDZ mobility program with the title "Transfer of Technical and Scientific Knowledge between Europe and China during the Early Modern Period/近代中欧技术和科学知识的转移," allowing numerous mutual visits for the purpose of academic collaboration between scholars working at Chinese and German universities.[4]

In Tübingen, translation work progressed onward, with selected text passages of the KYGZ and TXSF being added to the teaching material of the course "Translating Western Science, Technology and Medicine to Late Ming China" for advanced MA and PhD students of Chinese studies under the lead of Hans Ulrich Vogel, Cao Jin, and Sabine Kink, taking place every semester even during the pandemic.[5] As a result, highly reliable, unified, and standardized translations have been obtained, which has

1 For the website of the project, see https://uni-tuebingen.de/fakultaeten/philosophische-fakultaet/fachbereiche/asien-orient-wissenschaften/sinologie/forschung/kunyu-gezhi-taixi-shuifa-dfg/.

2 Scholars associated with the project as Project and Translation Collaborators are Christine Moll-Murata and Beatriz Puente-Ballesteros, as associated researchers Christian Buskühl, Sebastian Demuth, Alexander Jost, Jonas Schmid, Anna Strob, Thomas Zimmer, and as MA or PhD students Patrick Aberle, Han Qijin 韩奇金, Sheng Jia 盛佳, and Katharina Viklenko. For more details, see https://uni-tuebingen.de/fakultaeten/philosophische-fakultaet/fachbereiche/asien-orient-wissenschaften/sinologie/forschung/kunyu-gezhi-taixi-shuifa-dfg/persons/.

3 For more details about the 2019 Beijing workshop, see Liu (2019).

4 For members having participated in the CDZ mobility program, see https://uni-tuebingen.de/fakultaeten/philosophische-fakultaet/fachbereiche/asien-orient-wissenschaften/sinologie/forschung/kunyu-gezhi-taixi-shuifa-dfg/mobility/.

5 Besides the KYGZ and TXSF, other related treatises of which extended passages have been translated and discussed in our class are the *Investigation into Phenomena in the Atmosphere* (*Kongji gezhi* 空際格致, ca. 1633), *Essentials of Gunpowder Warfare* (*Huogong qieyao* 火攻挈要, ca. 1643), *The Meaning and Methods of Measurement* (*Celiang fayi* 測量法義, 1608), *On the Farseeing Telescopes* (*Yuanjing shuo* 遠鏡說, 1626), *Illustrated Explanation of Testing Air* (*Yanqi tushuo* 驗氣圖說, 1671), and *An Explanation of the Cold-and-Hot Meter for Testing Air* (*Yanqi hanshubiao shuo* 驗氣寒暑表說, ca. 1700).

enabled us to further refine the ongoing study of the texts and their contents and to enhance our understanding of the relevant subjects. Moreover, we created a comprehensive glossary of technical terms and published the first results of our research.

The first major component of the Tübingen project, the KYGZ, has in the meantime been completely translated into English, accompanied by commentaries and annotations. This manuscript of five chapters, which is held by the Nanjing Library, is a copy of the Chinese treatise compiled by Schall von Bell and his two Chinese collaborators Yang Zhihua 楊之華 and Huang Hongxian 黃宏憲.[6] After having presented three memorials related to the compilation of the KYGZ, the text opens with a preface on mineralogy and orogenesis and continues then with full-fledged chapters on prospection, assaying methods and instruments, as well as mining practices and relevant tools and machinery. Notes of two readers from the late imperial period are inserted after the table of contents and between chapters 2 and 3. Following the urgent need of the Ming state to generate revenue (Cao 2018), the KYGZ was designed as a practical treatise to improve mining and smelting according to Western examples. On the last days of the dynasty, the Chongzhen emperor (r. 1628–1644), despite strong opposition from conservative scholar-officials, ordered to hand over the KYGZ to local officials to carry out mining and smelting activities according to the methods described within. Research into newly discovered archival documents reveals, however, that although it is highly improbable that the KYGZ was ever printed due to the turmoil of the Ming-Qing transition, it survived into the first years of Qing rule in Beijing. It has, moreover, become evident that the Nanjing manuscript copy is not a complete textual version of the finalized KYGZ, but represents only its first translation phase of 1639 (Vogel and Cao 2024). Nor did it, as formerly assumed, exclusively rely on Agricola's *De re metallica* as its basis, but was instead a compilation of Western mining and smelting knowledge taken selectively from at least five European works in four different languages (Jost 2021).

As an interesting example, with the chapters relating to nitric acid (*aqua fortis*/*qiangshui* 强水) it can be demonstrated which European sources and terminologies were chosen to be included into the KYGZ and how they were translated during the period of Western knowledge transfer to China (Cao 2024). Apart from providing technical instructions, the KYGZ, like other Jesuit treatises on Western science, attempts—and this mainly in its preface—to present its content as part of a system integrating Aristotelian natural philosophy with the more progressive approaches of Agricola's concepts of mineralogy and orogenesis.

The second major component of our project, the *Hydromethods of the Great West* (*Taixi shuifa* 泰西水法, preface 1612), is an ideal object of comparison because—despite its

6 For further, though preliminary information on this manuscript and its rediscovery see Vogel (2016) and Vogel (2019).

similar focus on production techniques—its creation and reception took place under very different circumstances, allowing identification of further important but less obvious facets of the process of West-East knowledge transmission in the early modern period. This treatise in six chapters was jointly composed by the Italian Jesuit Sabatino de Ursis (Xiong Sanba 熊三拔; 1575–1620) and the notable official and Christian convert Xu Guangqi 徐光啟 (1562–1633). It introduced to China three Western hydraulic pumps and deals with methods for storing water and testing its quality, including some medical and therapeutic aspects, all of which is illustrated by a whole series of technical drawings. In addition, the "principles of water" (*shuili* 水理) that underlie a number of natural phenomena are systematically discussed within the framework of the Aristotelian theory of the Four Elements (*sixing lun* 四行論). Unlike the KYGZ, this work is therefore of a rather heterogeneous nature, as it combines theoretical and practical aspects of water and water management, the scientific with more hands-on approaches, and thus brings together the field of technology with medicine and natural philosophy. What the TXSF does share with the KYGZ is that it is based on a number of different sources and not simply the Chinese rendering of a single Western work. Additionally, its chief purpose was to encourage the practical application of relevant Western expertise to agricultural production. This was a sector of the Chinese socio-economic system whose prosperity was considered to be of crucial significance for the benefit of the people and consequently for imperial legitimacy, but at the same time was completely free of the ambiguous, nay negative, perception of mining. Given the fact that active support of the farmers' activities represented one of the fundamental statecraft concerns of Confucian scholar-officials, the TXSF addressed these issues and thus promised to make an important contribution for the benefit of the entire country, despite the foreign origin of its contents. And indeed, it was subsequently distributed relatively widely and reprinted several times. Similar lofty expectations were attached to this treatise from the Western side, albeit for completely different reasons. In the eyes of the Jesuits, the principal purpose of this book project was to attract elite members of the Chinese society and to convince them by means of a well-packed message of the superiority of the Catholic faith—a strategy that within the framework of Matteo Ricci's accommodation policy has been called "indirect mission." However, even though some of the presented scientific insights were extensively discussed in late Ming literati circles, neither were the TXSF's technological innovations widely implemented, nor did the book help Christianity to achieve a major breakthrough in China. As several essays by Sabine Kink, MA and PhD candidate, have shown, this Sino-Western attempt to make knowledge go global came thus to its limits in the longer term, despite its presumed usefulness and reliability. Based on the first English translation of the entire treatise and its paratexts, which has emerged from her collaboration with Prof. Hans Ulrich Vogel and Dr. Cao Jin and will become a

monograph in its own right, she has already published articles on the rhetorical and propagandistic strategies used in the TXSF's prefaces, on content related issues like the creation of snow-flakes in the atmosphere or the influence of the moon on water, and on the reception and further fate of the Western suction-lift pump.[7] This ongoing work will be an essential part of her forthcoming dissertation on the TXSF.

Another milestone of this project and its collaboration with Chinese scholars was the 16th International Conference on the History of Science in East Asia (ICHSEA), which took place in August 2023 at the University of Frankfurt. It formed an excellent venue for presenting research results and discussing them with partners from CAS-IHNS, project associates and other scholars from around the globe. Two panels were jointly organized and achieved much attention from the academic public.[8]

With the project now in its last year, it is the objective of its principal researchers to jointly publish the English translations of both the KYGZ and the TXSF. In addition, two thematic monographs will be finalized, one by Vogel and Cao dealing with the KYGZ, and the other by Kink on the TXSF. It is the intention of both monographs to individually shed light on the problems related to inter-civilizational encounters, especially in the field of useful and reliable knowledge during the early period of globalization, and to gain new insights with regard to questions about convergences and divergences in the historical developments between China and Europe.

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7 See Kink (2020); Vogel, Kink, and Cao (2021); Kink (2021, 2022, 2024).

8 At the ICHSEA conference in Frankfurt in 2023, Cao Jin and Alexander Jost organized two "twin" panels entitled "Knowledge Transfer between Europe and Ming-Qing China—Science" and "Knowledge Transfer between Europe and Ming-Qing China—Technology." Project members and colleagues who lectured in these panels included Sabine Kink, Anna Strob, Jonas Schmid, and Han Qijin. Thanks to the support of CDZ mobility program, it was possible to invite a substantial number of participants from China, including Zhang Baichun 张柏春, Tian Miao 田淼, Sun Chengsheng 孙承晟, Zheng Cheng 郑诚 (all Chinese Academy of Sciences), Shang Zhicong 尚智丛 (University of Chinese Academy of Sciences), Thierry Meynard 梅谦立 (Sun Yat-sen University), and Han Qi 韩琦 (Zhejiang University). Other speakers in the panels included Shi Yunli 石云里 (University of Science and Technology of China), Dominik Sachsenmaier (University of Göttingen), and Angela Schottenhammer (University of Leuven).

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