Zeitschrift: Asiatische Studien : Zeitschrift der Schweizerischen Asiengesellschaft = Études asiatiques : revue de la Société Suisse-Asie

Herausgeber: Schweizerische Asiengesellschaft

Band: 71 (2017)

Heft: 4

Artikel: From the west to the east, from the sky to the earth : a biography of Jaml al-Dn

Autor: Yang, Qiao

DOI: https://doi.org/10.5169/seals-737972

Qiao Yang*

From the West to the East, from the Sky to the Earth: A Biography of Jamāl al-Dīn

https://doi.org/10.1515/asia-2017-0010

Abstract: Jamāl al-Dīn (Zhamaluding 札馬魯丁 d. ca.1289) is probably the most successful and best-documented Muslim astronomer who was active in the Mongol Yuan court. He migrated from Central or West Asia to China and introduced Islamic astronomical, geographical and cartographic knowledge into China. In spite of his high official position and the honorable titles that were granted to him, his biographic information in Chinese sources is scattered, and there is uncertainty in identifying him in non-Chinese sources. This paper attempts to reconstruct Jamāl al-Dīn's life and activities by an in-depth reading and interpretation of the biographic information, supplementing and enriching it with biographies of Jamāl al-Dīn's contemporary astronomers in the Mongol Empire. This article argues that Jamāl al-Dīn achieved success and honor due to his knowledge in various fields that interested the Mongols, his correct reading of the imperial ideology and the political map, and the extensive social networks he built for himself during the decades he lived in China.

Keywords: astronomy, scientific exchange, Mongol Empire, Yuan China, Muslims in China

In Wuzhong (吴忠) city of Ningxia Hui autonomous region, a park of more than 181,000 m^2 is dedicated to the renowned historical characters of the Hui people, China's largest Muslim ethnic minority. Among the many statues of Muslims who lived in various periods spanning from the Yuan dynasty to contemporary China, stands the statue of the Muslim astronomer Jamāl al-Dīn (扎馬魯丁 *Zhamaluding*, d. ca. 1289), wearing a turban and beard, holding an alleged astronomical instrument, and looking at the ground that is full of drawings of constellations. Behind him is Zheng He's (鄭和) fleet, as if the Muslim scientist presaged the coming of China's era of world exploration.

This manifestation of Jamāl al-Dīn reveals the Hui people's self-perception rather than the historical Jamāl al-Dīn. They believe, not without some truth,

***Corresponding author: Qiao Yang,** The Hebrew University of Jerusalem, Har Ha-Tsofim, Jerusalem 91905, Israel. E-mail: qiao.yang@mail.huji.ac.il

that their ancestors started to arrive in China in great numbers during the Yuan period, and contributed to China's administration, literature, art and what we see as the symbol of advancement – science. Jamāl al-Dīn's life, however, tells a somewhat different story. Jamāl al-Dīn migrated to Yuan China to serve the Mongols, who were most likely interested in the interpretation of celestial omens and the prediction of future natural and human events, roles that used to be played by their shamans.[1] Although the Mongols in China officially adopted the Chinese calendrical system in order to legitimate their rule, they did not rely on their Chinese experts exclusively. They imported West and Central Asian astronomers to China to get a second opinion.[2] The upper layer of these foreign astronomers entered the central bureaucracy of the Yuan. Jamāl al-Dīn was one of them, probably the most successful and best documented. He succeeded in winning the Mongol ruler's favor and achieved high official positions and honorable titles. Nevertheless, Jamāl al-Dīn was not Sinicized. He did not know the Chinese language even after living in China for decades.[3] His contact with his Chinese counterparts is a debated topic, but it certainly was not an easy one.

Jamāl al-Dīn's biographical information is scattered throughout the Chinese sources.[4] This paper will supplement and enrich it with biographies of Jamāl al-Dīn's contemporary astronomers in Yuan China in order to provide a fuller picture of Jamāl al-Dīn's colorful life. Many speculations about Jamāl al-Dīn's activities, motivations and relationships cannot be confirmed with certainty. But since they cannot be denied absolutely, either, Jamāl al-Dīn's biography reveals the many possibilities and opportunities that migrant astronomers faced in Mongol China.

Chinggis Khan and his successors had great interest in astral observation and predictive analysis of the heaven. The great khan Möngke (r. 1251–59) was allegedly an intelligent man, enthusiastic about the mathematical sciences. In the early 1250s he commanded a Muslim astronomer to build an observatory, most likely in Qara Qorum. We do not know much about the astronomer except that his name was Jamāl al-Dīn Muḥammad b. Ṭāhir b. Muḥammad al-Zaydī al-Bukhārī, and that he failed to fulfill the order.[5] We can identify him with Jamāl al-Dīn of the Wuzhong statue with some confidence, since the latter was

1 Endicott-West 1999.
2 Allsen 2001: 210–211.
3 *Mishujian zhi*: 28.
4 For two previous biographic studies on Jamāl al-Dīn see Chen/Bai 1997; Van Dalen 2007.
5 *Jāmi' al-tavārīkh* 2: 718.

apparently a Persian speaker and of West or Central Asian origin. And it is very likely that after his failure in Qara Qorum he would try his fortune in China.

Jamāl al-Dīn's first opportunity in China came in the middle or late 1250s, when Qubilai (r. 1260–94), then the governor of northern China appointed by his brother Möngke, summoned Muslim astronomers to his court. Qubilai already had in his service Chinese advisors with knowledge in astronomy, such as Liu Bingzhong (劉秉忠 d. 1274) and Wang Xun (王恂 d. 1281), who endeavored to modify Mongol rule according to Confucian principles of governance.[6] Qubilai may have needed Muslim astronomers to balance their agenda. Jamāl al-Dīn and other Muslim astronomers offered their skills, yet there was no government office available to them.[7] Qubilai seemed to have intended to recruit Muslim astronomers to his imperial guard (*keshig*). Yet Jamāl al-Dīn was obviously not a member of Qubilai's imperial guard. He disappeared from the Chinese sources, only to reappear in 1267.

In the 1250s opportunities for Muslim astronomers in China were very few. An example is the weaver and astronomer Muḥammad al-Bukhārī, who was transferred with his co-workers from the western Tarim region to Qara Qorum, and then to Xijing (西京)[8] to weave silk. His knowledge of astronomy was known to the Mongol court, therefore he was not registered as a weaver; this allowed his descendants to leave the profession and achieve high official positions. Yet al-Bukhārī was not employed as astronomer either. He ended up as the head of a hundred (百夫長 *baifuzhang*) of Hongcheng (洪城) in Hubei, a position with little significance.[9] However, in the 1260s two astronomical offices were established. The Chinese Directorate of Astronomy (司天臺 *sitiantai*), established in 1260, excluded Muslim astronomers.[10] The Office of Western Astronomy (西域星曆司 *xiyu xinglisi*) and the Office of Western Medicine (西域醫藥司 *xiyu yiyaosi*), apparently one bureau with two functions, was established in 1263 and headed by ʿĪsā *kelemechi* (d. 1308), a Nestorian astronomer, physician and interpreter who served in Qubilai's imperial guard. This bureau was later transformed into a medical office.[11] Its astronomical function seems to have been limited.

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6 On the life of Liu and Wang see Chan 1993; *Yuanshi* 164: 3843–3845.

7 *Yuanshi* 90: 2297.

8 Xijing, "the west capital", refers to Datong 大同 in Shanxi province.

9 *Cunfuzhai wenji*: 25–30.

10 *Yuanshi* 90: 2297.

11 *Yuanshi* 8: 147; 134: 3249. The medical bureau was named *Jingshi yiyaoyuan* (京師醫藥院 the Capital Medicine Bureau), later *Guanghuisi* (廣惠司 Broadening Benevolence Office). ʿIsā *kelemechi* is known as Aixue 愛薛 in Chinese sources. On the life of ʿĪsā see Allsen 2001: 27–28, 149–50, 166. For a comprehensive study on ʿĪsa see Kim 2014.

In the meantime, on the other side of the Mongol Empire, Islamic astronomy saw its heyday and many opportunities were open to astronomers. In 1259, Ilkhan Hülegü (r. 1256–65) implemented his brother Möngke's dream of an observatory, but had it constructed in Maragha in northwest Iran.[12] The founder and director of the observatory, Hülegü's astronomer and advisor Naṣīr al-Dīn al-Ṭūsī (d. 1274), was also in charge of all the religious endowments (*awqāf*) in the Ilkhanate.[13] With the finance of the religious endowments and generous elite patrons, al-Ṭūsī hosted many renowned scholars of the time in the observatory and made it a center of learning for the sciences that attracted Muslim and non-Muslim scholars alike. During the late 1250s and early 1260s, Jamāl al-Dīn could have stayed in north China, like Muḥammad al-Bukhārī, manning a position irrelevant to astronomy. Or he could have sought knowledge and position at the Maragha observatory, and been sent back to China by Hülegü or by his son Ilkhan Abaqa (r. 1265–82) as a representative of the Maragha astronomers, since it was a common practice of the Mongol rulers to share human talent among the family. Although migration between China and Iran was full of chalenges, in the Mongol era many merchants, scholars, administrators, and artisans made their way between the two lands.[14] The diagrams of instruments that Jamāl al-Dīn later submitted to Qubilai may support this suggestion.

In 1267 Jamāl al-Dīn seized another opportunity and presented Qubilai with the "ten-thousand-year astronomical system" (萬年曆 *wannianli*) that he had compiled, as well as diagrams or models of seven Western instruments (儀象 *yixiang*).[15] The "ten-thousand-year astronomical system" was apparently an Islamic astronomical handbook (*zīj*), on whose basis Islamic astronomical almanacs (回回曆 *huihuili*) were rendered.[16] The seven diagrams of instruments comprise an armillary sphere, a 255–267 centimeter-high parallactic ruler,[17] a celestial globe, a terrestrial globe, an astrolabe, and two diagrams of large-scale mansion sundials for the equinoxes and solstices.[18] The armillary sphere deserves special attention. According to the Chinese description of the diagrams,

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12 On the Maragha observatory see Sayili 1988: 189–223.

13 Lane 2003: 213; *al-Wāfī bi al-wafayāt* 1: 182. On the life and works of al-Ṭūsī, see e.g., Ragep 1993: 1: 3–22.

14 Allsen 2015.

15 *Yuanshi* 52: 1120; 48: 998–999.

16 The Islamic astronomical almanacs were sold every year all over China, see *Yuanshi* 94: 2404.

17 The height of the parallactic ruler is recorded as 7 *chi* 尺 and 5 *cun* 寸. The length of *chi* during the Yuan period is estimated to be between 34.0–35.6 cm. See Qiu 2001: 393–397.

18 *Yuanshi* 48: 998–999. On the interpretation of the instruments see Yabuuti 1997: 14–17; Needham 1959: 373–374; Hartner 1950; Miyajima 1982; Tasaka 1957.

it was designed for latitude 36°. Yet in the same source the obliquity of the ecliptic is presented as 24°, while contemporary Muslim astronomers found its value as 23°30'.[19] Therefore the whole numbers 24 and 36 appear to be an inaccurate presentation or reading of the diagram, rather than the exact values of the obliquity and latitude. The number 36 is close to the latitude of Maragha, which was 37°20' according to the Maragha astronomers.[20] Since the large size of the instruments indicates they were designed for an observatory, and it is unlikely that Jamāl al-Dīn would plan an observatory for Qubilai outside his two capitals, it is rather compelling to argue that these instruments were originally designed for the Maragha observatory.

Jamāl al-Dīn's choice to present Qubilai with diagrams of instruments and a "calendar" was seemingly made after much deliberation. Qubilai had great interest in astronomical instruments. In 1279, when the Chinese astronomer Guo Shoujing (郭守敬 d. 1316) presented Qubilai with the astronomical instruments that he had constructed, the Qa'an followed his explanation and demonstration untiringly from morning to afternoon.[21] According to Chinese political culture, a calendar was the emperor's instructions as to the activities of his subjects and the symbol of heavenly harmony, thus an important component of the ruler's legitimacy. Now that the great khan ruled in China but had superiority over other khanates as well, presenting an Islamic "calendar" to the throne was a confirmation of his authority over the Muslim population of the empire. The symbolic and ceremonial application of the calendar was important to the Mongols. On the day of the winter solstice, the Yuan court held an elaborated ceremony in which Chinese, Uighur, Islamic (*huihui*) and Mongol calendars of the coming year were presented to the emperor and the emperor in turn granted calendars to princes and officials.[22] This time, Jamāl al-Dīn's effort was to be rewarded.

In 1271, the Muslim Directorate of Astronomy (回回司天臺 *huihui sitiantai*) was established, and Jamāl al-Dīn was appointed its Director.[23] In 1273, Jamāl al-Dīn was assigned Director of the newly established Palace Library (秘書監 *mishujian*), an institute for maintaining imperial documents and books as well as *yinyang* books.[24] At the same time, the Chinese and Muslim Directorates of

19 Tekeli 2007: 18.

20 Tekeli 2007: 17.

21 Ho 1993: 290.

22 *Xijinzhi jiyi*: 212, 223.

23 *Yuanshi* 7: 136.

24 *Yuanshi* 90: 2296.; Hucker 1985: 376–378. In the Yuan period the term "*yinyang*" in general refers to various knowledge and practices of divination which included astrology.

Astronomy, parallel in rank and similar in structure, were merged and placed under Jamāl al-Dīn's authority in the Palace Library.[25] Shortly after the merger of the two astronomical institutions, Liu Bingzhong, then Grant Guardian (太保 *taibao*), commanded that the two Directorates should report their official matters independently.[26] Many dynasties prior to the Yuan had multiple astronomical institutions, manned, however, by local astronomers, not foreign ones, in order to compare submitted astronomical reports and prevent the astronomers from copying observations from previous records.[27] This seemed to be Liu's primary consideration as well. However, the division suggested by Liu apparently limited Jamāl al-Dīn's administrative authority over Chinese astronomers as well.

Liu Bingzhong was envisioning an ambitious Chinese astronomical reform. As early as 1251, he proposed to Qubilai the reform of the Jin astronomical system, the *Revised great enlightenment* system (重修大明曆 *chongxiu damingli*), which had been in use from 1180 and accumulated numerous errors.[28] Liu did not live to see his plan materialize, yet he promoted capable Chinese scholars who, two decades later, led the most elaborated astronomical reform in Chinese history.[29] The reform started in 1276 and lasted four years, with the participation of over one hundred Chinese officials and experts and the foundation of the Astrological Commission (太史院 *taishiyuan*), a large autonomous government agency the primary responsibility of which was the preparation and distribution of official calendars.[30] It bore fruit in the form of the *Season-granting* astronomical system (授時曆 *shoushili*), which was to be in use for about 360 years, with only a few modifications made during the Ming dynasty (1368–1644).[31] Although innovations were made in the *Season-granting* system and in the astronomical instruments designed by Guo Shoujing for the sake of the reform, it is difficult to point at any significant influence of Islamic astronomy on them.[32] There is no

25 *Mishujian zhi*: 115, 126.

26 *Mishujian zhi*: 126.

27 For example, during the Northern Song (960–1127) period, astronomical institutions included, among others, the Directorate of Astronomy (司天監 *sitianjian*) and the Institution of Observation by the Armillary Sphere (測驗渾儀所 *ceyan hunyisuo*). In 1027 the Astronomical Office of the Artisans Institute (翰林天文院 *hanlin tianwenyuan*) was established because the two existing institutions failed to predict heavenly phenomena. See Chen/Zhang 2008: 98–99. On the Astronomical Office and the Directorate of Astronomy copying observation results from each other, see *Moke huixi* 7: 8a.

28 Song et al. 1995: 157: 3691; Sivin 2009: 156.

29 On the leading officials and experts of the reform and their relations with Liu Bingzhong see Sivin 2009: 28–30, 156–164.

30 Hucker 1985: 482.

31 For the *Season-granting* system, see Sivin 2009.

32 Van Dalen 2002: 340–343; Yabuuti 1997: 14–17; Sivin 2009: 218–225.

evidence that Jamāl al-Dīn, or any other Muslim astronomers, participated in this reform.

During the 1270s and 1280s, Jamāl al-Dīn probably led the astronomers of the Muslim Directorate of Astronomy to make extensive observations in Dadu (大都) and to produce a *zīj* in Persian based on these observations. This *zīj* was likely the ancestor of two later *zījes*.[33] One is known as the *Huihui lifa* (回回曆法 *huihui astronomical system*), translated from Persian to Chinese in 1383 by order of the first Ming emperor Zhu Yuanzhang (朱元璋 r. 1368–98).[34] The other is in Arabic, composed in 1366 by a certain Muslim astronomer called al-Sanjufīnī in modern day Gansu (甘肅) in northwest China, and dedicated to Prajnā, the viceroy of Tibet and Qubilai's descendant.[35] The tables for planetary mean motions in al-Sanjufīnī's *zīj* are based on the "observations of Jamāl", likely referring to Jamāl al-Dīn. The common ancestor of al-Sanjufīnī's *zīj* and the *Huihui lifa*, presumably produced in the Muslim Directorate of Astronomy, was a standard Islamic handbook, but a highly original one. Al-Sanjufīnī's *zīj* also showed Chinese influences, such as a table of the 24 equal divisions of the solar year with Persian transliterations of their Chinese names, and Persian transliterations of the names of the corresponding Chinese mansions in a table of the Arabic lunar mansions.[36]

At the same time Jamāl al-Dīn served as Qubilai's personal astrologer. Before 1273 he likely accompanied Qubilai on his seasonal migrations to Shangdu.[37] After assuming the direction of the Palace Library, on several occasions he reported official matters directly to Qubilai or met the khan in person, once in the bathing hall in the imperial palace.[38] Although according to the records of the Palace Library the two met for official matters, it is more likely that Jamāl al-Dīn was summoned to give astrological advice to the khan and he took the opportunity to promote some of his official matters. The records of the Palace Library create the impression that the meetings between the two were interpreted by ʿĪsā *kelemechi*, who became Jamāl al-Dīn's colleague in the Palace Library in 1286 after returning from a diplomatic mission to the Ilkhanate.[39]

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33 Van Dalen 2002: 336–339.

34 The original version of the *Huihui lifa* is lost. The earliest extant copy is the printed 1477 edition by Bei Lin 貝琳, the Vice-director of the Ming Astronomical Bureau. See Van Dalen 2002: 336–337; Shi 2014: 53.

35 Kennedy 1998: 60–62. For the family of Prajnā see Allsen 2001: 170–171.

36 Van Dalen 2002: 336–339. According to van Dalen, the Chinese influences found in *Huihui lifa* most likely stem from the Ming translators.

37 *Mishujian zhi*: 31.

38 *Mishujian zhi*: 31; 26–27; 74.

39 *Mishujian zhi*: 31, 74.

Jamāl al-Dīn's closeness to the throne also won him the privilege of recommending talented men directly to the khan. In 1285/6 he introduced a certain Shams al-Dīn to Qubilai, and recommended that Shams al-Dīn should study astronomy (*yinyang*), most likely under his own guidance. This Shams al-Dīn would become the Director of the Muslim Directorate of Astronomy in 1301, and would be recommended by ʿĪsā *kelemechi* in 1308 to an additional position as the Vice Director of the Palace Library (秘書少監 *mishu shaojian*).[40]

In 1288, the Chinese astronomers from the united Directorate of Astronomy waged a campaign to remove Jamāl al-Dīn and ʿĪsā's authority over Chinese *yinyang* experts. The campaign was led by Yue Xuan (岳鉉 d. 1312), a former protégé of Liu Bingzhong and member of Qubilai's imperial guard, then the Director of the Chinese Directorate of Astronomy.[41] The Chinese astronomers claimed that the foreigners (*huihui*) who were in charge of them in the Palace Library did not know *yinyang*, and they were concerned that the *yinyang* books of the library would get lost.[42] This campaign led to the departure of the Chinese Directorate of Astronomy from the Palace Library in the same year.[43] Jamāl al-Dīn's authority in the Palace Library was significantly reduced. Even the management of Muslim books was transferred to another Shams al-Dīn.[44] Later that year, Yue Xuan became the Director of the Palace Library.[45]

However, Jamāl al-Dīn's official rank had been elevated and his political status had been strengthened shortly before 1288, as if he could predict the coming challenges. Sometime prior to 1286, he was awarded the prestigious title of Grand Master for Excellent Counsel (嘉議大夫 *jiayi dafu*).[46] In 1287 he was further promoted to Grand Academician of the Scholarly Worthies (集賢大學士 *jixian daxueshi*).[47] The promotion was apparently the result of his initiation and administration of the composition of the *Comprehensive Gazetteers of the Great Yuan* (大元一統志 *dayuan yitongzhi*). In 1285, Jamāl al-Dīn proposed that since the astronomical reform had been accomplished and the composition of *Materia Medica of the Great Yuan* (大元本草 *dayuan bencao*) was ongoing, the Palace Library should assume responsibility for composing a compendium of gazetteers

40 *Mishujian zhi*: 32, 160. Shams al-Dīn was assigned the Director of the Muslim Directorate of Astronomy in 1300, but officially entered his post one year later.
41 On Yue Xuan's life see *Qiaowu Ji* 12: 1a–9b.
42 *Mishujian zhi*: 23–24.
43 *Mishujian zhi*: 128–129.
44 *Mishujian zhi*: 23–24.
45 *Mishujian zhi*: 165.
46 *Mishujian zhi*: 54, 74.
47 *Mishujian zhi*: 160. On the *Materia Medica of the Great Yuan* see Chen 1991.

and maps.[48] The initiative was a correct reading of Yuan imperial ideology. The state supported extensive and expensive cultural projects that glorified the greatness of the Yuan dynasty on one hand and served the empire's practical needs on the other. Such a compendium of gazetteers and maps magnified the extreme size of the Yuan territory, which was an important component in its legitimation.[49] It was also useful for the military and administrative management of such a vast territory. The proposal also reflects Jamāl al-Dīn's correct reading of the political map of the rivalry between the Chinese and non-Chinese astronomers – now that the Chinese astronomers had gained much power and influence through the astronomical reform, he suspected that they would challenge his authority sooner or later, and found another channel for making himself useful for the Qa'an.

Permission for the composition of gazetteers was given in the same year, and Jamāl al-Dīn was appointed to lead the project. For the first time, an interpreter was assigned to him.[50] Jamāl al-Dīn oversaw the progress of the project, and took care of many administrative details.[51] He also recommended Chinese scribes and three Chinese geography experts who lived in Qufu (曲阜), Jingzhao (京兆) and Sichuan (四川) respectively.[52] One of them, Yu Yinglong (虞應龍), arrived from Sichuan to Dadu and became the chief editor of the project.[53] Jamāl al-Dīn did not live to witness the completion of the *Comprehensive Gazetteers of the Great Yuan* in 1291, which contained 755 chapters.[54] Four years later, more gazetteers were added. The final version consisted of 1,300 chapters, and was presented to the throne by Yue Xuan and other scholars.[55]

Jamāl al-Dīn's initial proposal in 1285 apparently referred to a compilation of gazetteers and maps of Yuan China. However, in 1286 he suggested, in ʿĪsā *kelemechi*'s presence, that since the territories "from where the sun rose to where the sun set" all belonged to the Mongols, Muslim (*huihui*) maps that were in his possession could be added to make a comprehensive map of the Mongol Empire.[56] The Muslim maps were never mentioned in any sources before this year, and were not among the collection of Muslim books registered in the

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48 *Mishujian zhi*: 72–73; *Zhizheng ji* 35: 4–6.

49 *Mishujian zhi*: 72.

50 *Yuanshi*: 13: 277; *Mishujian zhi*: 28.

51 *Mishujian zhi*: 75.

52 *Mishujian zhi*: 26–27. 74, 76; *Yuanshi*: 14: 287. Qufu is located in Shandong. Jingzhao refers to Anxi (安西) route, in nowadays Shaanxi.

53 *Yuanshi* 14: 287. *Mishujian zhi*: 76–77.

54 *Zhizheng ji* 35: 4.

55 *Yuanshi* 21: 450; *Mishujian zhi*: 86–87.

56 *Mishujian zhi*: 74.

Palace Library in 1273.[57] It is very likely that ʿĪsā *kelemechi*, who returned in 1286 from his diplomatic mission to the Ilkhanate, brought maps of the Muslim regions to Jamāl al-Dīn, maybe the very maps that he used on his journey. Since ʿĪsā was appointed the Director of the Palace Library at the same year, he probably brought other Arabic and Persian books as well. Records of Jamāl al-Dīn and ʿĪsā's activities in the Palace Library indicate that they were political allies. They collaborated to promote the gazetteer project. And both were the target of the Chinese astronomers' campaign in 1288.

During the Yuan period, Islamic geographic traditions had an impact on the Chinese tradition. World maps were made for the first time, grids were used in maps, and knowledge of regions outside China was broader and more precise than before.[58] Jamāl al-Dīn's Muslim maps and diagram of the terrestrial globe which used grids for the calculation of distance must have made a significant contribution to the introduction of Islamic geographical and cartographical knowledge.[59]

Jamāl al-Dīn's knowledge was not confined to the science of the sky and the science of the earth. In 1273, the Palace Library registered 242 volumes belonging to the book collection of the Muslim Directorate of Astronomy and Jamāl al-Dīn's private collection. The Muslim Directorate of Astronomy held books on astronomy and other mathematical sciences, astrology, the construction of astronomical instruments, and geomancy. The private collection of Jamāl al-Dīn included, among others, books on alchemy (*iksīr* 亦乞昔兒 *yiqixi'er*), medicine (*ṭibb* 忒畢 *tuibi*), chronicles (*taʾrīkh* 帖里黑 *tielihei*), physiognomy (*firāsa* 福剌散 *fulasan*), and poetry (*shiʿr* [詩]艾立 [*shi*]*aili*).[60] Alchemy, medicine and various divination practices were all of interest to the Mongols.

Another undertaking of Jamāl al-Dīn's, although less significant, is also worth noting. In 1287/8, he caused civil artisans to produce *sadalaqi* (撒答剌欺 Mon. *sadragh* Tur. *sädräk*), a kind of loosely woven cloth of apparent Central Asian origin, in the Silk Civil Artisans Superintendency. Consequently, the office was converted to the *Sadalaqi* Superintendency.[61] It is curious that Jamāl al-Dīn

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57 *Mishujian zhi*: 129–131.

58 On Chinese geographic knowledge of the Islamic world during the Yuan period, see Park 2012: 91–123; on Chinese geographic knowledge of Central Asia during the Yuan period, see Kenzheakhmet 2015: 141–160; Park 2012: 119–140.

59 See Park 2012: 91–109; Allsen 2001: 109–111.

60 *Mishujian zhi*: 129–131. Other books cannot be identified with certainty. For an analysis of the books, see Ma 1983; Tasaka 1957.

61 *Yuanshi* 85: 2149. According to Francis W. Cleaves and Allsen, the unattested Mongolian form of the word *sadalaqi* originates from Turkic *sädräk*. The latter is defined in Kāshgārī's *Divān Lughāt al-Turk* (eleventh-century) as "loosely woven cloth". See Allsen 1997: 73.

bothered to lead a superintendency much below his rank and to produce textile when he headed the prestigious gazetteer project. But the production of *sadalaqi* was in fact relevant to the management of the gazetteer project. In 1286, seeing that members of the Palace Library who worked on the gazetteer project all lived in the new city of Dadu while the Palace Library was located in the old city, Jamāl al-Dīn applied to relocate the Palace Library in the new city for the convenience of the project. He even found a suitable place, a silk workshop, and suggested moving the artisans of the workshop to the old city to make place for the Palace Library.[62] Combining the two pieces of information, we know that Jamāl al-Dīn's suggestion was approved, and that he took the opportunity for encouraging the production of *sadalaqi*, which apparently pleased the Mongols. This evidence also suggests the possibility that Jamāl al-Dīn, like the above-mentioned Muḥammad al-Bukhārī, was among the weavers transferred from Central Asia to China.

The last time that Jamāl al-Dīn appears in the Yuan sources is 1289, when he was still in charge of the gazetteer project.[63] In 1290 a Muslim astronomer Kamāl al-Dīn (可馬剌丁 *kemalading*) was appointed Director of the Palace Library and head of the *Sadalaqi* Superintendency, apparently taking Jamāl al-Dīn's place.[64] Therefore 1289 is most likely the year of Jamāl al-Dīn's death. Curiously, there is no record of Jamāl al-Dīn's children inheriting his position or manning other positions in the Palace Library, while this practice was common in the Palace Library and was usually noted in its records.

There is no doubt that Jamāl al-Dīn migrated from Central or Western Asia to China, and he may have also visited Qara Qorum and Maragha before the late 1260s. Before he was appointed Director of the Palace Library in 1273, Jamāl al-Dīn likely accompanied Qubilai on his seasonal migrations. However, his mobility decreased with time. After 1273 he was seemingly based in Dadu, working in the old city and living in the new city. During the last years of his life, however, all of his official activities concentrated in the new city.

Jamāl al-Dīn's social mobility was also impressive. He succeeded in becoming, from a new comer to China ignorant of the Chinese language, into a high-ranking official in the central bureaucracy. This was due, first of all, to his knowledge in various fields that interested the Mongols – astronomy, astrology and other divination practices, geography and cartography, and textile production. His expertise in these fields not only won him intimacy with the khan, but also gave him much political flexibility. When he lost power

62 *Mishujian zhi*: 73.
63 *Mishujian zhi*: 77–78.
64 *Mishujian zhi*: 165.

in one field, he could turn to another and achieve equal or even greater success.

Nevertheless, knowledge alone was far from enough in the complicated political and social circumstances in which Jamāl al-Dīn operated. Jamāl al-Dīn was not only capable of reading the sky, he could also correctly read the Mongols' minds as well as the political map of the central bureaucracy, and made every effort to please the Mongol rulers. He presented Qubilai with diagrams of instruments that the latter was interested in, and a "calendar" that bore an important symbolic message in Chinese political culture. He initiated the composition of gazetteers and maps that were practical for military and administrative purposes and were in accordance with the imperial ideology that aimed to monumentalize the greatness of the empire through comprehensive, expensive and elaborate cultural projects. He even engaged in producing textiles that the Mongols liked, although such an undertaking was beneath his official rank and status.

Another important factor that contributed to Jamāl al-Dīn's success in Yuan China was his ability to build an extensive network that embraced non-Chinese and Chinese, astronomers and other scholars. He utilized his political influence to promote both Muslim and Chinese talents. He found an ally in ʿĪsā *kelemechi*, who shared a common language and interest in astronomy with him and was intimate with the throne. His other allies and friends were less visible, but we are almost certain that someone instructed him on what to present to Qubilai in 1267, and others informed him of qualified Chinese geographers. And it is very likely that some Chinese astronomer(s) informed him of Chinese astronomical knowledge or even collaborated with him on the *zīj* produced in the Muslim Directorate of Astronomy.

Jamāl al-Dīn's experience also provokes some thoughts regarding the mobility of scientific knowledge in Yuan China. Media of scientific knowledge – books, maps, instruments, and scientists – travelled from the Islamic world to China. Comparing the influence of Islamic geographic and astronomical traditions on the Chinese traditions, it appears that matters of facts, such as knowledge of Muslim regions, and concrete practices, such as the use of grids in maps, met fewer barriers than abstract knowledge and ideas that touched upon the fundamental principles of the Islamic and Chinese knowledge systems. Apart from scientific knowledge *per se*, the complicated political and social circumstances in Yuan China were also decisive for the mobility of knowledge. Allsen has discussed the Mongols' role as filter in the process of cultural exchange. The rivalry between Chinese and non-Chinese astronomers, as Jamāl al-Dīn's case shows, played an important role in their willingness to cooperate and borrow from each other. Our attention is usually directed to the limited influence that

Islamic astronomy had on Chinese astronomy, which may be challenged by new evidence. Equally worth noting is what knowledge, acceptable and feasible in China, the migrant astronomers chose to present and to produce in order to win the Mongols' support and distinguish themselves from their Chinese counterparts.

As our sources in many cases permit speculation only, other possibilities and explanations of Jamāl al-Dīn's life story exist as well. Yet all of Jamāl al-Dīn's possible activities and pursuits reveal the opportunities and challenges faced by Yuan Muslim astronomers, who are overshadowed by him. Jamāl al-Dīn succeeded in overcoming the challenges to a foreign migrant, and reached high positions. He became a close advisor of the Qa'an, and initiated imperial projects. Therefore he has become a symbol of Islamic science in China and remains alive in the collective memory of the Hui Chinese Muslims.

Acknowledgements: I would like to thank Prof. Michal Biran, Dr. Yoichi Isahaya and Dr. Qiu Yihao for reading previous drafts of this paper and providing many valuable comments. I would also like to thank the anonymous reviewers for their useful remarks.

Funding: The research leading to this publication has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP/2007–2013)/ERC Grant Agreement n. 312397.

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