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# "An Old China Hand Who Loved the Chinese People": Herbert Chatley (1885-1955), Civil Engineer and Historian of Chinese Science and Technology

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**Abstract** Herbert Chatley (1885-1955) was one of the scholars on whose research and expertise Joseph Needham drew when writing *Science and Civilisation in China*. Chatley worked in China for three decades, first as a teacher in Tangshan 唐山, where he trained a number of Chinese engineers and scientists, then as an engineer in charge of the dredging of the Huangpu 黃浦 river in Shanghai. His scholarship spanned a wide spectrum of fields, and therefore belonged in various spaces of circulation, including not only the global community of engineering, but also that of knowledge about China pertaining to the history of science and technology, then mostly separated from academic sinology in the West.

**Keywords** Republican China. Engineering. History of science and technology. Astronomy. Joseph Needham.



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## 1 Introduction

> [T]he dominant idea of mathematical order and relation of effect to cause appears in the Chinese classics in so definite a form that several very striking analogies are presented between the native philosophy and modern science. (Chatley 1911b, 557)

To a historian of Chinese science, these lines evoke the view of the field's pioneer, Joseph Needham (1900-1995). In fact, he was still a schoolboy when they were written. Their author, Herbert Chatley (1885-1955, Chinese name Cha Deli 查得利), shared with Needham several features that were fundamental to the latter's work: a scientific training in Europe, a strong interest in pre-modern Chinese science and technology, and the reliance on Chinese historical sources to study them. There is, however, a stark contrast between Needham's fame and the obscurity of Herbert Chatley, whose name has, to the best of my knowledge, never been mentioned in accounts of the history of the knowledge of China in twentieth century Europe.

I first encountered the name of Herbert Chatley when reading *Science and Civilisation in China* (Needham et al. 1954-, hereafter *SCC*). Volume 4 part 3 (1971), devoted to civil engineering and nautics, is dedicated posthumously to the Chinese economist and historian Ji Chaoding 冀朝鼎 (1903-1963) and to Chatley.[1] The dedication to the latter reads as follows:

> Herbert Chatley, once Professor of Engineering at Thang-shan[2] College and Chief Engineer of the Huang-po Conservancy, an 'Old China Hand' who loved the Chinese people, historian of the engineers of Cathay and Manzi.[3]

I wish to thank Christopher Cullen for his advice on the history of astronomy. John Moffett, the Librarian of the Needham Research Institute, helped me locate materials kept there, some of which are not yet fully catalogued; figures 2 to 7 below are reproduced by kind permission of the Needham Research Institute. I am also grateful to the *China knowledge Networks* project participants for their comments on an earlier version of the present article, to Théophile Rabu (EHESS) for helping me find Herbert Chatley's Chinese name(s), and to the participants of the Needham Research Institute Seminar for their questions and suggestions. My thanks also go to Laurent Blondeau-Georges, of the Grande Chancellerie de la Légion d'Honneur, and to Carol Morgan, Archivist of the Institution of Civil Engineers (London). Yu Jia 余佳 helped me obtain Mao Yisheng's 1917 article. Thorben Pelzer kindly shared with me some materials he had collected at the MIT. Last but not least, I am grateful to the two anonymous reviewers for their detailed comments.

1 Ji was an economist and political activist. The book on the economic history of China that he published in Britain (Chi 1936) was quite influential.

2 Tangshan 唐山. Needham used a slightly modified version of the Wade-Giles transcription, in which he replaced the apostrophe by an 'h'.

3 Cathay refers to North China, Manzi to South China; on the Tangshan College and the Huangpu Conservancy Board, cf. below section 3.

As we shall see below, the expression "China Hand" aptly captures Chatley's status vis-à-vis both China and Britain. It refers to Britons (and later Americans) who had acquired some expertise on China by working there, either in the service of the Chinese government, or as businessmen, journalists, or diplomats.[4]

Chatley's name also appears in the bibliographies of no less than eleven volumes of *SCC*. My attention was initially drawn to him by the fact that he is one of the Western language authors most quoted in volume 3 of *SCC*. More specifically, no less than sixteen titles by him are listed in the bibliography corresponding to section 20, devoted to astronomy. His name also appears in the bibliographies of volumes 1, 2, 4.1, 4.2, 4.3, 5.2 and 5.3, all written by Needham himself, as well as in volume 5.9, written by Dieter Kuhn, in volume 5.13, written by Peter Golas, and in volume 6.2, written by Francesca Bray.[5] Furthermore, a search for Chatley's name in the catalogued archives of the Needham Research Institute (NRI) reveals that he was in correspondence with Needham from 1948 until Chatley's death in 1955, and that Needham occasionally exchanged letters with his wife and daughter until 1982.

As well as one of many who indirectly contributed to *SCC*, Chatley was also one of those Europeans who played a double role in China. He was a Western expert in the service of China on the one hand, and a China expert to Western historians of science on the other hand. His professional affiliations (first Tangshan College, and then the Whangpoo[6] Conservancy Board, Junpuju 浚浦局) in great part determined the spaces of circulation within which he constructed and shared his knowledge of China. In what follows, I will explore his career and his writings on Chinese science and technology, as well as his relationship with Needham.

Beside his abundant publications,[7] materials that enable one to study Chatley's career and work include his papers, which are now available at the Senate House Library of the University of London.[8]

4 The expression "China hand" originally referred to the first Britons to visit China or establish themselves there since the end of the eighteenth century (Caroll 2021). During World War II and the Cold War, it came to refer to Americans who worked in China for US intelligence.

5 Like Needham himself, D. Kuhn and F. Bray refer to Chatley's translation of chapter 3 of the *Huainanzi*; P. Golas quotes an article by Chatley and Wright (1913).

6 The Huangpu 黄浦 is the largest river flowing through Shanghai. It flows into the Yangtze River less than 50 km upstream from the sea: Chatley had crucial responsibilities in maintaining Shanghai's role as a main entry port into China.

7 A search in the catalogue of the Cambridge University Library yielded more than 60 different titles, ranging from letters to the editor of *Nature* to books.

8 "Herbert Chatley papers", Senate House Library, University of London; cf. `https://archives.libraries.london.ac.uk/resources/MS420.pdf`.


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These include notebooks, typescripts and some correspondence. They give us a glimpse of how he worked, and also of what appears to have been a worldwide network of correspondents. Some of the books from his collection relating to China, which he bequeathed to the Royal Asiatic Society, shed further light on his interests.[9] His correspondence, with Needham, and with a few other persons, is kept at the Needham Research Institute. Other letters are kept in various libraries and archives in the United Kingdom and elsewhere.[10]

## 2 A Versatile Engineer

Herbert Chatley was born on 17, 1885 in London, where he attended the Cambridge House Grammar School, and then the Northern Polytechnic Institution (Holloway, North London), from which he received his Bachelor's degree in engineering in 1906. For the next three years, he was a Lecturer in applied mechanics at the Portsmouth Technical Institute.[11] His birthplace, education and first teaching post strongly suggest that Chatley came from a much less privileged milieu than Needham, who attended a public school[12] and then the University of Cambridge, where he spent the rest of his academic career.

In 1907, Chatley married Nelly Loader Smith. That same year, at the age of 22, he published two books. *The Problem of Flight: A Text-Book of Aerial Engineering* (Chatley 1907a) is a short, richly illustrated work that he described as "an epitome of the knowledge available at present on the subject" destined for "the engineering profession". At the time, aeroplanes were still at an experimental stage, and as Chatley put it, one was "on the verge of a practical solution to this classic problem of flight" (Chatley 1907a, Preface, n.p.). This gives us a first glimpse of his active curiosity about matters that were not strictly speaking indispensable to his role as a teacher. Published in

9 A handwritten list of these books is found together with the correspondence between the librarian and the executors of Chatley's will; Royal Asiatic Society of Great Britain and Ireland (1823-, London, England), Correspondence regarding Chatley bequest, January 31, 1955-April 14, 1955. Royal Asiatic Society Collections Acquisitions Records. Royal Asiatic Society Archives. GB 891 RAS COLL3-RAS COLL3/7-RAS COLL3/7/2-RAS COLL3/7/2/4.

10 Archives kept in China include the archives of the Tangshan College, now at the South-Western Jiaotong University (Chengdu) and those of the Whangpoo Conservancy Board, preserved in the Archives of the Shanghai Waterways Office (Shanghai hangdaoju dang'an shi 上海航道局档案室).

11 Correspondence dating to 1908 kept in Chatley's papers at the Senate House Library indicates that his address in Portsmouth at the time was 32 Britannia Road, Southsea.

12 In Great Britain this phrase refers to elite, fee-charging private schools. Needham attended Oundle School, in Northamptonshire.

London by C. Griffin & Co, who published a number of other books by Chatley, the work underwent two revised, augmented, editions, in 1910 and 1921, which suggests that it was quite successful. In 1911, another book by Chatley on the same topic, entitled *Principles and Design of Aëroplanes*, was published in New York by Van Nostrand as no. 126 in their *Science Series*. Sold for 50 cents, it attracted a severe review in *Scientific American*, as being outdated; the book nonetheless underwent a second edition the following year (Chatley 1911a; "New Books etc" 1911).

The second book Chatley published in 1907, entitled *How to Use Water Power* is, according to its author,

> not an exhaustive treatise, but a clear account of the methods and principles of Hydraulic Engineering as at present practised, in a form that can easily be grasped by the craftsman or student with limited knowledge of mechanics and mathematics. (Chatley 1907b, Preface, n.p.)

Compared with aeronautics, this is perhaps more central to the interests one would expect from a Technical Institute teacher. One might say the same about a third title, *How to Make a Survey*, mentioned on the title page of *How to Use Water Power* as authored by Chatley; the fact that no book with this title is found in any of the British copyright libraries suggests that it was never actually published (Chatley 1907b, cover page). Altogether, between 1907 and the 1930s, Chatley authored about a dozen books of the same kind on topics related to engineering and physics.[13]

Notwithstanding the opinion of the *Scientific American* reviewer, Chatley was a respected member of his professional community in his own country. In January 1906, he became a member of the Royal Society for the Encouragement of Arts, Manufactures and Commerce (known as the Royal Society of Arts) ("Ninth Ordinary Meeting" 1906, 298). He went on to give lectures at this Society, and to publish in its journal. In 1908, he joined the Aeronautical Society of Great Britain. He was admitted into the Institute of Civil Engineering, based in London, as an Associate Member in 1920, and then as a Member in 1928. He contributed seven papers to its meetings, and received Telford Premiums, money awards that ranged between GBP 15.00 and GBP 30.00, for four of them.[14] Altogether, his name occurred about

**13** Six of them have been republished by Forgotten Books over the last decade; cf. https://www.forgottenbooks.com/en/search?q=Herbert+Chatley&w=a&l=0&Y=0&y=9999&P=0&p=9999&V=0&v=9999&i=0&g=0.

**14** These papers all bore on topics relevant to his work as an engineer in Shanghai: "Silt" (1920-21); "Problems in the Theory of River Engineering" (1928-29); "The Principles of Drag-Suction Dredging" (1939-40); "Dredging Machinery" (1944-45)


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thirty times in the *Journal of the Institute of Engineering* up to 1950, both as author and in discussions on published articles.

Evidence of Chatley's interests beyond his professional expertise first emerged in 1908, in the form of a seven-page article on "Mediæval Occultism" published in a renowned philosophical journal, *The Monist*. Referring to a number of French authors of the 1890s, and relying on both occultist and Christian religious literature, the article draws parallels between religious and magic cults, both characterised as tending to "produce assent to and realization of certain beliefs"[15] ("Ninth Ordinary Meeting" 1906, 298). The article concludes that there is, "if not the identity, at least a close analogy of religious cult, ceremonial magic, and auto-suggestion" (Chatley 1908, 516). Chatley's interest in occultism, of which there is plenty of evidence in his papers, may be regarded as eccentric. But it should be emphasised that there is nowhere any indication of his adhesion to it; his is, in his own words, "a sympathetic but critical treatment of belief and cult" (510). His article on "Mediæval Occultism" is of interest because it indicates to us that he did not share the prejudices prevalent at his time, that led many to describe what they found in China as 'superstition' as opposed to the beliefs and rituals that prevailed in Europe, that they labelled as 'religion'.

## 3 Teaching Civil Engineering in Tangshan

In January 1909, Chatley, then aged 23, moved to China to become a professor of civil engineering at the Tangshan 唐山 College of Mining and Engineering (Tangshan lukuang xuetang 唐山路礦學堂, founded in 1906),[16] a post he held until 1915. The College was then divided in three departments: civil, mechanical and electrical engineering. By 1912, it had produced about fifty graduates; unlike most higher

(Communication from Carol Morgan, Archivist, Institute of Civil Engineering, London). The two sums are equivalent to GBP 560 and GBP 1,120 respectively in today's currency (cf. `https://www.bankofengland.co.uk/monetary-policy/inflation/inflation-calculator`).

15 The abundance of notes on occultism in Chatley's papers bear witness to the fact that he closely read at least some of the sources quoted in this article.

16 The full English name of the institution given here is the one found in a document kept among Chatley's papers at the University of London Senate House Library, MS420/3/1, inserted in a notebook titled "General Notes on occultism, electro-magnetic waves &c". The Chinese name held by the College at the same time literally means "Tangshan College of Railways and Mines". Founded in 1896, the College changed names repeatedly, including twice during the six years that Chatley spent there (cf. `https://en.swjtu.edu.cn/ABOUT/History.htm`). This College is an ancestor of the Southwest Jiaotong University, based in Chengdu (Cui 2021; Will 2019, 98). The date of Chatley's arrival in China is mentioned by Lunt (1925, 41).

education institutions, the College was not much disrupted by the 1911 Revolution. The main impact of this event seems to have been a diminution of financial resources, which impeded the acquisition of the machine tools necessary for the students' training, and in particular for the aeronautical course that Chatley hoped to start. In 1913, the college had about 200 students. The teaching was in English;[17] the heads of the three departments were all British, and a good part of the equipment had been imported from Britain. This reflected the wish of British engineering firms to develop connections in China, and may well have been behind Chatley's own departure for China. Also in 1913, he published an article on "Technical Education" in the *Journal of the Royal Society of Arts*. He concluded it by asserting that "China is on its way to take its place among those Powers whose industry and progress entitle them to be called 'Great'" (Chatley 1913, 819). He sharply criticised foreigners, especially his compatriots, for underestimating the Chinese. While he did not deny the difficulties that the country's development encountered, such as corruption, he professed respect, and even admiration, for its inhabitants' achievements and capacities (818), as Needham would after him. In both cases, this open-mindedness predated their historical investigations into science and technology in early and imperial China, and was indispensable to make these investigations fruitful. This being said, Chatley's 1913 article also reads as a plea for further British investment in Chinese industrial development, at a time when the 1911 Revolution may have made investors reluctant, or at least cautious, in the face of political instability.

Chatley's students mostly went on to staff positions in railway companies. Some of them, like Xue Zhuobin 薛卓斌 (1895-1991) and Tan Zhen 譚真 (1899-1976), who both graduated from the Tangshan College in civil engineering in 1917, and therefore must have at least started their studies under him, pursued further studies in the United States.[18] Both of them returned to China with John Ripley Freeman (1855-1932), a civil engineer famous among other things for designing the Panama Canal, when the latter was appointed hydraulic engineer at the Grand Canal Improvement Board (Duban Yunhe gongcheng shiyi chu 督辦運河工程事宜處) in 1919.[19] Xue later became Chatley's Assistant Engineer at the Whangpoo Conservancy Board, and then succeeded him as Engineer-in-Chief in 1937 (Yi et al. 2018,

17 A few teaching materials are preserved in Chatley's papers at the Senate House Library, including a notebook entitled "Engineering College, Tangshan, Civil Engineering Department, Mechanical Laboratory, Practical Instructions"; MS420/3/1.

18 Cf. Pelzer 2023, 32, and *passim* for the careers of Xue and Tan.

19 Papers of John Ripley Freeman, Box 130. MIT Libraries Distinctive Collections, MC.0051. On Freeman's work on the Grand Canal, cf. Pelzer 2023, 57-62.


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84). Tan eventually taught at the Tangshan College and in other Chinese higher education institutions.

Others among Chatley's former students went to the United States at a later stage of their careers. This was the case of Yu Mingde 余明德 (1893-?), who graduated from the College in 1913. When he travelled to America in 1924, Yu brought, among others, a recommendation letter from Chatley for Freeman. While this letter is evidence that Chatley kept contact with his former students after he moved to Shanghai, and was ready to support them, its terseness suggests that he was not well acquainted with either Yu or Freeman. The warmth of the latter's reaction to Chatley's recommendation is all the more striking:

> I have noted with great interest that you have studied under Dr Chatley. He sends me from time to time some of his publications which I judge about the best scientific presentations of the problems of silt which have appeared anywhere in the world. I only wish that Dr Chatley had returned to England by way of America and had made me a visit.[20]

Thus, Chatley and his former students were all integrated into what was effectively a global network of engineers connected to China, which allows a glimpse at a global space of circulation of Chatley's publications as an engineer.

Perhaps the most famous among Chatley's former students who went on to study in the United States was Zhou Houkun 周厚坤 (Chow Hou-Kun, 1890-after 1959). Best known as the inventor of the Chinese typewriter (Mullaney 2018, 137-46) Zhou studied at the MIT from 1912 to 1916. There he conducted experiments that led to a thesis entitled "Bamboo as a Reinforcing Material for Concrete". Chatley referred to this thesis in a paper he delivered in 1916, which shows that he kept in touch with the work of his former students, and had an interest in possible innovations coming from them (Shu 2021).

Among the students of Tangshan College during Chatley's tenure, there were others who later became famous. Mao Yisheng 茅以昇 (1896-1989), the most renowned bridge builder in twentieth century China, graduated in 1916. Zhu Kezhen 竺可楨 (1890-1974), a meteorologist who was President of the National Chekiang University from 1936 to 1949, studied at the College from 1909 to 1913. Li Yan 李儼 (1892-1963), a pioneering scholar in the history of Chinese mathematics, who earned a living as an engineer for many years, studied at the College from 1912 to 1913. All three names are familiar to historians of Chinese science and technology, the last two having

20 Papers of John Ripley Freeman, Box 130. MIT Libraries Distinctive Collections, MC.0051.

contributed in major ways to establishing the field in China.[21] Mao Yisheng also had an interest in the subject. In 1917, he published an article on the history of the number π in China; in a short foreword to the article, Mao pays homage to Li Yan's work, and states that his own wish to write on the history of π goes back to his days as a student at the Tangshan College (Mao 1917, 411).[22] One of Zhu Kezhen's contributions to the history of science will be discussed below. It is interesting to note that Chatley's interest in the history of Chinese science and technology was shared at least by some of his most illustrious students, although we do not know whether they discussed the topic together while he was their teacher.

It was during his tenure at the Tangshan College that Chatley completed his doctoral degree at the University of London: he became a DSc in 1914, with a dissertation on rolling friction and convex contact, a topic well suited to the fact that he taught future railway engineers.

## 4 A Prominent Figure in Shanghai

After six years at the Tangshan College, Chatley turned to working as an engineer. From 1915 to 1916 he served as District Engineer with the Nanking-Hunan Railway.[23] In 1916, he moved to Shanghai, where he was appointed Assistant Engineer at the Whangpoo Conservancy Board, the institution in charge of maintaining the Huangpu River at Shanghai and the mouth of the Yangzi River, which was jointly managed by China and foreign powers.[24] By 1925, he was Acting Engineer-in-Chief, and in 1928 he was promoted to Engineer-in-Chief, serving in that last post until he left China in 1937, the same year the Second Sino-Japanese War started. There he supervised

21 Cf. https://en.swjtu.edu.cn/Alumni1/Notable_Alumni.htm; in a letter to Needham dated September 3, 1948, Chatley mentions that Zhu Kezhen "was one of [his] old Tangshan students". Needham Research Institute Archives, Joseph Needham's book sale, uncatalogued.

22 Mao also had an interest in the history of Chinese bridge-building technology (Mao 1986).

23 A British firm obtained a concession for building this railway in 1914; cf. *The Brisbane Courier*, April 4, 1914, 5; cf. https://trove.nla.gov.au/newspaper/article/19946067.

24 The Whangpoo Conservancy Board was founded in 1905, following the Boxer Protocol signed in 1901. It was jointly supervised a Chinese and a Westerner of the Shanghai Customs. From 1920 to 1943, The Board compiled and published reports on the harbour and port of Shanghai; cf. Yi et al. 2018; Friedman 1940, 36-7, on the reorganisation of the Board in 1912.

important dredging works (Lunt 1925, 41)[25] and also worked on a number of reports.[26]

The responsibilities held by Chatley's in Shanghai are illustrated by an anecdote recounted on the "History of the Chinese Communist Party in Shanghai" website. The hero of this anecdote, Yang Junsheng 楊俊生 (1890-1982), who trained as engineer in Japan, was inspired by Sun Yatsen to start a shipbuilding company in Shanghai. In 1930, the lease of the land on which Yang's Great China Shipbuilding Machinery Factory (Da Zhonghua zao chuan jiqi chang 大中華造船機器廠, founded in 1926) was built was not renewed, and the factory had to be relocated. He then sought to rent a piece of land from the Whangpoo Conservancy Board, but was only granted less than 20 *mu* of land (about 1.3 ha), in an inconvenient location, for his new factory. He then went to see Chatley, who answered his request by saying: "Your factory only repairs small boats. A piece of land like this one will do". As one might expect in a stereotyped piece of propaganda, this response only strengthened Yang's determination to build large ships ("Yang Junsheng de 'Zhonghua' meng" 2022). This anecdote, evidently intended to praise Yang Junsheng's dream, casts Chatley in the role of the evil foreigner serving Western imperialism. This being said, it brings to the fore the fact that, unlike the Tangshan College, the Whangpoo Conservancy Board was not controlled by Chinese, and was not primarily concerned with Chinese sovereignty, but rather with the economic interests of the various foreign powers present in Shanghai (Ye 2015; Gong 2021). In this context, it is hardly surprising that today's propaganda disagrees with Needham's characterisation of Chatley as someone "who loved the Chinese people".

Chatley's social rank was no match to that of his predecessor in the post of Engineer-in-Chief: Captain August Verner Hugo von Heidenstam (1884-1966, Chinese name Hai Desheng 海德生), who held the post from 1910 to 1926, was a Swedish aristocrat and diplomat, as well as an engineer.[27] Nonetheless, Chatley seems to have been quite a prominent figure in Shanghai. The 1922 edition of the *Who's Who in China (Foreign)* mentions that he was then the President of

**25** The works he supervised were valued at GBP 100,000 (equivalent to about GBP 5.25 million in today's currency) and involved 3,000,000 cubic yards annually in 1928. Cf. `https://archives.libraries.london.ac.uk/resources/MS420.pdf`, 1.

**26** From 1920 to 1943, the Board produced reports regarding the harbour and port of Shanghai. Cf. `https://www.gale.com/c/service-lists-and-reports-of-the-chinese-maritime-customs-service-and-whangpoo-conservancy-board` (2024-05-10).

**27** Cf. Obituary. August Werner Hugo von Heidenstam, 1884-1966" (1967). Chatley mentions him in his paper on "Silt" for which he received his first Telford Premium (Chatley 1921). Chatley's papers contain a draft of a letter in Swedish to von Heidenstam from 56 Victoria Road South, Southsea (Portsmouth), presumably Chatley's parents-in-law's address, dated July 7, 1922 (during one of Chatley's trips back to Europe). MS 420/2/3.

the Aeronautical Society of Shanghai, and at the same time, the President of the Quest Society (founded in 1909 by a group of people with an interest in theosophy) (Lunt 1922, 63); this is consistent with his interest in occultism, to which his papers bear ample witness.[28] In the same edition of the *Who's Who in China*, we also learn that he had earlier been the Master of the Tongshan Masonic Lodge,[29] and that he belonged to the Shanghai Tuscan Lodge (founded in 1864), which he represented on the Executive Committee for the Masonic Hall in Shanghai (63). Freemasonry had by then been present in China for several decades. Chatley owned three books on the subject.[30] The most remarkable one is a lecture given by Herbert Giles on June 1, 1880 to the Ionic Lodge of Amoy (Xiamen, Fujian), simply entitled "Freemasonry in China".[31] In this lecture, Giles discussed evidence of the importance of the symbolic masonic tools, the square and the compass, in early Chinese sources, and described the mythical Pangu 盤古 as the Chinese "Great Architect of the Universe", taking up the Masonic term used to refer to the Deity (Giles 1880, 26). The lecture's purpose was to provide evidence concerning "any Masonic connection between China and the West". It contained numerous quotations from Chinese sources that mentioned the square and compasses, the best-known Masonic symbols, in a metaphorical way (33-4). The sketch of the famous representation of Fuxi 伏羲 and Nüwa 女媧 found in one of Chatley's notebooks **[fig. 1]**, in which the two deities respectively hold a try square and a compass, nicely illustrates the convergence between his Masonic culture and his interest in "the old knowledge of China".[32]

We have seen that Chatley's interest in occultism predated his departure for China (Chatley 1908). It remained historical and

28 He was also the President of the Engineering Society of China from 1927 to 1929, and the chairman of the Shanghai Association of the British Institution of Civil Engineers; cf. Shu 2021, 97.

29 This was lodge no. 3001, Province of North China; it closed in 1953. The spelling "Tongshan" for Tangshan is also found in the issue dated December 29, 1888 of *The Freemason*, 771, which reports the inauguration of the Tianjin to Shanhaiguan 山海關 railway ("Masonic and General Tidings" 1888). Cf. `https://masonicperiodicals.org/static/media/periodicals/119-FVL-1888-12-29-001-SINGLE.pdf`.

30 They are found among Chatley's books bequeathed to the Library of the Royal Asiatic Society in London. This Library's catalogue only includes three books said to be part of the "Chatley bequest". A list of about 30 titles, all in English, gives an idea of what was sent to the Royal Asiatic Society after Chatley's death. Interestingly, this list includes Ji Chaoding's book on Chinese economic history that Needham held in high regard (Ji 1936).

31 Herbert Allen Giles (1845-1935) was a British diplomat who became the second Professor of Chinese at the University of Cambridge.

32 Fuxi and Nüwa are two deities of Chinese mythology. Chatley's sketch reproduces a widely known rubbing from an Eastern Han dynasty (25-220 CE) tomb mural.


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ethnographic. Some of the notes found in his papers suggest that in his view, science in general and mathematics in particular provided tools that would eventually account for matters so far dealt with by other disciplines or by religion and occultism.[33] Such a view is consistent with his search for knowledge valid by the scientific standards of his time in sources that were (and still are) deemed as non-scientific, be they early Chinese texts or occultist writings. Both his publications and his private papers bear witness to this search. This being said, one cannot but wonder where Chatley would have located Masonic rites in the spectrum which included religious and magic cults defined in his 1908 article.

As indicated above, Chatley, beside his prominence in the Shanghai society, also remained an active member of the international academic and engineering community. During his career in China, he authored a large number of articles, published in a wide variety of journals. Beside the *Journal of the Institution of Civil Engineering*, he also was a regular contributor to the "Letters to the Editor" section of *Nature*: out of his sixteen contributions to the latter journal between 1908 and 1940, fourteen were published as "Research" and two as "News". Moreover, he contributed papers to a number of British, China-based and international conferences. Thus, he appears on the group photo of the members of the Royal Aeronautical Society taken in the UK on September 30, 1927 (Pilmer 2020). On 13, 1936, he gave the Chairman's address to the Shanghai Association of Civil Engineers, upon being re-elected for a third and final term in that position. But he was also President of the North China Branch of the Royal Asiatic Society in 1931-32 ("Presidents of the Royal Asiatic Society, N.C.B." 1948), which indicates that he was not only active in his profession, but had also won some recognition among knowledge of China circles. The remaining sections of the present article will be devoted to his role and visibility in the latter space of circulation.

Upon his retirement from the Whangpoo Conservancy Board in 1937, Chatley was awarded the Order of the Brilliant Jade (*Caiyu da xunzhang* 采玉大勳章, established in 1933) by the Republican government; he then moved back to London where he worked as a private consultant. During World War II, he became Superintending Civil Engineer at the Department of the Civil Engineer of the Admiralty; this may have been when he settled in Bath.[34] There he contributed to the development of the Mulberry harbours, temporary structures which facilitated the offloading of cargo during the Allies' landing

**33** Cf. for example Senate House Library, University of London, MS420/3/1, notebook 6, last two pages, a note on Kant's *Critique of Pure Reason* where consciousness is expressed as a quadruple integral.

**34** Senate House Library, MS420/3/4.


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in Normandy in 1944. For this, he was made an officer of the French Legion of Honour in 1947.[35] Chatley resided in Bath until his death on January 14, 1955.[36] His exchanges with Needham, through which he came to our attention, seem to have taken place during the last decade of his life.

## 5 Chatley and the "Old Knowledge of China"

Chatley's investigations into the history of Chinese science and technology are best understood in the context of his career in China, and of his intellectual pursuits within and beyond his profession. Some notes on Chinese science and technology are found in his notebooks kept at the University of London Senate House Library. His record of publication in that field is as striking as that relevant to his profession, albeit not as long. The earliest of these publications is, to the best of my knowledge, an article entitled "Chinese Natural Philosophy and Magic", which appeared in the *Journal of the Royal Society of Arts* where it is dated Friday, April 21, 1911, that is, two years after he started teaching in Tangshan (Chatley 1911b). This article is interesting in two respects. Firstly, it shows that at the time Chatley was already confident enough of his knowledge and understanding of the Chinese scholarly tradition to give a description of "the Chinese Theory of the Universe" according to the Song Neo-Confucian philosopher Zhu Xi 朱熹 (1130-1200), and to argue that there were Shamanistic features in the initiation rituals of some religious practitioners in China. Chatley writes as someone who has direct access to Chinese premodern sources, and quotes J.J.M. De Groot (De Groot 1892-1910) as well as missionaries who had written on China. Secondly, the opening paragraph of the article reveals Chatley's view on Chinese knowledge:

> Within the last few years there has been a rapid assimilation of Western science by the intellectual classes of China, and it may perhaps be feared that, as in Japan, the old knowledge of China is being forgotten. It is, nevertheless, quite demonstrable that the

35 The Légion d'Honneur's file of foreigners mentions: "Par décret du 24 juin 1947, la nomination au grade d'officier de la Légion de M. Herbert Chatley, Britannique, en qualité de 'Superintending civil engineer, civil engineer in chief's departement Admiralty'". This indicates that Chatley held a quite high post of responsibility.

36 Chatley died of a brain tumour (NRI Archives, GBR/1928/NRI/SCC4/1/26). This biographical sketch in based on two obituaries, one published in the *Proceedings of the Royal Institution of Civil Engineering*, 4(4) (1955), the other in the *Monthly Notices of the Royal Astronomical Society*, 116 (1956), and on information sent to Needham by Nelly Chatley with a letter dated June 10, 1955.

> early Chinese ideas as to cosmogony and physics have a basis far sounder than that of the Greek philosophy, which was so long the pabulum of the European scholars. In fact, the dominant idea of mathematical order and relation of effect to cause appears in the Chinese classics in so definite a form that several very striking analogies are presented between the native philosophy and modern science. (Chatley 1911b, 557)

This article, dated to April 1911, reveals its author's good command of classical Chinese; it is possible that he had begun to acquaint himself with the language and the sources before he left for China in 1909. The article is quite descriptive; it discusses "natural philosophy" and "magic" (some aspect of religion and religious rituals) separately, rather than connecting the two topics. As mentioned above, the view of Chinese knowledge expressed in it is consonant with that expressed by Needham who would later contrast two world views: Chinese "organicism" and Western "mechanism", and argue that the former was more in line with the findings of modern science (Needham 1969). Although a 'sound basis' of ancient worldviews according to modern science is no longer something historians seek in their reading of the sources that Chatley mentions in this article, his interest in and respect for the "old knowledge" they contain are quite striking. In that respect, there appears to have been some convergence between him and some of his Tangshan students mentioned above, Zhu Kezhen, Mao Yisheng and Li Yan.

This article was the first of a long series of publications on the history of science and technology in China. More than thirty articles by Chatley are kept in the off-print collection of the Needham Research Institute. They were collected by Needham himself; there is a dedication by Chatley on the front page of some of them. Many of them discuss the history of astronomy: his interest in it went beyond China. Several papers focus on Ancient Egypt. There is also a comparison between the Maya calendar and the Chinese system of counting the days. The offprint collection also contains a typescript translation of chapter 3 of *Huainanzi* 淮南子 (The Masters of Huainan, second century BCE), entitled *Tianwen xun* 天文訓 (Teaching on heavenly patterns). This translation was used not only by Needham, but also by Dieter Kuhn and Francesca Bray in their respective volumes of *SCC*. It is listed among the account of earlier *Huainanzi* translations in the complete translation of the book by John Major et al, which suggests that Needham and his collaborators were not alone if finding it of some value (Major et al. 2010).[37] A number of articles in the

37 It is likely that Major had access to the copy of this translation kept at the Needham Research Institute.


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same collection focus on the history of Chinese technology, in which Chatley was both an actor and an observer. He was recognised in the second role while working in China in the first one: it is in this second role that, as mentioned above, he was elected Chairman of the North China Branch of the Royal Asiatic Society in 1931 ("Presidents of the Royal Asiatic Society, N.C.B.", 1948).

## 6 Chatley and the History of Chinese Technology

An article on "The development of Mechanisms in Ancient China," which was read at the Royal Asiatic Society in London on February 11, 1942, opens in a way that echoes the words quoted above on old Chinese knowledge:

> One of the commonest reactions of the older Chinese scholars to the mechanical technique of the West has been the assertion that the Chinese themselves had originated machines in the past and that the principles of the new devices and of physical science in general are all to be found in Chinese ancient literature. Some Western scholars of eminence (e.g. Prof. H.A. Giles) have partially accepted this broad claim, whilst others have rejected it altogether. (Chatley 1941, 117)

Chatley then argues that the "older Chinese scholars" are right, drawing on Chinese written sources to identify devices similar to those found in Europe. He first gives a historical overview, referring both to extant mechanical devices and to works in which they were described. He then goes on to consider a number of devices, some of which he briefly compares to similar ones found in other regions of the world. The article is illustrated: a note mentions that the presentation was accompanied by lantern slides, only a few of which, namely figures 47 to 54 and plate XIII, are included in the publication. The figures "were supplied to the author by Mr. Wang Yen, who stated that they were taken from Wang Chen's *Nungshu* (*Wang Zhen Nongshu* 王禎農書), published in 1314 and last printed in 1617". These images are quite similar to illustrations found in Song Yixing's 宋應星 (1587-1666) *Tiangong kaiwu* 天工開物 (The Exploitation of the Works of Nature, 1637), a work on which Chatley did some research.[38] As is well known, the illustrations of Chinese books on technology were often copied from earlier books. In any case, this suggests that when Chatley worked on this piece, he did not have access to the sources he mentions in it. Plate XIII is composed of two photographs: "Chinese

38 On the *Tiangong kaiwu*, cf. e.g. Schäfer 2011.

water lift wheels on a river in Hunan Province", dated 1934, and "Chinese Windmill, from the Salterns near Tientsin", dated 1940. Although the latter cannot have been taken by Chatley himself, these images emphasise his status as a direct eyewitness of Chinese technological devices still functioning at the time when he wrote the article, and as a scholar who combined the study of written sources with fieldwork.

Limited access to the *Tiangong kaiwu* 天工開物 may also have prompted Chatley to keep a record of its contents and a list of its illustrations. An unlabelled notebook of his starts with the table of contents of *Tiangong kaiwu*, with an English translation of all the headings and the Wade-Giles romanisation of some of them. This is followed by a nine-page long list of the illustrations contained in the same book, in each case with an English title and in most cases also with their Chinese title. There is no date on the notebook.[39] In the same folder as this notebook, one also finds a handwritten copy of the part of the section of *Tiangong kaiwu* on "Making Salt" (*Zuo yan* 作鹹) devoted to brine wells, with an interlinear word for word translation.[40] This translation is written on the reverse of typewritten correspondence, some of which is dated to 1947, which gives us a *terminus post quem* for Chatley's translation. In a letter he wrote to Needham on 2, 1952, he acknowledges receipt of some written material from the latter, stating that "[he thought] this [would be] quite adequate for the 'History of Technology', on the subject of brine wells".[41] It could be that Chatley's interlinear translation was produced in direct connection with Needham's writings on the subject.

This translation, and the fact that Chatley cites one of his own articles, dated to 1923, in his "Bibliography of Chinese Mechanisms",[42] indicates that Chinese technology was a long-term interest of his.

## 7 Relating to the Scholarly Community: Chatley's Interest in the History of Astronomy

Another topic to which Chatley devoted extensive research over decades is the history of astronomy, which seems less directly related to his profession. As mentioned above, it was the fact that volume 3 of

39 Senate House Library, MS420/2/1.

40 Senate House Library, MS420/2/1.

41 NRI Archives, GBR/1928/NRI/SCC2/124/5/2. Section 37 of *SCC* has yet to be written; there are, however, many references to the Sichuan brine wells in *SCC* 4-2, devoted to mechanical engineering.

42 P. 133 of the Bibliography. I have not been able to access this earlier article (Chatley 1923), published in Shanghai.


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*SCC* quotes more than fifteen pieces by Chatley relating to the history of Chinese astronomy, published between 1933 and 1943, that first drew my attention to him (*SCC* 3, 751). His interest in the field was not limited to China: we have seen that he also published on Egyptian astronomy. The issue of knowledge circulation underlaid this broad curiosity, and, as on other topics, he expressed his views in print on several occasions. Thus, in 1934, he wrote a letter to *Nature* pointing to the differences between the Maya calendar and the Chinese calendar, arguing against Dr Kiang Kang-hu who felt "able to bring forward a number of instances, in which he sees resemblances between the two civilisations, for the further scrutiny of specialists," and who suggested that the Maya were at the very least "culturally related" to the Chinese (Chatley 1934). Chatley's criticism was based on the difference between the day counts of the two systems. Such a focus on technical details is characteristic of his approach to ancient Chinese astronomy, which relied on primary sources.

This taste for precise facts rather than general statements is also apparent in an article published in 1939, in which thirteen "salient features" of ancient Chinese astronomy are listed (Chatley 1939, 66). This article, more of a "state of the field" than an original contribution, confirms that Chatley was able to keep up to date with what sinologists and historians of astronomy had published. Most of the predecessors he lists in this article are European. Some of them were well-known sinologists: Édouard Chavannes (1865-1918), Henri Maspero (1883-1945), Léopold de Saussure (1866-1925),[43] Wolfram Eberhard (1909-1989), Homer H. Dubs (1892-1969, who taught among other places at Duke, Columbia, and Oxford). The name of Walter Perceval Yetts (1878-1957), a surgeon who was a collector of Chinese bronzes and became a Lecturer at SOAS in 1930, is perhaps less well-known. Chatley also mentions John Knight Fotheringham (1874-1936), a historian versed in ancient astronomy and chronology, who established the chronology of Babylonian dynasties. Three Japanese scholars are named in the same list. The first one is Shinzō Shinjō 新城 新蔵 (1873-1938), the founder of the Department of Astrophysics at Kyoto Imperial University, who wrote extensively on the history of Chinese astronomy; he was the president of the University from 1929 to 1933. The astronomer Ueta Jō 上田 穣 (1892-1976, also known in English as Joe Ueda), who studied under the former and became a Professor at Kyoto Imperial University, is also mentioned, for his article on *Shishi xingjing* 石氏星經 (Star Manual of Mr Shi), a text whose title is mentioned in the 2nd century BC historical work *Shiji* 史記 (Records of the Grand Historian). The third Japanese scholar

43 De Saussure is the most quoted author in the section of *SCC* devoted to astronomy, with about 40 titles mentioned in the bibliography.


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mentioned is Iijima Tadao 飯島 忠夫 (1875-1954), who authored a number of works on ancient Chinese astronomy. Chatley states in passing that "Several Chinese scholars, instructed in Western methods of criticism, have done useful work," but does not mention any of their names (Chatley 1939, 66).

This brings out an interesting question: how much did Chatley know about the work of Chinese scholars on the history of science done in the 1920s and 1930s? I have not found any Chinese names mentioned in those of his articles that I have consulted. The case of Zhu Kezhen is interesting, as it appears to be one of mutual ignorance. In 1926, Zhu published an article in which he undertook to ascertain the date of the *Yaodian* 堯典, the first section of the *Shujing* 書經 (Book of Documents) using the precession of equinoxes (Zhu 1926). Such a use of astronomy to critically investigate the Classics is highly evocative of Chinese evidential scholarship (*kaozheng xue* 考證學) of the late imperial period. Although Zhu's calculation methods must have been drawn from the science he learnt at Tangshan College and elsewhere in the academia of his time, it is less than certain that he would have needed "methods of criticism" uniquely Western to write on this subject. I have yet to find a reference to this article or to any other by Zhu Kezhen in Chatley's writings. Moreover, in a letter to Needham dated September 3, 1948, Chatley wrote:

> I had seen [Zhu Kezhen's] article [on the 28 lodges (*xiu* 宿)] in "Popular Astronomy". It is rather surprising that he doesn't refer to my papers as he is one of my old Tangshan students. Probably owing to the war he hasn't come across them.[44]

This is a reference to Zhu Kezhen's well-known article on the origin of the 28 lodges, first published in Chinese in 1944.[45] The English translation that Chatley read appeared in the American journal *Popular Astronomy* in 1947 (Chu 1947). Interestingly, this translation was first envisaged in the context of an English language edited volume on the history of astronomy. On 24, 1945, the chemist Zhang Zigong 張資珙 (1904-1968, who signed his name D.K. Djang in English), who was at Christ's College in Cambridge, informed Needham, then in Chongqing, about a plan to "translat[e] literatures on history of Chinese Science". He mentions that two papers translated by a Mr. C.Y. Hsieh "will form part of the Collection of Essays on History of Chinese Astronomy and Calendar Making, a volume proposed to be published sometime during the middle of next year". He adds that he is

**44** Needham Research Institute Archives, Joseph Needham's book sale, uncatalogued.

**45** The article was published in two journals: *Sixiang yu shidai* 思想與時代 34(1) and *Qixiang xuebao* 氣象學報 18(1); quoted in *SCC* 3, 725. It was reprinted in Zhu 2004.


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> entrusting the final editing of this volume to Dr. Herbert Chatley, the (sic) past chairman of the North China Branch of the Royal Asiatic Society, who is, for the present, quite occupied with war work.

Zhang intended to include in this collection three contributions by Dong Zuobin 董作賓 (1895-1963), the great specialist of oracle bones then based at Academia Sinica, as well as the "good paper on 'The Origin of the Twenty-eight Mansions'" by "President Tsoh Ko-tsen (竺可楨)".[46] At Zhang Zigong's request, Needham wrote to each of them on August 5 to suggest that the English translation should be done at their end. Zhu Kezhen replied to Needham on August 16, stating that he would do the translation himself; this task, he added, required that he should be in Beibei 北碚 (a district of Central Chongqing), "because most of the reference books mentioned in [his] paper [could] not be obtained in Tsunyi (Zunyi 遵義, Guizhou province)", to where Zhejiang University had been evacuated.[47]

Another witness to the links between Chatley and Zhu Kezhen at the time is the latter's diary, which he kept from 1936 to 1952. There are two occurrences of Chatley's name in it: in a letter he wrote on August 6, 1945, Zhu mentioned "his old teacher at Tangshan [who] has already retired to Britain". Ten days later, on the sixteenth, the news that "Japan [had] formally surrendered" was announced on the radio. On that day, Zhu replied to Needham's letter concerning the book that Zhang Zigong and Chatley intended to publish, mentioning that Zhu intended to translate his own article on the 28 lodges during the coming month of October. Other than that, Chatley's name does not appear in Zhu's diary.[48]

The English version of Zhu's article contains a substantial bibliography, mentioning not only James Legge (1815-1897), Gustav Schlegel (1840-1903), Léopold de Saussure (also mentioned in Chatley's article discussed above), and Nōda Chūryō 能田忠亮 (1901-1989), but also two specialists of "Hindu astronomy", W. Brennand and Prabodh Chandra Sengupta (1876-1962). Of these, the two most recent references published outside China are a book by Nōda (1933)[49] and a chapter by Sengupta (1936, referenced as 1940 by Zhu). This gives us some idea of what was available to Zhu Kezhen at the time: as

**46** Letter from D.K. Djang (Christ College, Cambridge) to Needham (Sino-British Science Cooperation Office, Chongqing), June 24, 1945, NRI Archives, GBR/1928/NRI/SCC2/3/9. Zhu Kezhen was then the president of Zhejiang University, which was based in Guizhou, successively in Yishan 宜山, Zunyi 遵義 and Meitan 湄潭 during the Japanese occupation of China.

**47** On Needham's visit to Zhejiang University during the war and on his relationship with Zhu Kezhen, cf. Cullen 2017.

**48** *Zhu Kezhen riji*; cf. also Pan 2017.

**49** This book is in Japanese, but Zhu gives its title in English (Sengupta 1936).


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Chatley suggested in his letter, the latter's works must have been unavailable to the former for geopolitical reasons in 1945. Chatley's words also suggest that he had not read Zhu's article before its publication. Therefore, it seems that he did not work on the editing of the papers that Zhang Zigong intended to put together as a collection; this is probably the reason why this collection was never published. In sum, there could well be some asymmetry in the absence of Zhu's and Chatley's names from each other's bibliography: Zhu had limited access to Chatley's publications, whereas Chatley may not have taken the time to acquaint himself with the work of Zhu and of his Chinese colleagues.

## 8 Herbert Chatley and Joseph Needham

In his letter of condolences to Chatley's widow, Needham wrote that he "came to know him through [their] mutual interest in the history of science and technology in China".[50] It is unclear when they became acquainted. The earliest mention of Chatley that I have found in Needham's correspondence is the one mentioned in the previous section, dated to 1945, when Needham was based in Chongqing and Chatley already resided in Bath; it is possible that the two became acquainted through mutual colleagues among Chinese scientists. The earliest item in their correspondence is dated to September 1948, when Joseph and Dorothy Needham had already visited Herbert and Nelly Chatley in Bath **[fig. 2]**.[51] The last item is a note from Chatley to Needham dated March 24, 1954. The correspondence mostly consists in Needham sending questions, manuscripts and published articles (not always written by himself) to Chatley, and in Chatley giving opinions on what he receives and answering Needham's questions.

The way in which some of Chatley's letters have been preserved in Needham's archives is revealing of how the latter worked: when the information provided by Chatley in a single letter was relevant to different topics, and therefore to different volumes of *SCC* as planned by Needham, the latter cut them up and filed each part of the letter in the folder where he accumulated information for these volumes. This was possible because Chatley's letters had text only on one side of each sheet. For example, on November 6, 1948, Chatley wrote a two-page letter which can be reconstructed from three different items in

**50** Joseph Needham, Letter to Nelly Chatley, March 20, 1955; Needham Research Institute Archives, uncatalogued.

**51** NRI Archives, GBR/1928/NRI/SCC2/262/6/4; Needham's letter is dated September 1, 1948; Chatley's reply, dated 1948, mentions this visit. The photo of the Chatleys kept at the NRI could have been taken around this period, as it is kept with an envelope stamped on October 4, 1948 (non-catalogued).


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the archives: the letter is a list of reading notes, each of which has an underlined title. Needham has added the date of the letter and/or "from Herbert Chatley" whenever necessary, so that each part of the letter is easy to identify **[tab. 1; figs 3-5]**.

The second part of the letter is heavily annotated in Needham's hand, both in pencil and ball pen: he checked and completed Chatley's bibliographical references. All these references occur in the bibliography of the volume where the subject they discuss belonged; but only some of them occur in the footnotes of the corresponding section. Needham chose to provide extensive bibliographies, rather than following the modern rule of listing only the items that occur in footnotes.

In the third part of the letter, Chatley has written the quotes in Chinese using a fountain pen. Needham has again added copious annotations using a ball pen, providing a draft translation and his idiosyncratic version of the Wade-Giles transcription the phonetic transcription of some characters.[52]

This sample suggests that Needham made full use of Chatley's notes, integrating them into his own research rather than quoting them directly in the text and footnotes of *SCC*. Moreover, it should be noted that in his review of bibliography at the beginning of volume 4.2, he put Chatley among the three authors of studies that "deserve particular gratitude". Among them, Chatley is the only one who wrote in English, the two other authors being Zhang Yinlin 張蔭麟 (1905-1942), a Chinese historian who taught at Zhejiang University in Zunyi at the end of his life, and Liu Xianzhou 劉仙洲 (1890-1975), a mechanical engineer who published extensively on the history of his field in China (*SCC* 4.2, 3).[53]

**52** Cf. above fn. 2.

**53** The two articles by Chatley mentioned are Chatley 1941 and Chatley 1954, 151-67 (no. 36 in *SCC*'s bibliography).


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**Table 1** From Chatley's Letter of 6 November 1948 to *Science and Civilisation in China*

| Part of letter | Call number | Headings in letter | Bibliography given in letter | Needham's classification | Occurrence in *SCC* |
|---|---|---|---|---|---|
| Top of p. 1 | GBR/1928/NRI/ SCC2/102/1/18 | Arabic Engineering | E. Wiedemann & F. Hauser. "Heben von Wasser in der Islamischen Welt", "Beitrage zur Geschichte der Technik und Industrie", Vol.8, p. 121-154, 1918. Berlin. | Engineering and mechanical technology 7a/ Water handling machinery | Vol. 4, part 2, section 27, g. Quoted as Wiedemann & Hauser (1) in bibliography. (1) The Swape ('Shādūf'; Counterbalanced Bailing Bucket). Quoted in note i p. 334. Chatley (36) quoted on p. 331. |
| Middle of p. 1 | GBR/1928/NRI/ SCC2/90/3/2 | Magic Mirrors | • Basil Hall Chamberlain. (1891). "Things Japanese". 2nd ed. London, 295.<br>• Ayrton and Perry, Proc. Royal Society, Vol. XXVII, pp. 127-42.<br>• J.J. Rein, "Industries of Japan", London, 1889, p. 447.<br>• Muraoka (Mitt.d. Gesel. Ostasiens, Heft 311, 1884<br>• Brewster, Phil. Mag, vol. ???, I think) 1832<br>• Ayrton & Perry, "On the Magic Mirrors of Japan", Proc. Roy. Soc. vol. XXVIII, pp. 127-142<br>• Govi, Ann. De Chim, et de Phys. 5 Serie, T.xx, 1880, pp. 99-110.<br>• Bertin, loc. cit.T.xxii, 1881, pp.472-513. | Physics: optics/ "Magic" mirrors of unequal curvature | Vol. 4, part 1, section 26, g (3). Mirrors of unequal curvature, pp. 94-97. All 7 refs in bibliography. Chamberlain, Ayrton & Perry, Rein and Bertin quoted in footnotes in section. |
| Bottom of p. 1 glued with p. 2 | GBR/1928/NRI/ SCC2/94/3/4 | Great Bear & Compass | A note on Lo-pan "Incidentally have you read my article on the Lo-pan in the Encyclopedia Sinica". | Physics: magnetism and electricity1/ Magnetic attraction | Volume 4, part 1, Section 26, i. Chatley's article on "Fêng-Shui" in bibliography as item (7). Quoted on p. 229, note d. |
| | | *Lun Heng* and magnetic needle | A note without bibliographical references. Quotation from the *Lunheng*, XVI, p. 692, p. 696, provided by Walter Perceval Yetts. | | Volume 4, part 1, Section 26, i (2). Passages of *Lunheng* quoted on p. 233. |

Needham stated his admiration for and indebtedness to Chatley repeatedly in his writings. The two of them shared great respect for the "old knowledge of China". However, despite this respect for knowledge of the past, Chatley still followed the model of most sinologists

of his time in that he did not cite contemporary Chinese authors in his work, but mostly European sinologists. This contrasts with an important feature of *SCC*: the extensive use of twentieth century Chinese scholarship on the history of science and technology. To Chatley's respect for the "old knowledge of China", Needham added respect for the knowledge held and produced by the Chinese scientists and scholars of his own time. He thus opened a new space of circulation, wider than the one in which Chatley's knowledge about China had operated. Indeed, it is one of Needham's achievements to have united the hitherto separated spaces of circulation defined on the one hand by Chinese scholarship, and on the other hand by Western and Japanese scholarship on the history of Chinese science and technology.

## 9 The Posterity of Herbert Chatley

Very few historians of science know the name of Chatley. The few who do have mostly spotted it in one of the volumes of *SCC*. However, his most visible contribution to it is also the most criticised. In his discussion of "ancient and medieval cosmological ideas" found in volume 3 of *SCC*, Needham famously presents three models of the universe. For the first model, which he calls "the *gaitian* 蓋天 theory", he relies heavily on Chatley's 1938 article entitled "'The Heavenly Cover' - A Study in Ancient Chinese Astronomy". In particular, he reproduces Chatley's diagram entitled "Meridian section of 'Tien Kai' Cosmos" (Chatley 1938, 18). This diagram embodies Chatley's attempt to make sense of the dimensions of the universe given in the *Zhoubi suanjing* 周髀算經 (Mathematical Classic of the Gnomon of Zhou, first century CE).[54] Chatley's diagram is inspired by that given by Nōda in his 1933 book (Nōda 1933, 53),[55] but it is a lot more elaborate, in that the various magnitudes given in the *Zhoubi suanjing* have been incorporated into what is effectively a hemispherical model **[figs 6-7]**.

According to the classification proposed by Qu Anjing in his historiographical review, this diagram pertains to the traditional interpretation of the *gaitian* model, in which heaven and earth are thought to be parallel curves (Qu 2002, 92-4).[56] Among the objections that can be raised to Chatley's model, one can be phrased in non-technical terms: in that model, day and night correspond to the sun's position being respectively above and below the observer's horizon. By contrast, the *Zhoubi suanjing* states: "The illumination of the sun

54 On this book, cf. Cullen 1996.

55 Nōda's diagram is reproduced in Ch'a 2000, 269.

56 Cf. also the review of nineteenth- and twentieth-century studies of the *Zhoubi suanjing* in Cullen 1996, 168-9.


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extends 167000 *li* to all sides. The distance to which human vision extends must be the same as the extent of solar illumination" (Cullen 1996, 180). In such a cosmos, day and night would simply correspond to the distance between the sun and the observer being respectively less and more than 167000 *li*, the change in that distance being brought about by the sun's rotation in a celestial plane parallel to the flat earth on which the observer stands.

It is somewhat ironical, and perhaps unfair, that the greatest visibility of Chatley's work in *SCC*, to which he contributed much information, should be through this diagram, which has received only criticism from later historians of astronomy, and has cast some doubt as to his understanding of the early sources that he read. His translation of chapter 3 of the *Huainanzi*, on the other hand, which was evidently deemed of some value by those who could access it, has remained invisible to the wider community of historians of science and historians of early China.

## 10 "Old China Hands" and Knowledge About China

This exploration of Herbert Chatley's life and work and of his connection with Joseph Needham brings into light a group of actors of knowledge about China in Europe who may be regarded as 'amateurs', in the sense that they were not academics paid to construct and circulate this knowledge, or savants who had the means to devote themselves entirely to the study of China, as Needham himself did during the last fifty years of his life. Chatley was "an old China hand", that is, a Westerner who spent his career in China during the late imperial and Republican periods. This group of actors played a significant role throughout the process of professionalisation of sinology in the nineteenth and twentieth centuries, and all 'professional sinologists' knew some of them. Nowadays, the latter group seldom assess positively what 'amateurs', whose expertise is acquired while working as engineers or businessmen in China, write, let alone quote them in their own publications. The experience of the China of their own time which amateurs past and present have in common is no longer deemed sufficient to contribute to academic research on China, and especially on its imperial past.

Chatley's story confirms the fact that in the first half of the twentieth century things were different: his affiliation with a number of learned societies, and his election as Chairman of the North China Branch of the Royal Asiatic Society indicate that his research on China was acknowledged as valuable scholarship: Needham was not alone in regarding him as a genuine contributor to knowledge about China. How unique was Chatley in this respect? Was he just one of many 'amateurs' who contributed to the Western discovery of

imperial China's science and technology? We have seen that his professional expertise allowed him to recognise pre-modern Chinese technological achievements, and that his technical understanding of astronomy enabled him to investigate early Chinese astronomy. This leads to a second question: was the study of Chinese science and technology more accessible to Westerners than, say, that of the classics or poetry, which could only be approached through a lengthy process of becoming literate in classical Chinese? Answering such broad questions would require a prosopographical study of the men and women who, like Chatley, contributed to European knowledge of China from the margins of the academic institutions of sinology in nineteenth and twentieth-century Europe. The case of Chatley suggests that the bibliographical sections of *Science and Civilisation in China* would form an interesting starting point for such an enterprise.


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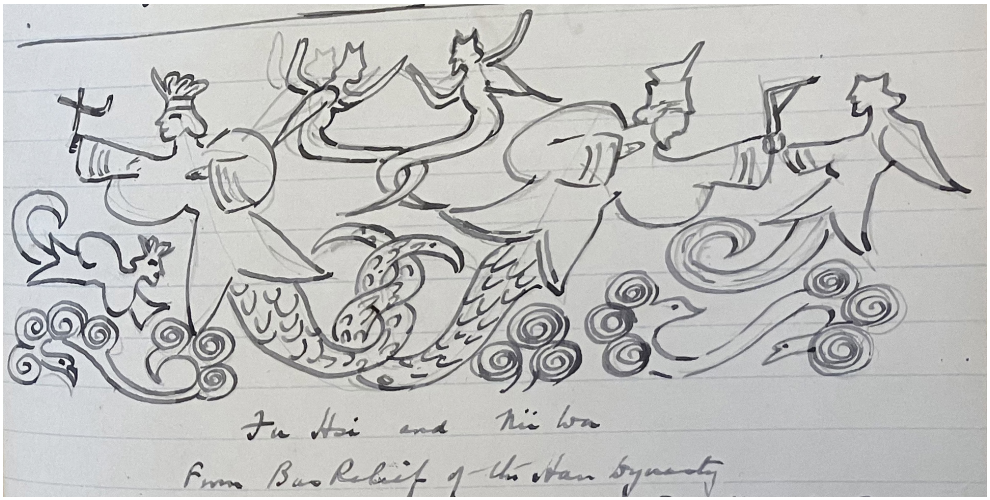
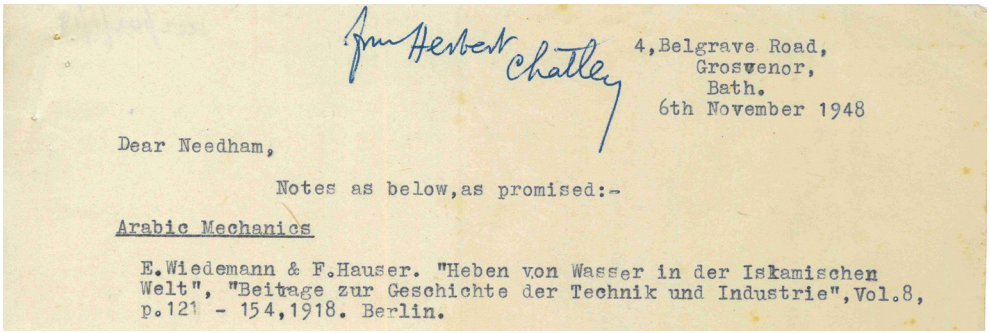



**Figure 1** Chatley's sketch of the Nüwa and Fuxi mural. Notebook, Senate House Library, MS420/3/1

**Figure 2** Nelly and Herbert Chatley c. 1948. Photo kept at the Needham Research Institute; not catalogued



from Herbert Chatley 4, Belgrave Road,
Grosvenor,
Bath.
6th November 1948

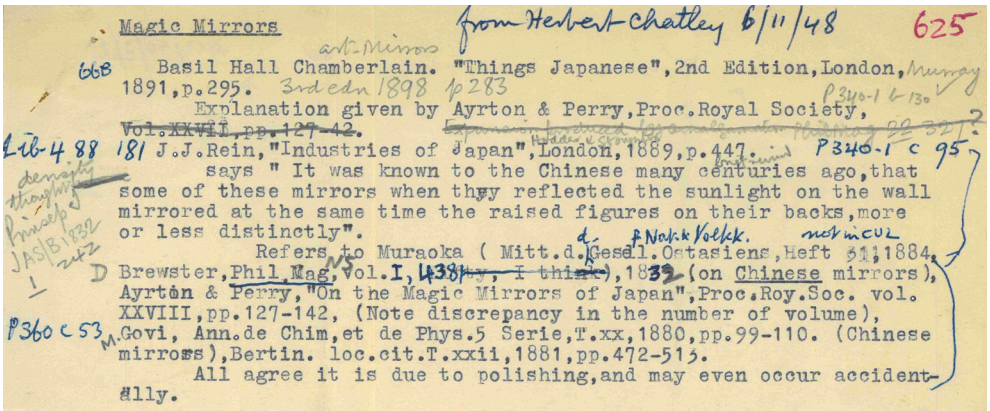
Dear Needham,

Notes as below, as promised:-

Arabic Mechanics

E. Wiedemann & F. Hauser. "Heben von Wasser in der Islamischen Welt", "Beitrage zur Geschichte der Technik und Industrie", Vol. 8, p. 121 - 154, 1918. Berlin.

**Figure 3** Letter of November 6, 1948, part 1



Magic Mirrors — from Herbert Chatley 6/11/48 — 625

668 Basil Hall Chamberlain. "Things Japanese", 2nd Edition, London, 1891, p. 295. 3rd edn 1898 p 283

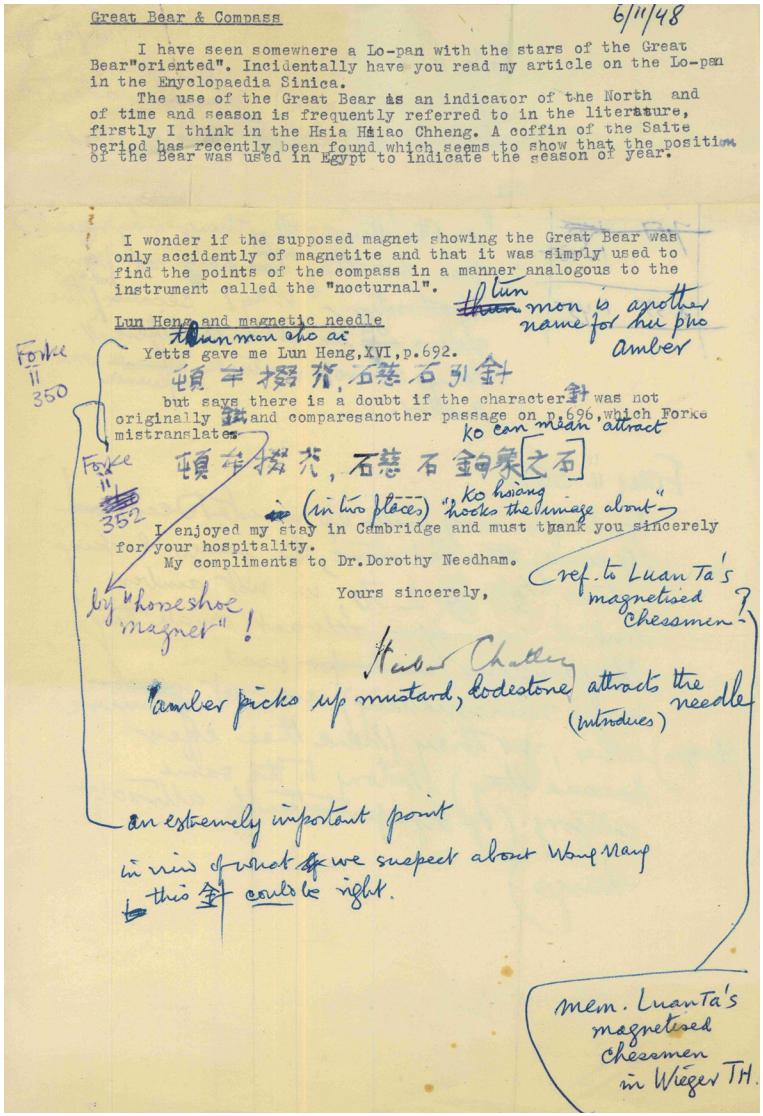
Explanation given by Ayrton & Perry, Proc. Royal Society, Vol. XXVII, pp. 127-42.

181 J.J. Rein, "Industries of Japan", London, 1889, p. 447. says " It was known to the Chinese many centuries ago, that some of these mirrors when they reflected the sunlight on the wall mirrored at the same time the raised figures on their backs, more or less distinctly".

Refers to Muraoka ( Mitt. d. Gesel. Ostasiens, Heft 61, 1884, Brewster, Phil. Mag, Vol. I, 1838, (on Chinese mirrors), Ayrton & Perry, "On the Magic Mirrors of Japan", Proc. Roy. Soc. vol. XXVIII, pp. 127-142, (Note discrepancy in the number of volume), Govi, Ann. de Chim, et de Phys. 5 Serie, T. xx, 1880, pp. 99-110. (Chinese mirrors), Bertin. loc. cit. T. xxii, 1881, pp. 472-513.

All agree it is due to polishing, and may even occur accidentally.

**Figure 4** Letter of November 6, 1948, part 2



Great Bear & Compass 6/11/48

I have seen somewhere a Lo-pan with the stars of the Great Bear "oriented". Incidentally have you read my article on the Lo-pan in the Encyclopaedia Sinica.

The use of the Great Bear as an indicator of the North and of time and season is frequently referred to in the literature, firstly I think in the Hsia Hsiao Chheng. A coffin of the Saite period has recently been found which seems to show that the position of the Bear was used in Egypt to indicate the season of year.

I wonder if the supposed magnet showing the Great Bear was only accidently of magnetite and that it was simply used to find the points of the compass in a manner analogous to the instrument called the "nocturnal".

Lun Heng and magnetic needle

Yetts gave me Lun Heng, XVI, p.692.

頓牟掇芥，石慈石引針

but says there is a doubt if the character 針 was not originally 鉗 and comparesanother passage on p.696, which Forke mistranslates:

頓牟掇芥，石慈石鉤[之]石

(in two places) "hooks the image about"

I enjoyed my stay in Cambridge and must thank you sincerely for your hospitality.

My compliments to Dr. Dorothy Needham.

Yours sincerely,

Needham Chatley

Forke II 350

Forke II 352

Lun mon is another name for hu phu amber

Ko can mean attract

Ko hsiang

by "horseshoe magnet"!

ref. to Luan Ta's magnetised chessmen?

amber picks up mustard, lodestone attracts the needle (introduces)

an extremely important point in view of what we suspect about Wang Mang & this 針 could be right.

mem. Luan Ta's magnetised chessmen in Wieger TH.

**Figure 5** Letter of November 6, 1948, part 3

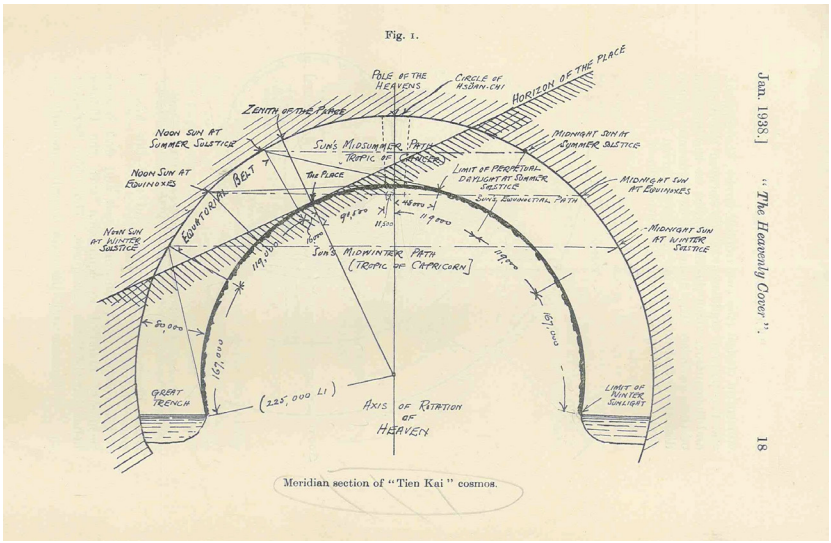



**Figure 6** Chatley's cosmographical diagram (Chatley 1938, 18)

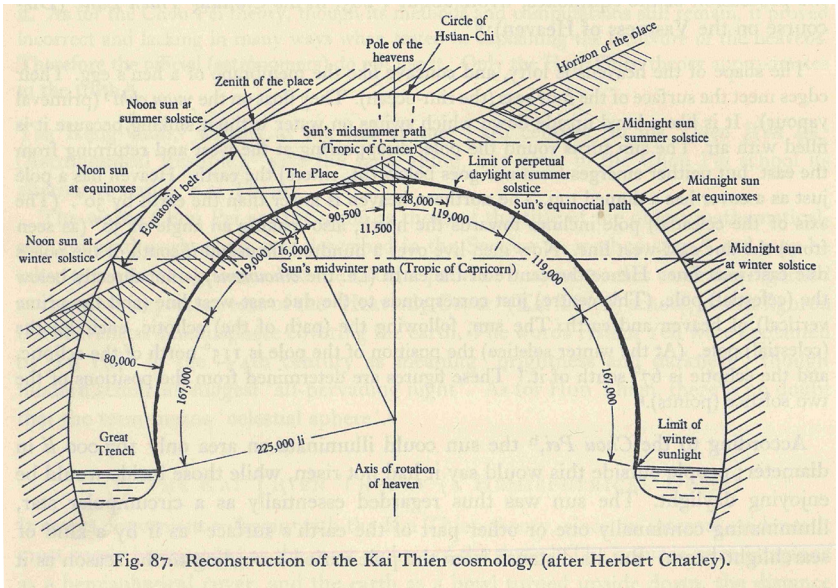



Fig. 87. Reconstruction of the Kai Thien cosmology (after Herbert Chatley).

**Figure 7** Needham's reproduction of Chatley's diagram (SCC 3, 212)

## Archives

Royal Asiatic Society Archives, RASCOLL 3/7/2/4.
Senate House Library, University of London, Herbert Chatley's Papers, MS420.
MIT Libraries Distinctive Collections, MC.0051: Papers of John Ripley Freeman, Box 130.
Needham Research Institute Archives, GBR/1928/NRI/SCC.

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