

RESEARCH ARTICLE

Picturing Chinese science: wartime photographs in Joseph Needham's science diplomacy

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Abstract

Joseph Needham occupies a central position in the historical narrative underpinning the most influential practitioner-derived definition of 'science diplomacy'. The brief biographical sketch produced by the Royal Society and the American Association for the Advancement of Science sets Needham's activities in the Second World War as an exemplar of a science diplomacy. This article critically reconsiders Needham's wartime activities, shedding light on the roles played by photographs in those diplomatic activities and his onward dissemination of them as part of his self-fashioning. Images were important to the British biochemist, and he was an avid amateur photographer himself, amassing a unique collection of hundreds of images relating to science, technology and medicine in wartime China during his time working as director of the Sino-British Science Co-operation Office. These included ones produced by China's Nationalist Party-led government, and by the Chinese Communist Party. Focusing on these photographs, this article examines the way Joseph Needham used his experiences to underpin claims to authority which, together with the breadth of his networks, enabled him to establish himself as an international interlocutor. All three aspects formed essential parts of his science diplomacy.

British biochemist Joseph Needham's photographic collection from wartime China has been used to tell many stories about science, technology and medicine. An avid amateur photographer, he took hundreds of photographs between 1943 and 1946 while working for the British Council and the British embassy. Needham founded the Sino-British Science Co-operation Office (SBSCO), on behalf of which he travelled extensively throughout what was known as 'Free China'. The SBSCO, for which his wife and fellow biochemist Dr Dorothy Needham served as associate director in 1944–5, aimed to act as a "clearing house" for scientific exchange, making connections with, and offering practical support for, the research of those working in the '[u]niversities, industrial plants and research laboratories, arsenals and the like' scattered across parts of central and western China previously considered its hinterland.¹ Many of these had been rebuilt after being relocated from the heavily populated and modernized eastern coast.² This was the scientific, technical and industrial infrastructure that accompanied both the tremendous flow of

¹ Needham Research Institute (subsequently NRI) Library, JN-C:3, Joseph Needham, 'The first year's working of the Sino-British Science Co-operation Bureau', February 1944, pp. 2, 5.

² On wartime adaptation in Chinese higher education see John Israel, *Lianda: A Chinese University in War and Revolution*, Stanford, CA: Stanford University Press, 1998.

refugees fleeing Japan's rapid 1937 invasion and the Republic of China's (RoC) government, led by the Kuomintang (KMT, Nationalist Party) retreating from its capital, Nanjing. From 1938 onward, Chiang Kai-shek's government re-established its wartime capital in Chongqing (Chungking).³

Along with those he took himself, Needham also collected many dozens more photographs while in Chongqing and on his journeys across other parts of unoccupied China. These were given to him by friends, associates and official contacts. Their breadth of content, distinctiveness and quantity have seen these images prominently feature in a wide range of contexts in recent decades. They have appeared in physical exhibitions and multiple digital collections.⁴ They are also regularly reproduced to illustrate works of historical scholarship. Recent examples range from studies of vaccination in modern China to an examination of the origins of Needham's contributions to UNESCO.⁵ Consequently, the collection has become inextricably interwoven in our understanding of science in China during the Second World War and, in doing so, embedded him within narratives on the subject.

This was no accident. As an amateur photographer, as a collector, and as an onward disseminator, images were simultaneously an important resource and a crucial means of communication for Needham. He made extensive use of them in multiple contexts both during and after the war, particularly his own publications. In doing so, he drew on long-established conventions and strategies utilized by 'explorers', including natural philosophers and scientists, who crafted interrelated narratives about themselves and their travels to distant locales intended for consumption by audiences back home.⁶ The integral role played by images in Alexander von Humboldt's publications, for example, was one that had long-term influence.⁷ By the photographic age, such explorers utilized still images and films to craft narratives about themselves and the sites of their expeditions. Frank Hurley's images have had a durable influence in shaping both contemporary and later audiences' conceptions of Ernest Shackleton and the Antarctic alike.⁸ Needham's relationship with photography provides a particularly useful window through which to examine and better understand his 'science diplomacy'.

Photographs played their own distinct role within this process both as objects of exchange and as part of his 'self-fashioning' as a Western interlocutor for Chinese science. Self-fashioning has been especially prominent in scholarship seeking to move beyond

³ On these dynamics see Rana Mitter, *China's War with Japan, 1937-1945*, London: Penguin Books, 2014, pp. 172-8.

⁴ For example, Wang Yufeng (ed.), *Li Yuese yu kang shi Zhongguo de ke xue ji nian zhan zhuan ji* (Joseph Needham in Wartime China (1942-1946) Exhibition Catalogue), Kaohsiung: Guoli kexue gongyi bowuguan (National Science and Technology Museum), 2000; Chinese Wartime Science exhibition shown in Bristol, Cambridge, London and Hong Kong, 2015; Joseph Needham collection, Cambridge University Digital Library, at <https://cudl.lib.cam.ac.uk/collections/needham> (accessed 1 June 2022); and IDP Database, International Dunhuang Project, <http://idp.bl.uk> (accessed 1 June 2022).

⁵ Mary Augusta Brazelton, 'Engineering health: technologies of immunization in China's wartime hinterland, 1937-45', *Technology and Culture* (2019) 60(2), pp. 409-37, esp. 420; and Brazelton, *Mass Vaccination: Chinese Bodies and State Power in Modern China*, Ithaca, NY: Cornell University Press, 2019, p. 98; Thomas Mougey, 'Building UNESCO science from the "dark zone": Joseph Needham, empire, and the wartime reorganization of international science from China, 1942-6', *History of Science* (2021) 59(4), pp. 461-91, esp. 466, 468-89.

⁶ Beau Riffenburgh, *The Myth of the Explorer: The Press, Sensationalism, and Geographical Discovery*, London: Belhaven Press, 1993.

⁷ Laura Søvsø Thomasen, 'Showing and telling science: the integrated use of literature and images in the works of Erasmus Darwin and Alexander von Humboldt', *Interdisciplinary Science Reviews* (2017) 42(3), pp. 227-40.

⁸ For example, Robert Dixon, *Photography, Early Cinema and Colonial Modernity: Frank Hurley's Synchronized Lecture Entertainments*, London: Anthem Press, 2013, pp. 109-46; Sophie Gordon, 'At the ends of the Earth: polar images and royal collecting', in David Hempleman-Adams, Sophie Gordon, Emma Stuart and Alan Donnithorne, *The Heart of the Great Alone: Scott, Shackleton and Antarctic Photography*, London: Royal Collection, 2009, pp. 39-67; Julian Thomas, *Showman: The Photography of Frank Hurley*, Canberra: National Library of Australia, 1990.

professionalization as a lens through which to consider science-related boundary work, identity formation and public personae during the long nineteenth century.⁹ It provides an equally powerful framework for analysing scientists' involvement in international affairs. Geert Somsen, for example, has powerfully utilized self-fashioning to understand the process by which scientists from the Netherlands sought to establish themselves as international mediators and promoters of peace.¹⁰ Neither Needham nor any other scientific and technical advisers in China during the Second World War had a singular or firmly established template by which to either identify themselves or operate, leading to great variation in their activities and agendas. In this context, the British biochemist has been singled out and has served as a comparator in such a role.¹¹

In fact, Needham has pride of place in the narrative underpinning the singularly influential definition of 'science diplomacy' articulated by the Royal Society (RS) and the American Association for the Advancement of Science (AAAS).¹² There is no denying the RS/AAAS definition's ubiquity in discussions of science diplomacy. As a result, it is worth continuing to consider the context in which it was most influentially articulated. The report in question opens with a 'brief history of science diplomacy', starting with seventeenth-century English diplomat Sir Henry Wotton and eighteenth-century RS foreign secretary Philip Zollman, but soon leaping ahead to examples from the twentieth century.

Needham's activities served as a waypoint in a centuries-long historical sequence centred on British actors. A fellow of the Royal Society from 1941, he fit well within a narrative centring an anglocentric sequence of scientists and scientific organizations as key drivers of scientific internationalism and, ultimately, problematically presenting them as 'the real science diplomacy initiators', as Turchetti *et al.* have noted.¹³ As for Needham's 'science diplomacy', the RS/AAAS portrait encompassed everything from his work during the Second World War to later involvement in UNESCO and *Science and Civilisation in China*. In providing this sequence of examples, the text highlights the extent to which his period in wartime China served as a catalyst for his subsequent undertakings.¹⁴ At the same time, in doing so the biographical sketch simultaneously communicates that all were also

⁹ For example, Ruth Barton, "'Men of science': language, identity and professionalization in the mid-Victorian scientific community', *History of Science* (2003) 41(1), pp. 73–119; Heather Ellis, *Masculinity and Science in Britain, 1831–1918*, London: Palgrave Macmillan, 2017; Jan Golinski, *The Experimental Self: Humphry Davy and the Making of a Man of Science*, Chicago: The University of Chicago Press, 2016; Paul White, *Thomas Huxley: Making the 'Man of Science'*, Cambridge: Cambridge University Press, 2002.

¹⁰ Geert Somsen, "'Holland's calling": Dutch scientists' self-fashioning as international mediators', in Rebecka Lettevall, Geert Somsen, and Sven Widmalm (eds.), *Neutrality in Twentieth-Century Europe: Intersections of Science, Culture, and Politics after the First World War*, London: Routledge, 2012, pp. 45–64.

¹¹ Li Zhang and Yanmei Zhu, 'Technical assistance versus cultural export: George Cressey and the U.S. Cultural Relations Program in wartime China, 1942–1946', *Centaurus* (2020) 63(1), p. 32–50.

¹² *New Frontiers in Science Diplomacy*, London: Royal Society, 2010. Key critical perspectives are Matthew Adamson and Roberto Lalli, 'Global perspectives on science diplomacy: exploring the diplomacy–knowledge nexus in contemporary histories of science', *Centaurus* (2021) 63(1), pp. 1–16; Tim Flink, 'The sensationalist discourse of science diplomacy: a critical reflection', *Hague Journal of Diplomacy* (2020) 15, pp. 1–11; Pierre-Bruno Ruffini, 'Conceptualizing science diplomacy in the practitioner-driven literature: a critical review', *Humanities and Social Sciences Communications* (2020) 7(1), pp. 1–9.

¹³ Simone Turchetti *et al.*, 'Introduction: just Needham to Nixon? On writing the history of "Science Diplomacy"', *Historical Studies in the Natural Sciences* (2020) 50(4), pp. 323–39, 327. For a Royal Society-centred biographical sketch see J.B.A. Gurdon and Barbara Rodbard, 'Joseph Needham, C.H., F. R. S., F.B.A. 9 December 1900–24 March 1995', *Biographical Memoirs of Fellows of the Royal Society* (2000) 46, pp. 367–76.

¹⁴ For example, Gordon Barrett, 'Between sovereignty and legitimacy: China and UNESCO, 1946–1953', *Modern Asian Studies* (2019) 53(5), pp. 1516–42; Mougey, *op. cit.* (5); and Thomas Mougey, 'Needham at the crossroads: history, politics and international science in wartime China (1942–1946)', *BJHS* (2017) 50(1), pp. 83–109; Simon Winchester, *The Man Who Loved China*, New York: HarperCollins, 2008.

important for understanding his status as a scientist diplomat and, by extension, the nature of science diplomacy.

Notably absent in the RS/AAAS sketch is any mention of Joseph Needham's advocacy and support for the People's Republic of China (PRC) in the decades after 1949. Yet Needham rapidly established an international reputation as one of the PRC's pre-eminent 'foreign friends' (*waiquo pengyou*), alongside contemporaries such as Israel Epstein, Rewi Alley and Edgar Snow.¹⁵ Most controversially, this included heading up the World Peace Council-sponsored 'International Scientific Commission' supporting Chinese and North Korean allegations that the United States had engaged in bacteriological warfare during the Korean War.¹⁶ Beyond this, however, Needham's efforts focused on encouraging greater 'Western', particularly British, engagement with the Chinese Communist Party-led (CCP) party state. He maintained links with Epstein and Alley as well as with scientific friends and colleagues through multiple trips to the PRC from the 1950s onward. Through organizations like the Britain–China Friendship Association, he helped facilitate visits to the PRC by other prominent British scientists such as J.D. Bernal to Dorothy Hodgkin.¹⁷ It is not for nothing that Jon Agar has labelled him 'undoubtedly the most important figure in mid-twentieth-century Sino-British scientific relations', aptly connecting Needham's wartime activities and his efforts to act as an interlocutor encouraging development of Sino-British relations across Cold War divides.¹⁸

These activities are as relevant to Needham's science diplomacy as those included in the RS/AAAS narrative. Their exclusion prevents any engagement with questions of ideology beyond broad-brush internationalism or consideration of the complexities inherent in the British biochemist's later relationship with the PRC's foreign-affairs system. However, even when focusing on a single period such as the Second World War, if the aim is to consider Joseph Needham as an exemplar of science diplomacy, then a well-rounded portrait is essential. His passion for photographs – particularly in that period – provides a particularly useful opportunity to compile such a portrait. Needham's image collection reveals the multi-layered nature of his approach to science diplomacy as it developed during the Second World War. His use of photographs of the Chongqing Industrial and Mining Exhibition provided by the RoC's Natural Resources Commission simultaneously show his close cooperation with the KMT-led government and the way that he used his experiences as the key underpinning for his claims to authority. His repurposing of a Communist-produced image of laboratory glassware was rooted in his desire to serve as an international interlocutor and advocate for science and technology in China in both behind-the-scenes and public-focused contexts. And, finally, not only was Needham's interest in the relationship between Chinese communism and science and technology evident in his obtaining photographs of the CCP-governed Shaan-Gan-Ning Border Region, but also his ability to do so reflected the breadth and cross-cutting nature of his networks

¹⁵ For example, Wang Yongqiang and Cai Jingbiao, 'Honored and remembered, the Chinese connection: top ten international friends of China', *China Pictorial*, February 2010, pp. 8–23. On 'foreign friends' see Anne-Marie Brady, *Making the Foreign Serve China: Managing Foreigners in the People's Republic*, Lanham, MD: Rowman and Littlefield, 2003.

¹⁶ On Needham's support for the allegations see Mary Augusta Brazelton, 'Plagues from the skies: the 1952 germ warfare allegations and shifting definitions of expertise in Chinese bacteriology', in Jennifer Altehenger and Aaron Moore (eds.), forthcoming; Tom Buchanan, 'The courage of Galileo: Joseph Needham and the "germ warfare" allegations in the Korean War', *History* (2001) 86(284), pp. 503–22; Shiwei Chen, 'History of three mobilizations: a re-examination of the Chinese biological warfare allegations against the United States in the Korean War', *Journal of American-East Asian Relations* (2009) 16, pp. 213–47, esp. 226–43.

¹⁷ Gordon Barrett, *China's Cold War Science Diplomacy*, Cambridge: Cambridge University Press, 2022, pp. 173–4, 200.

¹⁸ Jon Agar, "'It's Springtime for Science": renewing China–UK scientific relations in the 1970s', *Notes and Records of the Royal Society* (2013) 67(1), pp. 1–18, 2.

during that period. These images of science were both objects of exchange and tools for communication for Needham, contributing to the self-fashioned persona related to science diplomacy.

The Chongqing Industrial and Mining Exhibition: Needham's experiences

Joseph Needham spent much of his time in China on the road visiting everything from labs to factories and air tunnels to oilfields. He travelled to the very edges of unoccupied China, at times not far from the fluid front lines of China's war with Japan. These primarily took the form of four regionally focused 'tours', as Needham called them, across 'Free China': to the North West from August to December 1943, to the South East from April to July and the South West from August to October 1944, and finally to the North from August to November 1945. His willingness to undertake lengthy journeys under very difficult conditions was crucial when it came to his usefulness to both the British and Chinese governments.

This also lent him credibility as a communicator about science, technology and industrial development in China, underpinning his various publications on the subject. We have a much fuller sense of his time on the road than while based in the KMT's wartime capital, Chongqing, as his surviving diaries from this period were travel-related. Compared to Dorothy Needham, whose diaries provide a rich picture of life and work in Chongqing, we know far less about Joseph's activities in Chongqing than we do about his 'tours'. There were, however, a few exceptions. One activity which he chose to publicly promote was his attendance at the Chongqing Industrial and Mining Exhibition (CIME) during March 1944. Joseph Needham's promotion of CIME through a combination of text and images exemplified two key aspects of his public-facing science diplomacy. First was the centrality of his experiential knowledge within it. The second was that, while he may have been in China as a British representative, he offered enthusiastic public support for science and technology in China based on that experience.

With CIME, Needham amplified an event that was designed to showcase scientific and technological achievements under the leadership of the Republic of China's KMT-led government. The exhibition was sponsored by the Natural Resources Commission (NRC), an RoC body coordinating industrial development.¹⁹ Needham's copy of the official English-language guide described it as designed to 'facilitate the public's close-up inspection of the Commission's multiple activities ... The exhibits consist of samples and actual products, models, tables and charts, and photographs and drawings'.²⁰ While events such as the UK's Festival of Britain have been analysed as a vehicle for governmental organizations seeking to legitimate controversial technologies, the Chongqing Industrial and Mining Exhibition is best considered in opposite terms.²¹ It was a technology-focused exhibition aiming to legitimate government.

The majority of visitors would have been Chinese, particularly those living in Chongqing or surrounding areas in Sichuan, drawn from a local population and elite that had displayed notable reticence about accepting the KMT government's legitimacy

¹⁹ Morris L. Bian, *The Making of the State Enterprise System in Modern China: The Dynamics of Institutional Change*, Cambridge, MA: Harvard University Press, 2005; William C. Kirby, 'Continuity and change in modern China: economic planning on the mainland and on Taiwan, 1943–1958', *Australian Journal of Chinese Affairs* (1990) 24, pp. 121–41.

²⁰ NRI Library, Offprints: Chinese Science (modern) I, 'Guide to industrial & mining exhibition of National Resources Commission, Ministry of Economic Affairs, National Government of China, Chungking, China, 1944', p. 9.

²¹ Sophie Forgan, 'Festivals of science and two cultures: science, design, and display in the Festival of Britain, 1951', *BJHS* (1998) 31(2), pp. 233–5.

or, by extension, the modernizing culture and industrialization it actively promoted.²² That the guide was available in English underscores that it was created with the city's foreign population as an intended audience, many of whom were working on behalf of governments, agencies and organizations as part of the war effort. Even so, all the signage and textual content visible in photographs is in Chinese characters, providing a language barrier for many of those foreign visitors. This would have provided the NRC organizers a certain degree of insulation from the need to navigate such visitors' sensitivities about national achievement-inflected narratives that might naturally arise with such state-sponsored exhibitions.²³ The guide would have been a particularly important source of information concerning technology and industry for that high percentage of foreign visitors without a working knowledge of written Chinese.

Needham was one such foreign visitor to the exhibition, albeit a highly atypical one. He did not record that visit in his diary covering spring 1944, but he did take a number of photographs which were included among those for that subsequent 'southern tour' through Guizhou, Guangxi, Jiangxi, Guangdong and Fuzhou.²⁴ Needham's eight photographs give an excellent sense of the sheer scale of the exhibition, as well as the range of the displays noted in the guide's description.²⁵ His camera also captured some of his fellow visitors, including members of the public, among whom were foreigners in civilian and military dress.²⁶ In all, Needham's photographs on their own provide a richer sense of the exhibition itself than the official guide – a text more oriented toward describing the NRC's organizational units and achievements than anything else.

This was equally true of what Needham wrote about the exhibition. Mere months later, the 3 June issue of *Nature* carried an article by him on the CIME.²⁷ He moved quickly to write and send this off, given that the exhibition took place in March and he was on the road travelling through the South East from April through July. Other readers will have also encountered it four years later when reprinted in his and Dorothy Needham's book *Science Outpost*.²⁸ His approach to writing about the exhibition was to provide readers with a virtual tour. The text's main sections are framed slightly differently from those in either the guide or the exhibition itself, being simplified down to 'Mining and metallurgy', 'Chemical industry' and 'Engineering'.²⁹ Still, in terms of content it faithfully follows the ten sequential sections into which the original event was subdivided: natural resources, coal, petroleum, iron and steel, non-ferrous metals, export minerals, chemical products, electrical supplies, electric power, machinery.³⁰ In doing so, his aim was to do more than just note the exhibition's existence or argue for its significance for those living outside Chongqing or outside China. He went much further, aiming to convey a sense of what it was like to physically move through the exhibition. Needham did so by including detailed descriptions of its space, presentation, and content. In the second paragraph, for example, he wrote, 'Facing the visitor in the imposing entrance-hall were the

²² Shuge Wei, *News under Fire: China's Propaganda against Japan in the English-Language Press, 1928–1941*, Hong Kong: Hong Kong University Press, 2017, p. 220.

²³ For a discussion of this issue in the British context see Forgan, op. cit. (21).

²⁴ NRI2/5/12/2, 'Joseph Needham's journal of his tour of south-east China, Apr.8–Jul.1, 1944 and south-west China, Aug.1–Oct.31, 1944'.

²⁵ This series of Needham's photographs are NRI2/10/1/1/4/3/7–14.

²⁶ For example, NRI2/10/1/1/4/3/14.

²⁷ Joseph Needham, 'Chungking industrial and mining exhibition', *Nature* (1944) 153(3892), pp. 672–5.

²⁸ Joseph Needham, 'Chungking industrial and mining exhibition', in Joseph Needham and Dorothy Needham (eds.), *Science Outpost: Papers of the Sino-British Science Co-operation Office (British Council Scientific Office in China), 1942–1946*, London: Pilot Press, 1948, pp. 189–94.

²⁹ Needham, op. cit. (27), pp. 672–73; Needham, op. cit. (28), pp. 190–1.

³⁰ 'Guide', op. cit. (21), p. 9.

devices ... of the 105 mines and industrial plants operated by the National Resources Commission'.³¹ He opened the next section with similar language: 'Proceeding along his fixed path, the visitor came next to the section on coal and oil'.³² Throughout the article, he used such phrases to align his text with the sequencing of his journey through the halls, explicitly linking the information and messages conveyed in the exhibition with their means of communication, be they through models, maps or images.

So, too, does he seek to capture a sense of how visitors might interact with the exhibits. He describes how visual materials on the walls in the entrance hall were accompanied by geological samples, writing that 'one could handle a specimen of the ponderous tungsten ore, wolframite, of which China is the leading world producer'.³³ When introducing the sections on electrical supplies and power, he provides detail on the shape and lighting in the hall, going on to explain that 'Chinese-made radio gramophones' provided musical accompaniment.³⁴ In Needham's article-length textual tour of the Chongqing Industrial and Mining Exhibition, then, readers were presented with a multi-sensory portrait of an event that conveyed a sense not only of the country's modernizing achievements, but also of its wartime importance.

However, readers were not solely reliant on textual descriptions of the exhibition space and displays. This CIME-focused article was the only one out of the nine China-focused ones that Needham published in *Nature* between 1943 and 1946 to include images.³⁵ Any readers of those other articles wishing to see images on related subjects would have had to seek out Joseph Needham's 1945 pictorial book *Chinese Science*. This experientially focused article was the sole exception, with *Nature* publishing three images embedded in the text. Photographs therefore played an important and prominent role in the article.

Needham had taken photographs throughout his visit to the exhibition, yet none of these were among the trio printed with his article. Instead, he opted to use ones from a set of eight provided by the NRC.³⁶ Among the advantages they provided were quality and clarity. An official photographer would have been better placed to control conditions and set up their shots than an exhibition visitor. One image used was of the entrance hall (Figure 1). Needham had also taken two shots of this hall, including one from a very similar angle. These convey a sense of the space as it was used, with other visitors in each image looking at and moving around the displays.³⁷ In contrast, the official photograph includes no people and has been set up at such an angle as to capture most of the room's central console and pillar, containing exhibits on standardization of weights, measures and equipment. So, too, are visible examples of the geological samples, maps and insignia along and on the walls.³⁸ This photograph is far less dynamic than those taken by Joseph Needham. Consequently, it provides a more detailed view of the exhibit contents.

Content was also important. All had clear connections to what is argued through description in the text. The exhibition's machinery section as captured in the first of these images was very unlike that of the entrance hall in its being far from empty. Although the large machine tools are visible in the image, the space around them is packed full of people.³⁹ The crowds in this photograph align well with Needham's

³¹ Needham, op. cit. (27), p. 672; Needham, op. cit. (28), p. 189.

³² Needham, op. cit. (27), p. 672; Needham, op. cit. (28), p. 190.

³³ Needham, op. cit. (27), p. 672; Needham, op. cit. (28), p. 189.

³⁴ Needham, op. cit. (27), p. 673; Needham, op. cit. (28), p. 191.

³⁵ For a complete list of his publications during this period see Gregory Blue, 'Joseph Needham: a publication history', *Chinese Science* (1997) 14, pp. 102–3.

³⁶ Needham and Needham, op. cit. (28), p. xi.

³⁷ NRI2/10/1/1/4/3/10–11.

³⁸ NRI2/10/1/1/8/13/2.

³⁹ NRI2/10/1/1/8/13/4.



Figure 1. Entrance Hall, Chongqing Industrial and Mining Exhibition. NRI2/10/11/8/13/2, reproduced courtesy of the Needham Research Institute.

assertion near the opening of his article that it ‘attracted daily many thousands of visitors’.⁴⁰ It was a much better match than any of his own photographs, in which only a steady stream of visitors appear.

The final photograph included with the article provides an indication of the motivation for such grandiose language. In it, Chiang Kai-shek and senior NRC officials are being shown a model oilfield by Dr Sun Yueqi, general manager of the Gansu Petroleum Administration (Gansu youkuang ju).⁴¹ Joseph Needham used language throughout the article that emphasized the exhibition’s importance, impact and sophistication. Including this image with the text in *Nature* helped to reinforce the point through association with the RoC and KMT’s easily recognizable leader and the other high-level visitors. Needham took no equivalent photograph during his time at the CIME. These images each served a distinctly different purpose when paired with that text. The image of a crowd filling the final exhibition hall featuring machine tools similarly spoke to the event’s impact, while the one showing off the range of exhibits and images contained in the entrance hall underscored the range and sophistication of what was on display. In each case the staging and preparation that will have gone into the preparation of these official photographs all made them attractive and clear companion pieces to the text that they accompanied. Needham, like the KMT, used these images to convey to an international audience this showcase of the country’s modernizing ambitions and achievements taking place even as China’s war with Japan raged on.

⁴⁰ Needham, op. cit. (27), p. 672; Needham, op. cit. (28), p. 189.

⁴¹ On Sun and the NRC’s formation of the Gansu Petroleum Administration see Bian, op. cit. (19), p. 63.

In addition to the CIME focusing on subjects of direct interest to them, the very fact that it was an overt showcase for the National Resources Commission's activities and achievements will have also been a motivating factor. He makes plain his opinion of the NRC when describing photographs scattered throughout the exhibition promoting its welfare-related activities:

the National Resources Commission stands as a striking example to private firms in Chinese mining and industry, where the workers' conditions are sometimes still in a distinctly backward state. Those who, like the present writer, have had the privilege of visiting many of the [NRC's] plants ... know that these pictures are no mere propaganda, but do actually represent the facts.⁴²

Here, as with other aspects of the exhibition, Needham used his own experiences as the foundation for his arguments about the exhibition and, by extension, the NRC. He framed them in terms of knowledge and authority lent by his scientific background, combined with his activities in China. This is central to what made Joseph Needham such a powerful – and attractive – international advocate for the KMT and the CCP alike.

In its initial publication in *Nature*, Needham's CIME article and the official photographs he selected to accompany it fit well with the image that the KMT sought to convey through the exhibition. The guide stated early on, 'Innumerable obstacles notwithstanding, the Commission has been making serious effort to meet the wartime situation, and at the same time to lay a foundation for the future industrialization of the country'.⁴³ Through the exhibition, the NRC – and by extension the KMT-led RoC party state – aimed to demonstrate the extent to which it was making the best of a difficult situation and contributing to the war effort. Even more, it was simultaneously working toward China's post-war industrial development.

These intertwined messages were nearly exactly aligned with those Joseph Needham sought to communicate in his CIME-focused article. In its concluding section, 'The future', he wrote,

the Exhibition demonstrates, once and for all, that given the tools of the trade, Chinese technologists, engineers and scientific men are the equal of any in the world. To me, not unfamiliar with them beforehand, this came as no surprise, but it is a point which ought to be brought home to all those in Western countries who are concerned with post-war trade relations with China. Any idea that the Chinese are personally unfitted for technology and industry is a complete illusion. Any idea that they do not wish to industrialize their great country and will for ever be content to accept the industrial products of other countries is a fatal mistake. They deserve, and should receive, every help in their industrialization.⁴⁴

In providing a textual and visual portrait of the CIME exhibition, Needham's larger aim was to use it as a vehicle to communicate a much broader set of interlinked arguments. Through a combination of images and descriptive text, Needham intended this first-hand portrait of an exhibition as a vehicle for advancing much bigger arguments about China's scientific and technical capacities, its global importance and trajectory, and the need for his readers to fundamentally readjust their understandings of these things.

⁴² Needham, op. cit. (27), p. 674; Needham, op. cit. (28), p. 193.

⁴³ 'Guide', op. cit. (20), pp. 1–2.

⁴⁴ Needham, op. cit. (27), p. 675; Needham, op. cit. (28), pp. 193–4.



Figure 2. Laboratory glassware. NRI2/10/1/1/8/3/12, reproduced courtesy of the Needham Research Institute.

Glassware images: Needham's advocacy

Needham's comments in *Nature* on supporting China's industrialization were rooted in his aim to act as an advocate and interlocutor. A pair of images on the manufacture of laboratory glassware provide a particularly useful lens through which to view his efforts to establish himself as an interlocutor. These images came from the photograph collection Needham obtained of the CCP-governed Shaan-Gan-Ning Border Region. The first of these shows a man and a woman involved in blowing laboratory glassware. The other (Figure 2) shows a collection of such equipment laid out on a table.⁴⁵ Needham's deployment of the latter within his publications also, in turn, highlights a crucial area of overlap in his framing of science, technology and the modernization agendas of both the Nationalists and the Communists. These images also tangibly exemplify the link between Needham's advocacy impulses in both public and behind-the-scenes contexts.

The latter of these laboratory glassware images appears in Needham's pictorial volume *Chinese Science*, published in 1945. That image of a tableful of round-bottom flasks and other equipment appears at the tail end of a sequence highlighting the work of institutions 'which manufacture scientific apparatus for university and school laboratories' in the book's first chapter.⁴⁶ It focused on Sichuan Province, which Needham described as the 'Heart of Free China' because of its proximity to the wartime capital, Chongqing, and the corresponding concentration of institutions and activities there. Most photographs in this chapter focus on a scientific apparatus factory in Chengdu that Needham visited during May 1943 established by the Sichuan Provincial Bureau of Scientific Instruments.⁴⁷ The image came from the border region collection but was not included in the section on CCP-controlled territory. Instead, it was redeployed to support an argument about science under the KMT.

There is little in the photograph to immediately indicate its place of origin. This contrasts the image of glass blowing, in which its border region context is more

⁴⁵ NRI2/10/1/1/8/3/2, NRI2/10/1/1/8/3/12.

⁴⁶ Joseph Needham, *Chinese Science*, London: Pilot Press, 1945, p. 31.

⁴⁷ NRI2/10/1/1/8/1 contains the full series of thirty photographs of this factory given to Needham. Further information about this factory can be found in NRI2/10/1/1/8/1/29.

obvious from the clothing of those pictured, especially in comparison to that featured in a similar photograph from Sichuan that also did not make it into *Chinese Science*.⁴⁸ This underscores the significance of the clothing as a signifier of place and politics in these photographs, much as with those of students in the border region. The lack of such signifiers in the image allowed Needham to redeploy it to highlight an issue common to areas under KMT and CCP control. Through this scientific instruments-focused sequence, Joseph Needham specifically uses glassware in *Chinese Science* as an example to highlight war-related shortages.

Israel Epstein's article on science in the border region, which Joseph and Dorothy Needham reprinted in *Science Outpost*, similarly features laboratory glassware. In his text, Epstein uses it to highlight that the shortages caused by the KMT's blockade necessitated the manufacture of specialist glassware locally, as well as the impossibility of doing so effectively for chemical research thanks to the unavailability of required ingredients in the region.⁴⁹ In *Chinese Science*, Needham also used glassware to exemplify the challenging conditions in wartime China. However, his political and geographical focus was entirely different for this photograph of round-bottomed flasks. Instead, Needham referred to the specific circumstances in Sichuan, stating, 'Other factories produce not unsatisfactory chemical glassware, but since the closing of Academia Sinica's own glassworks owing to the financial situation, it has not been possible to produce good hard or fireproof glass in Free China'.⁵⁰ Beyond the wider context of the other photographs and text in this chapter, this mention of Academia Sinica is significant, since it was a government institution central to the KMT's industrial and educational development programme.⁵¹ Thus, whether intentionally or not, Needham redeployed this photograph from the border region collection to make a specific point relating to the challenges faced by RoC institutions in the war.

Chinese Science characterized Chinese wartime science and technology in terms of resilience and dynamism taking place in remarkably difficult conditions. A brief review in *Nature* explicitly noted that the book was more focused on 'the workers and conditions rather than on the work being done', while also echoing Needham's framing of China as a soon-to-emerge scientific and technological power, 'and that urgent as may be China's needs for equipment and supplies, even now the traffic will not be only one way'.⁵² A reviewer for the *Geographical Journal* also picked up on Needham's emphasis on material conditions, arguing that the book's photographs 'show ... the archaic and improvised scientific equipment which often had to be used; what they cannot show is the absolute shortage of reagents and equipment which handicapped scientific work at every turn'.⁵³ The first part of this assessment aligned with Needham's presentation of glassware manufacture, while the caption reinforced a message of shortcomings and shortages of equipment and supplies being key impediments to scientific and technological progress in China.

Needham was explicit about his motivation for creating an entire book focused exclusively on photographs. As he wrote at the end of his preface to *Chinese Science*, through these images he sought to create among readers a sense of connection to China's war effort and Chinese science:

⁴⁸ NRI2/10/1/1/8/1/10.

⁴⁹ Israel Epstein, 'Scientific research and education in the Border Region', in Needham and Needham, op. cit. (28), p. 201.

⁵⁰ Needham, op. cit. (46), p. 31.

⁵¹ J. Megan Greene, *The Origins of the Developmental State in Taiwan: Science Policy and the Quest for Modernization*, Cambridge, MA: Harvard University Press, 2008, pp. 22–4.

⁵² 'Scientific background in China', *Nature* (1946) 157(3990), p. 509.

⁵³ H.L.R., review, 'CHINESE SCIENCE. By Joseph Needham', *Geographical Journal* (1946) 108(1–3), pp. 96–7, 96.

You will see with what resource and energy Chinese scientists are tackling urgent problems and contributing effectively to the Allied war effort. When the fighting is over, Chinese Science will be able to develop into a force of major significance not only for China, but for the whole world. It is essential that the British public, and particularly British scientists, should realise that this force is even now and in spite of all difficulties, manifesting itself so vigorously in the heart of war-torn China.⁵⁴

Needham hoped that such a curated collection of photographs would provide readers a means of seeing Chinese science from his perspective. The *Geographical Journal's* reviewer noted that *Chinese Science* worked effectively 'as an illustration' of Needham's *Nature* articles.⁵⁵ It was an apt characterization since the book of images cleanly mapped onto the organization and the themes of his unillustrated articles on science in various regions of 'Free China'. It was one thing to describe things like supply and equipment shortages in writing, but visual examples such as with the manufacturing of laboratory glassware lent these a further sense of tangibility and immediacy.

Needham was not the only actor effectively using images in soliciting international support during the war. For example, the China Defence League (CDL) consistently made effective – and extensive – use of images in its own publications in its 1939–40 annual report. Most photographs reflected the report's primary focus on health-related initiatives, including medical manufacturing, as well as care for refugees and orphans, and educational institutions. Its 'Anti-Japanese University' section – which ended with the statement that '[d]onations of money and books are urgently required' – featured two photographs, one of a class being conducted outdoors and another of students with the CCP military general Zhu De.⁵⁶ As indicated by Zhu's appearance, the CCP had connections to all projects and places it discussed. Outwith the ambiguous glassware photograph discussed here, the CDL's photographs and those in Needham's border region collection were strikingly similar, likely due to sharing common origins discussed in the next section. As with Needham's use of such photographs, these were also deployed in appeals for international support for China's war with Japan.

Nor was Needham just aiming to act as a public advocate and interlocutor, since those efforts had direct connections to his behind-the-scenes activities. This extended even to the very specific example of laboratory glassware, which also feature in his reports for the UK Foreign Office and the British Council. From 1943 onward, Needham had been advocating for the dispatch of British technical experts in specialist areas. That spring, he had dedicated an entire section to this in his report to the British Council and the Foreign Office.⁵⁷ It was a subject to which he returned in 1944 as part of a further report prepared about other 'Western' – largely American – technical experts.⁵⁸ In that second report, Needham again reproduced a list of what he considered priority areas based on his discussions with his Chinese contacts. Second on that list was a request for a 'good glassblower able to train good Chinese glassblowers. Glassblowing is one of the arts fundamental to science, both pure and applied; in China it has been neglected. Asked for by

⁵⁴ Needham, op. cit. (46), p. 16.

⁵⁵ H.L.R., op. cit. (53), p. 97.

⁵⁶ Central Committee, *China Defence League: Annual Report and Survey of Projects, 1939–1940*, Hong Kong, [1940], pp. 85–7.

⁵⁷ Memorandum from Dr Joseph Needham on Sino-British scientific relations' (April 1943), in Antony Best (ed.), *British Documents on Foreign Affairs: Reports and Papers from the Foreign Office Confidential Print, Part III, Series E: Asia*, Frederick, MD: University Publications of America, 1997, pp. 339–53.

⁵⁸ Li and Zhu, op. cit. (11).

Chwingishu'.⁵⁹ That final sentence was a crucial part of Needham's messaging in the memo in its indication that there was tangible institutional interest in an adviser on scientific glassblowing. It was one repeated through the list and mirrored language he used elsewhere in his reports. Given his audience and role as a British representative, he also made a great effort to frame his requests and his advice as looking to advance British interests. Still, Joseph Needham was consistent in rooting his requests and advice alike in his own on-the-ground experience, linked to his formal and informal contacts in China.

Border region photographs: Needham's networks

For all that Joseph Needham saw and did during his 'tours' through 'Free China', he never visited any of the areas under Chinese Communist Party control. These were areas for which Needham lacked direct, personal experience. He therefore depended on his networks of contacts for information, whether gleaned from formal meetings or casual conversations or from printed materials, including formal reports, pamphlets and newspaper clippings – and photographs. Thus, in analysing the significance of images in Needham's science diplomacy, it is important to consider them as objects embedded in diplomatic, social and cultural contexts.⁶⁰ Needham was an avid collector, something he had in common with many natural philosophers and scientists before him, with his own collection and exchange of photographs therefore matching long-standing practices.⁶¹ His collection of images from the CCP-controlled Shaan-Gan-Ning Border Region were tools for communicating to others his own understandings and arguments. They were also a source of information for him, making these photographs a distinct subset within Needham's wider wartime collection.

Needham's lack of direct knowledge about science in CCP-controlled areas was not down to lack of opportunity. For example, among his high-level American contacts in China was none other than David Dean Barrett, a long-term fixture of the diplomatic and military presence of the United States in the RoC, and, by the time of Needham's arrival in China, chief military attaché in Chongqing. In July 1944, Barrett served as the senior military officer for the United States Army Observation Group, the 'Dixie Mission', to establish direct dialogue with the CCP leadership in Yan'an.⁶² Barrett later published a book on his time on the Dixie Mission, in which Needham handwrote an inscription on the dedication page of his copy: 'He offered me an air-lift up there several times, but I judged that the scientific and technological aspects of the Communist Region were not important enough make it worth while going'.⁶³ This was written over thirty years after the CCP came to power, decades during which Needham had been a vocal supporter and advocate for both the People's Republic and the accomplishments of its scientific community. Nevertheless, the inscription points to his wartime perspective as being that science in CCP-controlled areas was not of sufficient importance to justify making the trip.

⁵⁹ Kew (UK), The National Archives (subsequently TNA), F3137/16/10, J. Needham, 'Memorandum on Western technical experts in China', 14 January 1944, p. 7. This is likely a typographical error for 'Chingchipu' (Jingjibu), the Ministry of Economics.

⁶⁰ Elizabeth Edwards, *Raw Histories, Photographs, Anthropology and Museums*, Oxford: Berg, 2001; Edwards, 'Objects of affect: photography beyond the image', *Annual Review of Anthropology* (2012) 41, pp. 221–34.

⁶¹ Jennifer Tucker, 'The historian, the picture and the archive', *Isis* (2006) 97, pp. 111–20.

⁶² On Barrett in China see John N. Hart, *The Making of an Army 'Old China Hand'*, Berkeley: Institute of East Asian Studies, University of California, 1985.

⁶³ Signed 'Joseph Needham, 16 Mar 81'. Handwritten note on NRI Library copy of David Barrett, *Dixie Mission: The United States Army Observer Group in Yanan, 1944*, Berkeley: Center for Chinese Studies, University of California, 1979, p. 4.

However, this was either entirely or in part based on political calculation relating to the Needhams' roles as British representatives through the SBSCO and Joseph Needham's relationship with Chiang Kai-shek's government in Chongqing. For example, while Dorothy and Joseph were visiting Xi'an in September 1945 during the 'North China Tour', both recorded in their diaries that Joseph discussed making a trip to the CCP's capital during one of his meetings with Col. Barrett there. Joseph wrote, 'Quaere [queried] whether worth going to Yen-an. DB [David Barrett] thought would not compromise position if permission from CK [Chongqing], so sent off a radio'.⁶⁴ Joseph Needham's interest was great enough to tangibly explore the possibility, but that was tempered by an overriding sense of caution about how such a visit might be perceived in relation to his position.

That decision not to go is notable as Joseph Needham chose to feature photographs of science under the CCP in multiple publications after the war. But to do so, he had to obtain those photographs in the first place. The opportunity came thanks to the Needhams' networks in wartime China, which extended across a range of not only scientific, medical and industrial communities, but also diplomatic, political and military ones – both Chinese and expatriate. On 28 September 1945, during the Needhams' visit to Xi'an, Joseph recorded in his diary that in the morning he went out 'with Commissioner of Health Chang Shan-Chün [Zhang Shanjun] to see the Provincial Health and Hygienic Lab and Vaccine plant in a Tang-founded Temple to the south of the city', lunched with Commissioner Zhang, and then went 'to Col. Barrett's and asked for ... gasoline and cigars!'⁶⁵ The cultivation of such relationships across multiple communities was central to the Needhams' activities in wartime China.

They were also sources of information about and material from CCP-controlled regions. In *Science Outpost*, the Needhams thanked 'Mr Ling' for the two CCP-related photographs used in the book. Most plausibly, this was Lin Boqu (then known as Lin Zhuhan), whom they each recorded meeting in July 1944.⁶⁶ Dorothy wrote in her diary that she met Lin with Austrian medic Fritz Jensen, her friend and frequent companion while in Chongqing, and that the three talked about education in rural China.⁶⁷ The initiatives they discussed were focused on areas under CCP control and dovetailed nicely with the collection of photographs in which scientific and technical education so prominently featured.

Lin Boqu headed the Shaan-Gan-Ning Border Region government when the Needhams met him. His early revolutionary activities and KMT connections saw him repeatedly act as a representative in dealings with the Nationalists and with foreigners interested in the CCP's activities.⁶⁸ He was well known and equally well connected in Chongqing, simultaneously involved in both political and propaganda activities for the CCP. Between 1937 and 1941, he had shuttled between the CCP-controlled border region and the KMT's wartime capital during the period of uneasy alliance between the CCP and the KMT. In the spring

⁶⁴ NRI2/5/12/3, p. 55. DN: GCPP Needham 5/1/1/3, p. 24.

⁶⁵ NRI2/5/12/3, p. 61.

⁶⁶ Needham and Needham, op. cit. (28), p. xi. Joseph regularly romanized the surname 'Lin' as 'Ling' in this period, including on the relevant entry in his wartime name card index: 'LING Tsu-Han [Lin Zhuhan]' in NRI2/4/2.

⁶⁷ Girton College Library and Archive, GCPP Needham 5/1/1/1, Dorothy Needham, China 1944–1945, Diary I (subsequently DND), p. 32. On Jensen's activities and connections see Barrett, op. cit. (14), pp. 1529–30; Cao Yi, 'Yan Feide dafu zai zhan shijian Zhongguo' (Dr Fritz Jensen in Wartime China), *Dangshi bocai* (1995) 4, pp. 31–3.

⁶⁸ On Lin Boqu see Wolfgang Bartke, *Who Was Who in the People's Republic of China*, Munich: K.G. Saur, 2012, pp. 266–7; David C. Klein and Anne B. Clark, *Biographic Dictionary of Chinese Communism, 1921–1965*, vol. 1, Cambridge, MA: Harvard University Press, 1971, pp. 567–74.

of 1944 he also travelled to Xi'an and then on to Chongqing for negotiations with the Kuomintang which went into that summer.⁶⁹ Lin also prominently featured in foreign-language propaganda material circulating among those sympathetic expatriate residents of Chongqing.

Both Needhams were well connected in these circles; however, Dorothy was more overt in her activities, as her closeness to Fritz Jensen showed. Joseph wrote to a UNESCO colleague in the weeks before the CCP came to power in 1949 that, while he did not disguise his left-leaning political views, he had cultivated the broadest possible networks that included politicians, officials and academics across the political spectrum.⁷⁰ Through their CCP connections, both direct and indirect, the Needhams built up a discreet collection of pamphlets about the border region and clippings from Yan'an's *Liberation Daily* (*Jiefang ribao*) newspaper.⁷¹ These included an annual government report authored by Lin Boqu and the pamphlet *I Visit Yanan* by Israel Epstein.⁷² Like Col. Barrett, Epstein was another member of China's wartime expatriate community with direct experience of the CCP's capital who formed a part of the Needhams' networks. But, like Lin, Epstein was actively working to support the party's activities especially through the China Defence League, which by 1943 was primarily involved in aiding 'medical projects, cooperative drug production, children's work, and refugee famine relief in the Border Regions'.⁷³ A left-wing journalist who had grown up in China, Epstein joined the group of foreign journalists whom the KMT allowed to pass through its blockade of the border region, and stayed there for five months.⁷⁴ Dorothy Needham recorded seeing him socially in March, April and May 1944. The last of these meetings took place just two days before Epstein's trip to Yan'an.⁷⁵

The Needhams' 1948 book *Science Outpost* included an article by Epstein based on that trip. It had originally been written for publication in 1945 by the New York-based China Aid Council, a major CDL funder.⁷⁶ The Needhams further amplified Epstein's depiction of the CCP's approach to science-related research and education in the border region with photographs from Joseph's border region collection. The CCP-related material's very inclusion in the book afforded it a particular prominence.

The two photographs they included in the book featured students at Yan'an University. The university was the border region collection's focus, featuring nine of twelve images showing lab work and lecturing related to botany, chemistry, embryology, engineering and mathematics. Established by the CCP in 1941, the university was an early foray

⁶⁹ For a detailed account of Lin in these negotiations see Deng Ye, 'Proposal for coalition government and KMT-CCP negotiations in the later stage of the Anti-Japanese War', *Journal of Modern Chinese History* (2013) 7 (1), pp. 1-16.

⁷⁰ Cambridge University Library, Joseph Needham Papers, GBR0012/MS Needham D.159, J. Needham to E. Barger, 11 September 1949. On the context of this letter see Barrett, op. cit. (14), esp. pp. 1522-4. On the early development of Needham's contacts with the CCP see Fu Banghong, 'Li Yuese yu Zhongguo gongchan dang de zaoqi qingyuan' (The early relationship between Joseph Needham and the Chinese Communist Party), *Kexue wenhua pinglun* (2016) 13(3), pp. 27-35.

⁷¹ NRI Archive (uncatalogued), box '1942-45 border region documents and pamphlets'.

⁷² Lin Tsu-han [Lin Zhuhan], 'Annual report of the Shensi-Kansu-Ninghsia Border Region government', August 1944; Israel Epstein, *I Visit Yanan: Eye-Witness Account of the Communist-Led Liberated Areas in North-West China*, Bombay: People's Publishing House, April 1945.

⁷³ China Defence League, *In Guerrilla China: Report of China Defence League*, New York: China Aid Council, 1943, p. 2. On Epstein see Cagdas Ungor, 'Reaching the distant comrade: Chinese Communist propaganda abroad (1949-1976)', PhD dissertation, State University of New York at Binghamton, 2009, pp. 41-3.

⁷⁴ For a detailed, if Cold War-inflected, analysis of the visit see Warren W. Tozer, 'The foreign correspondents' visit to Yanan in 1944: a reassessment', *Pacific Historical Review* (1972) 41(2), pp. 207-24.

⁷⁵ DND, op. cit. (67), pp. 15, 28-9.

⁷⁶ Epstein, op. cit. (49), pp. 199-205.

into crafting its own vision for higher education. As reflected in the images, natural sciences featured prominently from the outset, as did an ideologically inflected emphasis on practice and application in education.⁷⁷ The photographs and Epstein's text presented scientific education in the border region in such terms and with little distinction between workers and students: 'No one is afraid to dirty his hands'.⁷⁸

This agenda had been explicitly articulated in university regulations shortly before Epstein's mid-1944 visit. Its objective was to develop cadres' 'practical work in political, economic and cultural reconstruction suited to the needs of the war of resistance [against Japan] and the reconstruction of the Border Region', with 'research workers' and students required to contribute to 'practical work' and engage in labour.⁷⁹ This aligned with the CCP's 1943 production movement to reorganize and develop the regional economy toward a goal of self-sufficiency. Members of the military and cadres at all levels were therefore expected to contribute to production.⁸⁰ As Pauline Keating has put it, these efforts 'were meant to produce revolutionary new officials and intellectuals, people who worked with their hands as well as their minds and who had renounced the elitist values that typified old-style teachers and bureaucrats'.⁸¹ Education and research at Yan'an University were therefore very much a part of the CCP's mutually supporting goals to simultaneously remake the border region's society and economy.

Moreover, as texts and images coming from the border region all emphasized, the social and economic context that the CCP sought to transform and in which Yan'an University functioned was rural, isolated, and poor. Literacy levels were low and there were few schools or trained teachers, making post-secondary provision ultimately only a small part of a developing education system focused in the first instance on expanding at the primary level.⁸² And, as the laboratory glassware photographs and the texts by CDL and Epstein all emphasized, scarcity of everything from basic resources to specialized equipment was a further formidable obstacle.⁸³ Outwith salt exports, it was a region with little existing industrial capacity or expertise and one heavily dependent on imports that were then disrupted by Nationalist blockade.⁸⁴ Given these challenges in producing, obtaining and maintaining essential materials and equipment, photographs featuring equipment, such as Figures 3 and 4, stand out within a collection that otherwise emphasized issues of scarcity and the basic nature of conditions in which the university operated.

Yet even these images stress practical work and focus on applied science along with the ideological agenda associated with these dynamics. This, too, was reflected in *Science Outpost*. The first of the border region photographs reproduced in the book focuses on surveying and showed three people working outdoors with a tripod-mounted theodolite (Figure 3).⁸⁵ The second showed an individual working with an analytical balance

⁷⁷ Xue Yizhong and Zhang Jinsuo, 'Yan'an shiqi Zhongguo gongchandang chuangan xinxing gaodeng jiaoyu de tansuo' (Exploring the Chinese Communist Party's establishment of a new type of higher education in the Yan'an period), *Zhongguo gaoxiao shehui kexue* (2019) 5, pp. 140–9.

⁷⁸ Epstein, op. cit. (49), p. 202.

⁷⁹ 'Yenan University Educational Line and Temporary Regulations, May 21, 1944', in Michael Lindsay (ed.), *Notes on Educational Problems in Communist China, 1941–47*, New York: Institute of Pacific Relations, 1950, pp. 133–9, 133.

⁸⁰ Mark Selden, *China in Revolution: The Yenan Way Revisited*, London: M.E. Sharpe, 1995, pp. 196–7.

⁸¹ Pauline Keating, *Two Revolutions: Village Reconstruction and the Cooperative Movement in Northern Shaanxi*, Stanford, CA: Stanford University Press, 1997, p.126.

⁸² Lindsay, op. cit. (79), p. 40.

⁸³ Further discussion of these issues can be found in Lindsay, op. cit. (79), pp. 49–50.

⁸⁴ Selden, op. cit. (80), p. 199.

⁸⁵ NRI2/10/1/1/8/3/3.



Figure 3. Needham's original caption: 'Shensi Border Area, surveying class'. NRI2/10/1/1/8/3/3, reproduced courtesy of the Needham Research Institute.

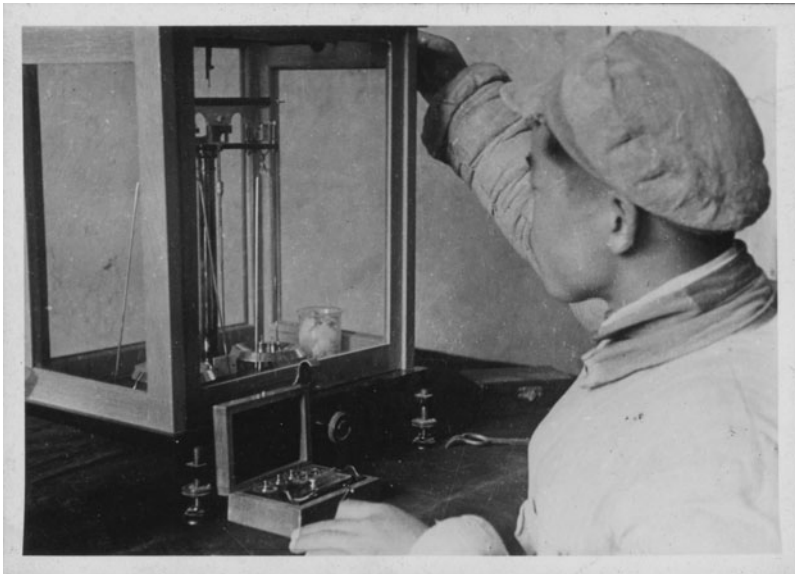


Figure 4. Needham's original caption: 'Border Area, chemist at work'. Source: NRI2/10/1/1/8/3/1, reproduced courtesy of the Needham Research Institute.

(Figure 4).⁸⁶ The clothing worn by all people in the photographs immediately lends them a distinctive character. Indeed, the CCP's dress reforms were intended to serve as signifiers of societal transformation under its leadership by downplaying differences, be they social

⁸⁶ NRI2/10/1/1/8/3/1.

status, profession or gender.⁸⁷ The people appearing in these images therefore are much more readily identifiable as living in an area under communist control. The photographs thereby cast scientist academics and students in the role of scientific workers rather than rarefied – or reactionary – members of the ideologically problematic intellectual class (*zhishi fenzi*). The category of intellectual was a broad one in this rural context, including those with more than primary education, so that in practice their differing backgrounds led to varying levels of engagement with mass mobilization.⁸⁸ Varying local conditions across the Shaan-Gan-Ning Border Region also encouraged both community building and class struggle.⁸⁹ The photographs thus conveyed the educational institutions' roles in fostering intellectuals' engagement with the CCP's ideological and developmental programmes, complementing the arguments found in Epstein's article.

Ultimately, the Needhams' inclusion and curation of this CCP-related content in *Science Outpost* clearly communicated aspects of their ideological interests and relied upon a wider breadth of wartime networks than reflected in the Royal Society's and the AAAS's science-diplomacy-inflected character sketch of Joseph. Reviewing the Needhams' book for *Pacific Quarterly*, Wilma Fairbank described the volume as a 'compendium' of wide-ranging material, from poems to travel diary excerpts, speeches and *Nature* articles, the last of which served as the 'backbone of the book'. Collectively, the book's contents provide 'an interesting picture of Needham himself'.⁹⁰ Fairbank was well placed to make such an assessment as she was a key official in the US State Department's Cultural Relations Program, which had sent out the numerous technical advisers Needham discussed in his 1944 report to the British Council and the Foreign Office.⁹¹ In that report, Needham also wrote at length about her husband, John King Fairbank, who had also been based in Chongqing, representing the Library of Congress. Alongside his effectiveness and impact in that role, Needham noted that 'he was highly cooperative with the British side'.⁹² Thus, when Wilma Fairbank characterized the book as providing a 'summary and uncritical' portrait of wartime Chinese science, she did so as someone highly knowledgeable on the subject who was also familiar with the Needhams.

Conclusion

While border region content made up only a small proportion of *Science Outpost's* overall content, the photographs' placement helped to increase its visibility. They were included near, but not next to, Epstein's text. The photographs ended up printed in the middle of its reprinting of Joseph Needham's article for *Nature* on the KMT-led government-sponsored Chongqing Industrial and Mining Exhibition. This photograph placement may well have been determined by the publisher rather than by the Needhams, but the result remained the scattering of the CCP-related content. This patchwork approach thereby integrated images and text about the border region as simultaneously distinctive, yet constituent, parts of a much larger narrative about science in 'Free China' as a whole.

It was a logical approach given the timing of *Science Outpost's* publication. In 1948, Joseph Needham was two years into his new role as the inaugural head of UNESCO's Natural Sciences Division. He was in the next phase of his career as scientist diplomat

⁸⁷ A.C. Scott, *Chinese Costume in Transition*, Singapore: D. Moore, 1958, p. 92.

⁸⁸ Chen Yung-fa, *Making Revolution: The Communist Movement in Eastern and Central China*, Oakland: University of California Press, 2021, p. 424.

⁸⁹ Keating, op. cit. (81).

⁹⁰ Wilma Fairbank, 'Review of *Science Outpost*, Joseph Needham, Dorothy Needham', *Pacific Affairs* (1949) 22(4), pp. 422–3.

⁹¹ On the Cultural Relations Program and Fairbank's involvement see Zhang and Zhu, op. cit. (11), p. 34; and Wilma Fairbank, *America's Cultural Experiment in China, 1942–1949*, Washington, DC: Department of State, 1976.

⁹² TNA, op. cit. (59), p. 5. Needham also notes Wilma Fairbank's role on p. 1.

as described in the Royal Society and AAAS narrative. Yet, crucially, the Chinese Civil War was also ongoing, bringing with it the distinct possibility of the CCP coming to power. Within the next year, Needham would be involved with high-level discussions among UNESCO officials about potential engagement with the CCP.⁹³ Meanwhile, the Republic of China was one of UNESCO's founding member states, with KMT-appointed representatives active within the organization. That fluid and complex political backdrop to *Science Outpost's* publication would not have been lost on its readers. As a short review in *Nature* noted, the Needhams' book gave 'some indication of what is at stake in the present struggle in China, at least so far as science and technology are concerned'.⁹⁴ For all the patchwork nature of *Science Outpost*, the inclusion of CCP-related content like the border region photographs sent a salient message about science and technology remaining as relevant in the Chinese Civil War as they had been during China's war with Japan. As for Needham himself, these photographs pointed toward the role he would go on to play as an advocate and interlocutor supporting the PRC after its founding in 1949.

Joseph and Dorothy Needham's ability and inclination to include the border region material in publications like *Science Outpost* were rooted in the breadth of the networks they developed while working in China during the Second World War. Such networks underpinned and enabled Joseph's efforts to establish himself as an international interlocutor who sought to support science and technology in China. This included supporting very specific causes, such as the manufacture of laboratory glassware, which Needham mentioned not only in behind-the-scenes advocacy, but in public as well. In all of this, the breadth of his direct knowledge about the state of science, technology and industry in the Republic of China formed the foundation for his claims to authority. And ultimately these enabled Joseph Needham to play an active role crafting his own legacy through text and images alike as deployed in his various publications about that period.

Joseph Needham's collection and dissemination of images relating to science under both the KMT and the CCP provide a tangible example of the fundamental interconnection between all these aspects of his approach to science diplomacy. If Needham is to be held up as an archetypal example of a scientist diplomat, as the Royal Society and the AAAS have done, and his wartime activities afforded a place of prominence in doing so, then it is essential to avoid oversimplifying the nature and extent of interests or activities that were a part of his science diplomacy. Images of science were important to Joseph Needham. They form a prominent part of the historical record of his activities in wartime China, in no small part thanks to his own use of them both then and after. In turn, a better understanding of their role in Needham's work in that period further illuminates the complexity inherent in the 'science diplomacy' label when applying it to a historical figure such as Joseph Needham.

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⁹³ Barrett, op. cit. (14), esp. pp. 1522–30.

⁹⁴ R. Brightman, 'Science outpost', *Nature* (1949) 163(4149), p. 704.

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