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# Icehouses in Motion:

## Knowledge Flows Across the Cryosphere

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Before the advent of mechanical refrigeration, natural ice harvested from lakes and rivers served as a means of cooling. From the nineteenth century onwards, this frozen commodity was shipped from North America and Norway to colonial tropical regions to satisfy Western desires for comfort and health (Dickason 1991). Recent research has highlighted how imported ice projected Euro-American ideals of purity, hygiene and civility onto non-Western societies, while its consumption as a luxury reinforced class and racial hierarchies (Hobart 2022; Ashutosh 2023; Surland 2025). However, scholarship centered on the ice trade often obscures the role of Indigenous knowledge in shaping transnational encounters during the era of imperial expansion.

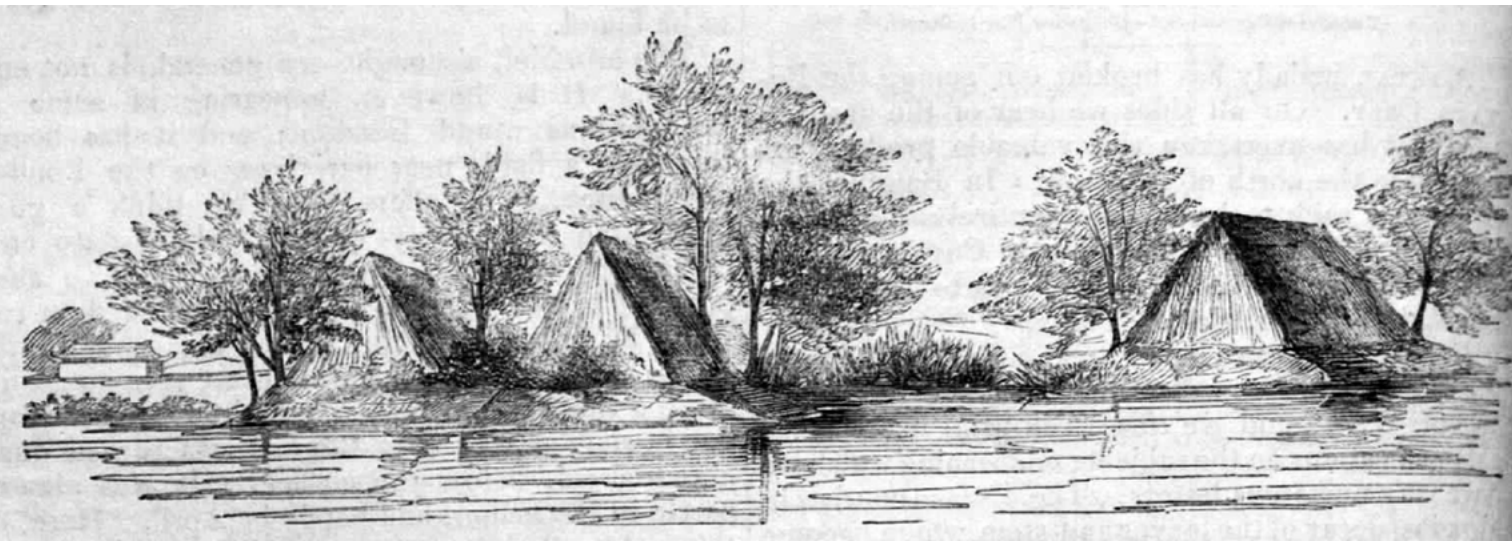
In Ningbo, on China's east coast, a port city opened to foreign trade and residence under the Treaty of Nanking in 1842, visitors and expatriates encountered an abundant and inexpensive supply of ice collected by farmers from their fields. The remarkable number of icehouses lining the riverbanks drew interest from Western and Japanese researchers in botany, geography, architecture and history, who recorded these vernacular landscapes in their travel accounts, which soon reached overseas readerships and served as references for icehouse designs elsewhere (see Carlisle 1872: 134–5; von Richthofen 1907: 6–7; Boerschmann 1911: 4; Saeki 1942).

Mass-media coverage, together with models of icehouses displayed in Chinese pavilions at international exhibitions, further captured public fascination. Drawing on archival sources, this paper traces the circulation of these representations and examines how ice-making and storage techniques in Ningbo were documented, interpreted and adopted by foreign observers as practices of knowledge and interest. Rather than reproducing a narrative of colonial domination, it reveals a more interconnected history of the cryosphere, in which locally grounded practices intersected with global networks and environmental imaginaries.

**From Observation to Adoption**

Integrated into the seasonal rhythms of agricultural production, ice harvesting in Ningbo, particularly in Yin County, sustained the thriving fishery industry along the Yong River. In winter—generally considered here to span December to February—farmers flooded shallow paddy fields to freeze water, then stored the ice in pyramid-shaped structures made of mud walls and thatched bamboo roofs. These buildings, over six meters tall, featured a roof-level loading door accessible via a sloped ramp or steps, and a smaller ground-level door for retrieval. In spring, meltwater was channeled through gutters to irrigate nearby crops, while during the summer fishing season starting from May, Ningbo fishermen purchased ice from the icehouses as they set out to sea, using it to preserve their catches.

***Ningbo icehouses.*** Photo: Ato Photographic Association. Source: Cressey 1934: 74.



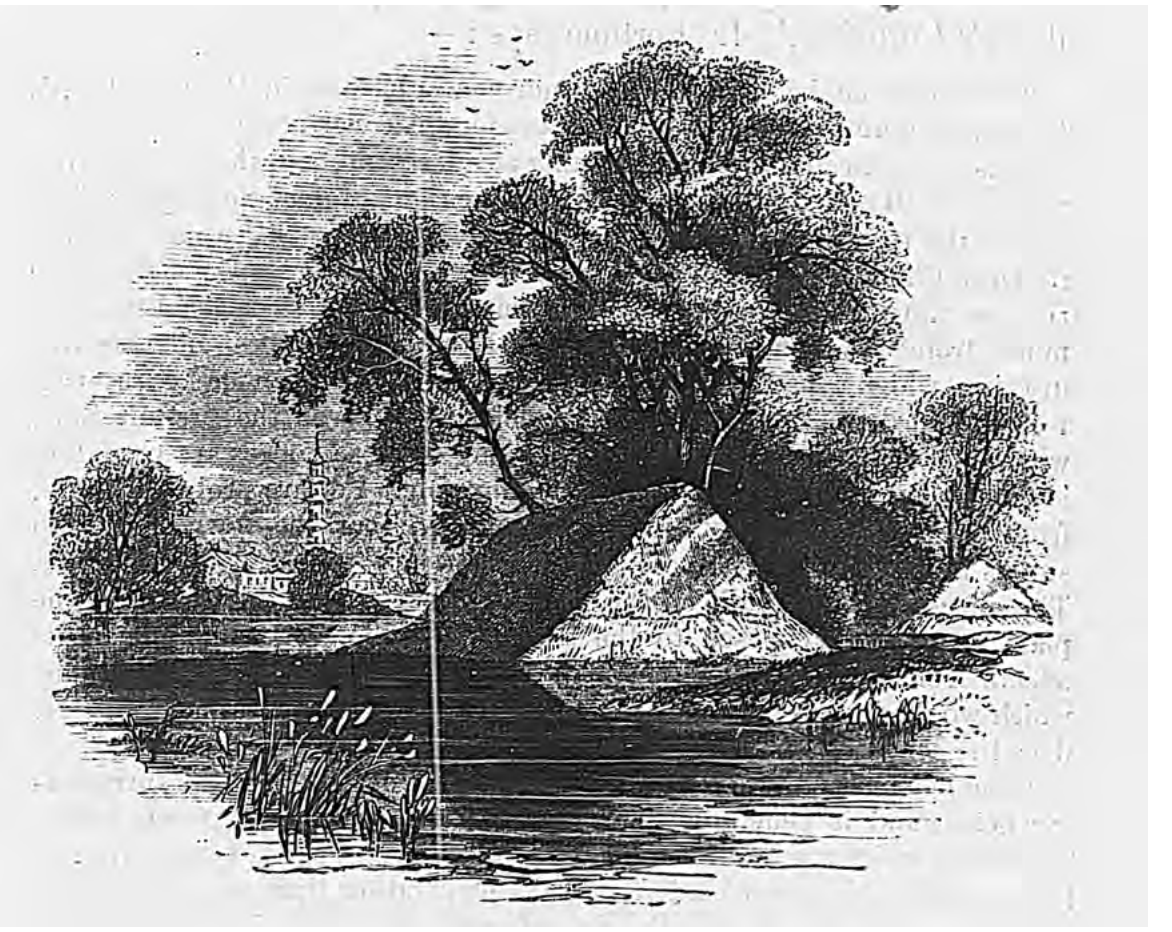
***Sketch of Ningbo icehouses by Robert Fortune, August 1844.*** Source: Fortune 1845.

Among the many observations of Ningbo's icehouse structures, one of the most widely circulated was a letter from Robert Fortune (1845) to Professor John Lindley, co-founder and first editor of *The Gardener's Chronicle*, which described the construction methods and included a sketch. Fortune, best known for his plant-collecting expeditions to China commissioned by the Horticultural Society of London, highlighted these vernacular structures—situated on a level plain and fully exposed to the "clear, fierce, and burning" sun (Fortune 1845: 576), far harsher conditions than in England—as models of efficiency and economy. His portrayal remained influential long after its publication and was later cited in *Science and Civilisation in China*—a landmark series of volumes begun by the late Joseph Needham that challenges Eurocentric understandings of science and technology by foregrounding non-Western contributions—in discussions of Chinese methods of food preservation (Huang 2000: 435–36).

Yet Fortune's observations went beyond a site-specific record; they resonated with readers in nineteenth-century Britain and the United States, where the rapid expansion of the ice trade had fueled growing interest in effective storage techniques. In Victorian Britain, horticultural journalism flourished as the rising middle class—unlike aristocratic landowners, who valued architectural grandeur—favored practical and economical icehouse designs for their suburban gardens (Beamon and Roaf 1990).[1] Periodicals provided a platform for sharing construction insights, discussing building materials, ventilation, drainage, insulation and site selection, including considerations like the orientation and the shade of trees. One of the most debated questions concerned whether icehouses should be built above ground. The example provided by Fortune sparked responses in later issues and informed similar debates across the Atlantic. While plantation and estate owners generally followed the European preference for subterranean construction, above-ground structures gained popularity for their lower cost, ease of loading and unloading, and improved resistance to dampness and humidity. American agricultural journals and farming magazines cited Fortune's article in support of such designs, which were implemented at key sites in the ice-harvesting industry.[2]

[1] According to Beamon and Roaf, wealthy elites largely owned the country's icehouses, which were increasingly adorned with ornate facades displaying a wide range of stylistic influences.

[2] See, for instance, "Ice House" 1848, which presents content similar to that of other contemporary journals citing Fortune's article.



***Sketch of Ningbo icehouses.***
Source: SEIH 1855: 243.

**Public Dissemination and Display**

The growing domestic demand for ice further promoted the dissemination of ice-preservation methods to the public, with popular journals drawing on Fortune's observations. *The Home Friend*, published by the Society for Promoting Christian Knowledge in London, noted the scarcity of ice in England and suggested that "by following the Chinese plan, every village might have its icehouses" (SEIH 1855: 243–45). Although the accompanying illustration carried an Orientalist inflection, placing the structures in a picturesque landscape with Chinese-style pagodas in the background, it underscored contemporary curiosity about technological adaptation. In the United States, ice consumption became widespread among urban populations by the mid-nineteenth century but remained far less common in rural areas. *Godey's Lady's Book and Magazine*, a Philadelphia-based publication with over 150,000 subscribers by 1860, similarly endorsed the cost-effective Chinese method as particularly suitable for butchers and other country food suppliers (CIH 1855).

Meanwhile, interest in Ningbo icehouses derived from their crucial logistical role in the fish supply and was further amplified by their visibility at international fairs. As the city hosted China's largest fish market, a specific Ningbo collection—including an icehouse model—was showcased at fishery exhibitions in Berlin in 1880 as a representation

of China's industrial developments (IGC 1880: 35). Three years later in London, the elaborately decorated Chinese pavilion received extensive media coverage, and the "ingenious details" (CCFE: 6) of Ningbo icehouses were highlighted as advantageous for similar structures in England and America. In the United States, which led the advancement of mechanical refrigeration, the new technology did not displace ice harvesting overnight; direct competition emerged only in the 1880s and persisted for several decades (Rees 2013: 30). The display of an icehouse model alongside other manufacturing facilities at the 1904 Louisiana Purchase Exposition reflected the continued recognition of traditional Chinese practices.


***Model of a Ningbo icehouse in the Chinese section of the Liberal Arts Palace at the Louisiana Purchase Exposition.***
Source: Bennitt et al. 1905: 291.

***Icehouses in Shanghai.***
Photo: Charles Ewart Darwent, circa 1902. Courtesy: Special Collections, University of Bristol Library.

**Conclusion**

Besides a general interest in China's environment, culture and society—heightened by opportunities for on-site observation following the country's mid-nineteenth-century forced opening up—foreign attention towards Ningbo icehouses was largely driven by the practical solutions that these structures offered to meet the expanding need for "cold infrastructure" (Schönach 2018) and to support food systems (Freidberg 2010; Perera 2025). While ice harvesting relied heavily on bodily knowledge and an intimate understanding of local natural conditions (Robichaud 2022), experiences and models from abroad also served as valuable references, as the underlying principles of storage could be adapted across other regions. Within China, ice storage practices varied geographically, yet similar methods were common around Ningbo. According to a survey initiated by the Ministry of Industry in 1933, Yin County contained the largest number of icehouses in Zhejiang Province, providing livelihoods for tens of thousands of people (SGMJ 1933: 479–84). Among the roughly twenty registered plants, each was estimated to hold on average 200–250 tons of ice. This was followed by the provincial capital city Hangzhou and several coastal fishing towns, while only two mechanical ice plants operated in Zhejiang, where their business remained sporadic. Nevertheless, with the growing popularity of artificial cooling, the landscape of icehouses along the Yong River had vanished from public view by the early 1980s, surviving only in place-names such as Bingchanggen 冰厂跟, or 'site of ice factories' (BG 2016).

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**Exercise**

Tracing cryospheric knowledge across scales

1. Select Sources
   Choose a small set of materials—such as travel writing, scientific reports, photographs or paintings—that depict cryospheric environments in different social or cultural contexts.

2. Identify Representations
   Examine how ice, cold or cryospheric practices are described. Note recurring themes, metaphors and underlying assumptions, as well as the roles that different actors and technologies play.

3. Reflect on Environmental Imaginaries
   Write a short reflection on how these representations shape environmental imaginaries and historical narratives. Consider, for instance:

   - Which forms of knowledge are highlighted or marginalized?
   - Are Indigenous, local or vernacular methods recognized or appropriated?
   - How do notions of efficiency, purity or modernity emerge?
   - What do these materials suggest about the relationships among climate, labor, trade and science?

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**Zhengfeng Wang** is a historian of the built environment. She is currently Postdoctoral Researcher on the European Research Council Synergy Grant project "Cultures of the Cryosphere: Infrastructures, Politics and Futures of Artificial Cooling" at Paderborn University and is completing her book manuscript *Building Freshness: Refrigerated Space for Foodways and Techno-Politics in Treaty-Port China*. She previously held postdoctoral positions at Leiden University and University College Dublin. Her work has appeared in *Architectural Histories, Journal of the Society of Architectural Historians and Mobs and Microbes: Global Perspectives on Market Halls, Civic Order, and Public Health* (Leuven University Press), among other venues.

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