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Chronology of early China: A radiocarbon databank for Chinese archaeology

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The role of radiocarbon dating in Chinese archaeology has grown increasingly significant in recent decades. Thousands of archaeological radiocarbon dates have been published along with the development of multiple laboratories. However, radiocarbon dates were published in a fragmented manner, in different languages and limited to specific archaeological sites or topics. This fragmentation has created substantial barriers to cross-regional and interdisciplinary research at various temporal and spatial scales. While several datasets have been compiled, there is a lack of crucial details regarding the archaeological context, geographic information, and essential parameters of the radiocarbon data. This databank seeks to bridge this gap by providing the most up-to-date comprehensive radiocarbon database of Chinese archaeology. This effort involves a systematic review of the relevant literature and the revision of earlier datasets. A total number of 7,083 radiocarbon dates, accompanied by their detailed information, were collected. This databank offers a valuable resource for interdisciplinary research that aims to quantify human activity in prehistoric China, and it establishes a foundational framework for future data collections.

Background & Summary

Scientifically validated chronology is essential for accurate interpretation of any archaeological or historical event. Recognizing this critical need, scholars have increasingly applied various scientific dating methods to the field of Chinese archaeology over the last five decades, with radiocarbon dating emerging as the most widely adopted approach. Radiocarbon dating was first introduced into China in 1955 following the strong advocacy of pioneering archaeologists Xia Nai and others[1]. The first generation of laboratories was set up by two scholars Qiu Shihua and Cai Lianzhen in the Institute of Archaeology, Chinese Academy of Science (IA CAS, later changed to the Institute of Archaeology, Chinese Academy of Social Sciences, IA CASS)[2]. Facilitated by major national projects[3–6] and international collaborations[7–9], the following decades witnessed not only establishment of radiocarbon dating laboratories in an increasing number of research institutes and universities that provide targeted support to archaeology (e.g., School of Archaeology and Museology of Peking University or College of Earth & Environmental Sciences of Lanzhou University), but also deeper collaboration between Chinese archaeology and subjects in Quaternary sciences[10], creating a substantial quantity of radiocarbon dates documented in the literature.

However, a prominent limitation hindering the broader application of radiocarbon dating in Chinese archaeology is the scattered publication of raw data. These data are disseminated in a variety of forms, such as journal articles, full or brief archaeological reports, monographs, and appendices, primarily in Chinese or English. On the other hand, as the contributions of Chinese archaeology to various broader subjects on the international stage (e.g., early domestication of plants and animals, spreading of agro-pastoralism, and the rise of urbanism and early civilization) gain wider recognition, there is an increasing need for a comprehensive and accessible

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database, allowing scholars to effectively break down the linguistic barrier and identify sites of interests with radiocarbon dates. The current project aims to address this gap by presenting the most extensive radiocarbon databank for Chinese archaeology to date. This is to support multiple research agenda, including data retrieval, quality evaluation and the identification of gaps for future studies. The scope of this radiocarbon database arguably extends beyond chronological studies, providing a foundational resource for interdisciplinary inquiries such as demographic modelling and palaeoclimate, which is particularly pertinent to large-scale craft production and human-environment interaction in early China[11–13].

Methods

The current synthesis of radiocarbon dates for Chinese archaeology would not be possible without the three foundational publications[11–13], which build important foundation to our work. Wang *et al.*[12] established the first comprehensive digital database of radiocarbon dates in Chinese archaeology by systematically reviewing published literature, particularly early texts recorded in Chinese paper documents[11], thereby enhancing the accessibility of these data. On the basis of their work, additional data were incorporated by Dong *et al*.[13], which provided the starting point for our compilation in this study. We built this databank based on the one made available online as supplementary material to their article (https://journals.sagepub.com/doi/abs/10.1177/0309133319876802)[13]. Beyond that, we carefully reviewed these data and compiled over 2,500 new radiocarbon dates from a wider range of open sources, encompassing publications in either English or Chinese language, such as reports, journal articles, dissertations, datasets, monographs, and books. We also largely extended information relevant to archaeology, geography and laboratory techniques, permitting more efficient search and selection of data. In addition to the original literature where the radiocarbon data were published, this study also collected information from related publications[14–543]. To enhance comparability and interoperability, we constructed the current databank with reference to the p3k14c framework for global archaeological radiocarbon data[544].

For English-language publications, we primarily used Google Scholar website (https://scholar.google.com/) to search for relevant resources, using both keywords (e.g., Chinese archaeology, radiocarbon dating, chronology, subsistence, and specific site or cultural names) and the publication profiles of relevant researchers. For Chinese-language publications, we primarily used the website of China National Knowledge Infrastructure (CNKI; https://www.cnki.net/) to search for relevant resources, using: (1) keywords such as 'brief report', 'excavation report', and those mentioned above; (2) the publication profiles of relevant researchers; and (3) the catalogues of relevant anthropological, archaeological, and geographic journals (e.g., Acta Anthropologica Sinica, Acta Archaeologica Sinica, Archaeology, Cultural Relics, Quaternary Sciences, and regional archaeological journals).

The overall databank has been organized into the five geographic regions of China–Northwest (in yellow), Southwest (in orange), Northern & Northeast (in blue), Yangtze Plain (in green), and Southeast (in purple)–mirroring common division related to archaeological cultures and climate conditions (e.g., pastoralism, agropastoralism, the Central Plains, the Yangtze River Plain and further south) (Fig. 1).

Archaeological information including the name, era, cultural association, and the status of previous archaeological work, were collected to enhance data specificity. Radiocarbon dates derived from sedimentary profiles associated with archaeological sites were excluded from the databank, unless the corresponding layer was explicitly identified as a cultural layer in the original publication. For the previously incorporated data, the original authors had applied specific screening criteria to reject unreliable radiocarbon dates[12,13]. For the newly collected data in this study, we primarily assessed data reliability based on the evaluations provided in the original publications, and excluded any data deemed unreliable. All radiocarbon dates were calibrated by the OxCal v4.4.4 online program (https://c14.arch.ox.ac.uk/oxcal/OxCal.html) using IntCal20 calibration curve[545,546].

Geographic information, such as the administrative affiliation and the geographic coordinates, were gathered to maximize the potential for future spatial analyses. Specifically, this study verified the longitude, latitude and altitude of the archaeological sites through their original and related documents, as well as the geographic information tools such as Google Earth (https://earth.google.com/web/). When exact coordinates were not provided by their original and related documents, approximate coordinates were provided through Google Earth or other similar tools, based on existing geographic locations, descriptive texts, and graphic references. This ensures that all sites are assigned a 'LocAccuracy' index of level 2 or higher, following the criteria defined in the p3k14c framework[544]. All coordinates were standardized to decimal degree format[544].

Data Records

This study collected 7,083 radiocarbon dates of Chinese archaeology dating to the Han Dynasty and earlier (before 1830 BP), with full publications dated up to 2023. The databank is available at Zenodo (https://zenodo.org/records/17107786; https://doi.org/10.5281/zenodo.17107786)[547]. Data published during or after 2024 were partially collected. The databank contains seven sheets that recorded data from the five regions, original reference, and the institution associated with the lab codes. Each data entry across the five regions includes three categories of information—archaeological, geographic, and radiocarbon—structured to enhance usability and context.

For archaeological information, the standardized site name was recorded in both English and Chinese, along with their alternative names encountered in the literature. The column of "category" describes the nature of each site (e.g., settlement, cemetery, ancient city, and cave), while the "era" shows abbreviated designation of the site's chronology (e.g., PA for Palaeolithic Age, CA for Chalcolithic Age, NA for Neolithic Age, BA for Bronze Age, EIA for Early Iron Age, and MA for Metal Age). "Cultural association" records the type of culture that the site belongs to. "Work description" specifies the type of previous archaeological work (e.g., investigation, profile, and (test/systematic) excavation).

Fig. 1 Five geographic divisions of the radiocarbon databank. The basemap was downloaded from Natural Earth (https://www.naturalearthdata.com/) and the boundaries were sourced from a standard map of China (no. GS(2019)1822).

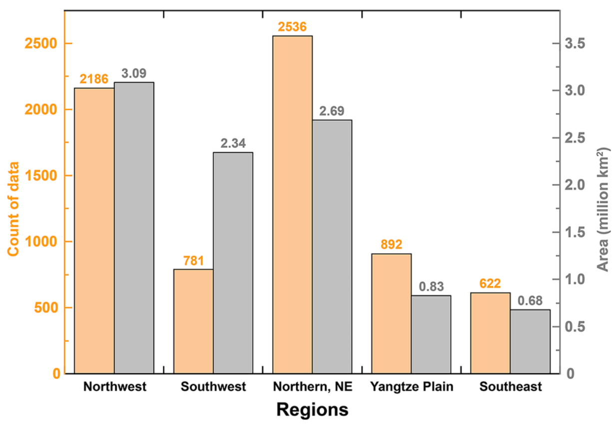

Fig. 2 Summary of the total number of published radiocarbon dates[547] (in orange, data by 2023) and the area of the five regions (in grey).

Regarding GI, the administrative location was indicated by "province", "prefecture", and "county" levels. Geographic coordinates and their source were also listed.

The radiocarbon section documents detailed information such as the sample category, species, lab code, dating technique, archaeological context, and original dates of each sample, where available. The "median", "σ", and "95.4% range of" the calibrated radiocarbon dates were recorded and rounded by one year. Data-quality proxies

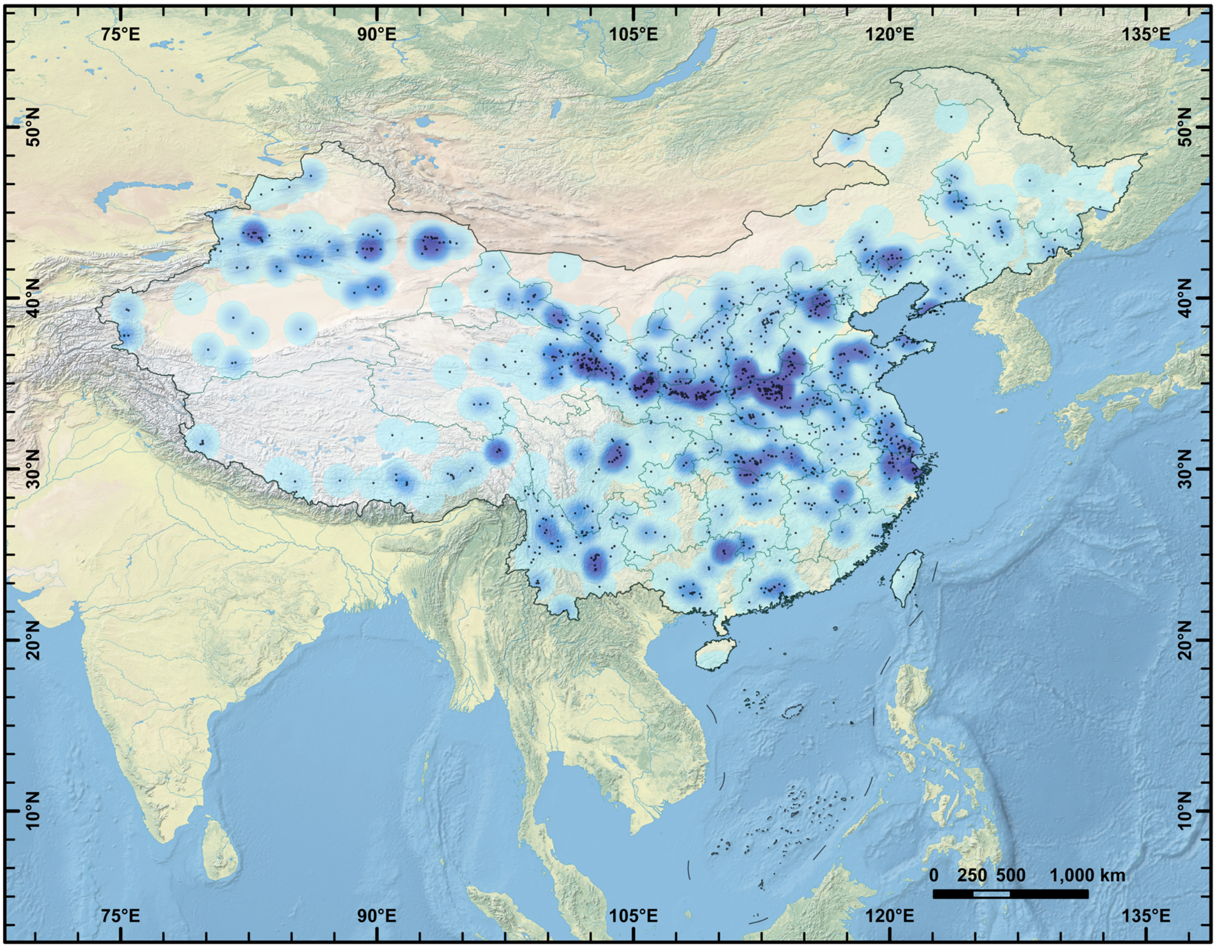

Fig. 3 Map showing the distribution of published radiocarbon dates[547] overlayed with the kernel density. Black dots represent individual radiocarbon dates, while the intensity of the blue shading indicates the density of the data distribution. The basemap was downloaded from Natural Earth (https://www.naturalearthdata.com/) and the boundaries were sourced from a standard map of China (no. GS(2019)1822).

like $\delta^{13}C$, carbon yield, and C/N ratio for collagen were also collected when reported. The "year of publication" corresponds to the original reference, with standardized abbreviations incorporating author, publication year, and publisher information. For papers published in English, "DOI" was provided where possible; for Chinese publications, the Chinese characters of the publisher were also recorded. The title of each publication was listed in the sheet "Data Source" in both English and Chinese.

Technical Validation

All radiocarbon dates collected by this databank are sourced from published materials and reviewed by the authors. For radiocarbon dates both previously collected in other datasets[11–13] and newly collected in this databank, their original provenance was traced to make sure the information is accurate. Archaeological and geographic information related to the radiocarbon data were primarily collected from the original and related documents and supplemented by using geographic tools to make the databank as intact as possible.

The distribution of these radiocarbon dates was calculated, and plotted with kernel density analysis on the map (Figs. 2, 3). Whilst radiocarbon dating has been incorporated as a routine approach in Chinese archaeology nowadays, especially for sites dated prior to the Qin-Han dynasties (221 BCE–220 CE), significant regional variation in data distribution remains evident. This is probably arguably driven by multiple factors. The majority of radiocarbon dates have been concentrated to Northern & Northwest China. Historically, the Central Plain in Northern China have been regarded as one of the cradles of Chinese civilization within the traditional historiographic framework or world-periphery system since the birth of Chinese archaeology as a distinct field[548–550]. This privilege of course attracts more scholarly attention as well as funding for radiocarbon dates.

A prime example is the first national programme Xia-Shang-Zhou Chronology Project, which aimed to establish a complete chronological sequence of the earliest Chinese dynasties through combination of radiocarbon dating, archaeology, early texts and astronomy[3–5]. The following national programme Source of Chinese Civilization further expanded the use of radiocarbon dates across Northern China and beyond[6]. As a result of growing realization of the continuous and complex communication between Northern China, Central Asia and

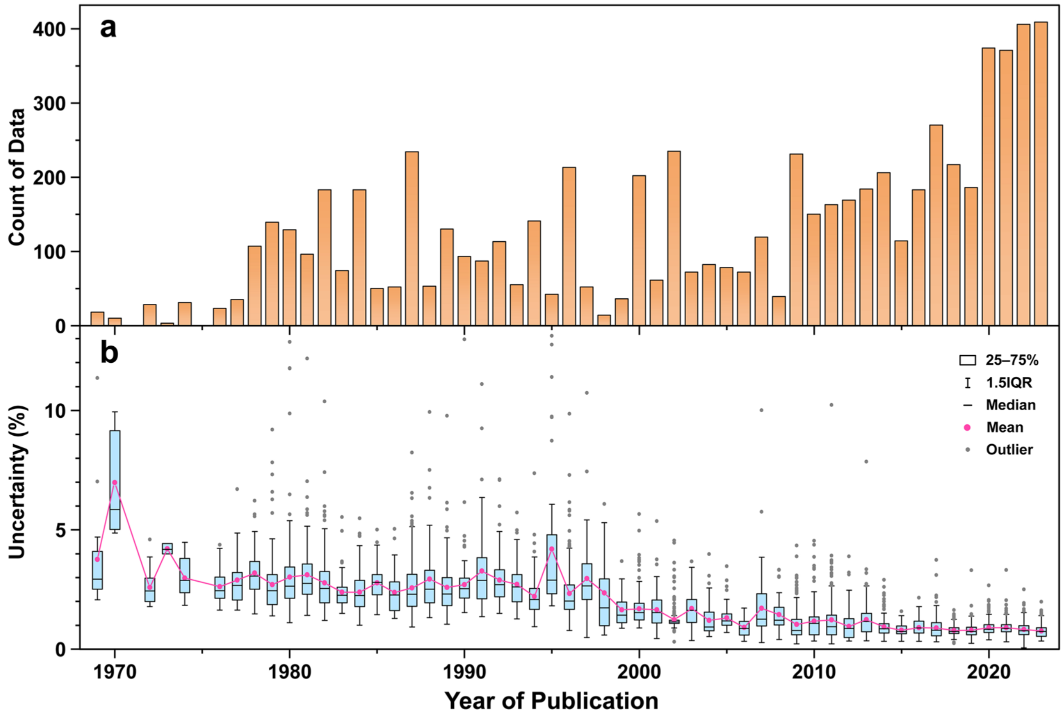

Fig. 4 Summary of the radiocarbon dates[547]: (**a**) Counts of published radiocarbon dates by year; (**b**) Variation of the uncertainty of the radiocarbon dates.

further Eurasia Steppe[551], Northwest China–better known as the eastern Silk Roads–has also become a focal area for radiocarbon research.

By sharp contrast, the remaining three regions (Southwest China, Yangtze River Plain and Southeast China) show comparatively fewer radiocarbon dates in total count. Although it is true that the Yangtze River Plain and Southeast China are much smaller in physical size, one of the key reasons that restricts the number of radiocarbon dates might be the limited preservation of datable organic material, often due to acidic soil conditions. Nonetheless, the recent years have seen a notable increasing number of radiocarbon dates in specific areas in these regions, such as the Yangtze Delta where Liangzhu, the earliest complex city in China, has been extensively excavated[552], or the eastern rim of the Tibetan Plateau, which serves as a crucial link between China and South/Southeast Asia[289,553].

The databank also summarizes the radiocarbon year uncertainty. Since accelerator mass spectrometry (AMS) was introduced to Chinese archaeology in 1990s[2], the radiocarbon uncertainty started to show a substantial decrease (Fig. 4). It is rather obvious that the previous dates generated by gas proportional counting or liquid scintillation counting, both essentially dependent on β emission, appear far less precise than AMS.

In comparison with the large body of radiocarbon dates, very few publications, either in Chinese or English, chose to publish the associated data-quality indices, making a direct data quality assessment virtually impossible. However, if available, these indices all fall within the range of normal criteria[547]. Most of the radiocarbon dates were provided with lab codes, or at least accompanied by information about the laboratory that conducted the test. This indicates that most of the radiocarbon data are quality-guaranteed by the corresponding laboratory. However, it is strongly recommended to provide quality-related index when publishing radiocarbon dates in the future.

Data availability

The dataset has been deposited to Zenodo (https://zenodo.org/records/17107786; https://doi.org/10.5281/zenodo.17107786).

Code availability

No code was used in the creation of this databank.

Received: 16 April 2025; Accepted: 8 September 2025;
Published online: 21 October 2025

References

1. Xia, N. The application of radioisotopes in archaeology: radiocarbon dating method. *Archaeology* **4**, 73–78 (1955).
2. Chen, X. L. Radiocarbon dating and its applications in Chinese archaeology: An overview. *Front. Earth Sci.* **11**, 1064717, https://doi.org/10.3389/feart.2023.1064717 (2023).

3. Guo, Z. Y. *et al*. The use of AMS radiocarbon dating for Xia–Shang–Zhou chronology. *Nucl. Instr. Meth. Phys. Res. B* **172**, 724–731, https://doi.org/10.1016/S0168-583X(00)00368-2 (2000).
4. Li, X. Q. The Xia-Shang-Zhou Chronology Project: Methodology and results. *J. East Asian Archaeol.* **4**, 1–4 (2002).
5. Xia-Shang-Zhou Chronology Project Expert Group. *Report on Xia-Shang-Zhou Chronology Project*. (Science Press, Beijing, 2022).
6. Wang, W. & Zhao, H. Chinese Civilization's Origin Project and its main achievements. *J. Chin. Hist. Stud.* **4**, 5–32 (2022).
7. Zhou, W. J., Zhou, J., Xiao, J. Y., Donahue, D. & Jull, A. J. T. Preliminary study on radiocarbon AMS dating of pollen. *Sci. China Ser. D* **42**, 524–530, https://doi.org/10.1007/BF02875246 (1999).
8. Zhou, W. J., Head, M. J., Wang, F. B., Donahue, D. J. & Jull, A. J. T. The reliability of AMS radiocarbon dating of shells from China. *Radiocarbon* **41**, 17–24, https://doi.org/10.1017/S0033822200019305 (1999).
9. Cao, H. H. *et al*. Performance and inter-comparison tests of the MICADAS at the radiocarbon laboratory of Lanzhou University, China. *Radiocarbon* **65**, 41–50, https://doi.org/10.1017/RDC.2022.80 (2023).
10. Carbon-14 Chronology Group, CAQR. *Collection of papers on Quaternary glaciation and Quaternary geology IV (Special issue for Carbon-14)*. (Geology Press, Beijing, 1987).
11. Institute of Archaeology, CASS. *Radiocarbon dating dataset in Chinese archaeology (1965–1991)*. (Cultural Relics Press, Beijing, 1992)
12. Wang, C., Lu, H. Y., Zhang, J. P., Gu, Z. Y. & He, K. Y. Prehistoric demographic fluctuations in China inferred from radiocarbon data and their linkage with climate change over the past 50,000 years. *Quat. Sci. Rev.* **98**, 45–59, https://doi.org/10.1016/j.quascirev.2014.05.015 (2014).
13. Dong, G. H., Li, R., Lu, M. X., Zhang, D. J. & James, N. Evolution of human–environmental interactions in China from the Late Paleolithic to the Bronze Age. *Prog. Phys. Geogr. Earth Environ.* **44**, 233–250, https://doi.org/10.1177/0309133319876802 (2020).
14. Aldenderfer, M. & Zhang, Y. N. The prehistory of the Tibetan Plateau to the seventh century A.D.: Perspectives and research from China and the West since 1950. *J. World Prehist.* **18**, 1–55, https://doi.org/10.1023/B:JOWO.0000038657.79035.9e (2004).
15. Archaeology Institute of Zhejiang Province. *Journal of Archaeology Institute of Zhejiang Province: The tenth anniversary of the institute (1980–1990)*. (Science Press, Beijing, 1993).
16. Archaeology Institute of Zhejiang Province. *Nanhebang: Report on the excavation of a Songze Culture site*. (Cultural Relics Press, Beijing, 2005).
17. Atahan, P. *et al*. Subsistence and the isotopic signature of herding in the Bronze Age Hexi Corridor, NW Gansu, China. *J. Archaeol. Sci.* **38**, 1747–1753, https://doi.org/10.1016/j.jas.2011.03.006 (2011).
18. Atahan, P. *et al*. Early Neolithic diets at Baijia, Wei River valley, China: stable carbon and nitrogen isotope analysis of human and faunal remains. *J. Archaeol. Sci.* **38**, 2811–2817, https://doi.org/10.1016/j.jas.2011.06.032 (2011).
19. Atahan, P. *et al*. Temporal trends in millet consumption in northern China. *J. Archaeol. Sci.* **50**, 171–177, https://doi.org/10.1016/j.jas.2014.07.012 (2014).
20. Bai, Z. G. The 2019 excavation of the Datongpu site in Jianhu County, Jiangsu. *Southeast Cult.* **5**, 81–97 (2023).
21. Bao, Y. G. *et al*. Evolution of prehistoric dryland agriculture in the arid and semi-arid transition zone in northern China. *PLoS ONE* **13**, e0198750, https://doi.org/10.1371/journal.pone.0198750 (2018).
22. Bao, Y. G. *et al*. Evolution and bioenvironmental adaptation of Neolithic and Bronze age agriculture in the North Chinese Loess Plateau. *Acta Anthropol. Sin.* **39**, 461–472 (2020).
23. Barton, L., Brantingham, P. J. & Ji, D. X. Late Pleistocene climate change and Paleolithic cultural evolution in Northern China: Implications from the Last Glacial Maximum. *Dev. Quat. Sci.* **9**, 105–128, https://doi.org/10.1016/S1571-0866(07)09009-4 (2007).
24. Barton, L. *et al*. Agricultural origins and the isotopic identity of domestication in northern China. *Proc. Natl. Acad. Sci. U.S.A.* **106**, 5523–5528, https://doi.org/10.1073/pnas.0809960106 (2009).
25. Barton, L. *Early food production in China's Western Loess Plateau*. (University of California, Daivs, 2009).
26. Bestel, S., Bao, Y. G., Zhong, H., Chen, X. C. & Liu, L. Wild plant use and multi-cropping at the early Neolithic Zhuzhai site in the middle Yellow River region, China. *Holocene* **28**, 195–207, https://doi.org/10.1177/0959683617721328 (2018).
27. Brantingham, P. J. *et al*. Speculation on the timing and nature of Lake Pleistocene hunter-gatherer colonization of the Tibetan Plateau. *Chin. Sci. Bull.* **48**, 1510–1516 (2003).
28. Brantingham, P. J. *et al*. A short chronology for the peopling of the Tibetan Plateau. *Dev. Quat. Sci.* **9**, 129–150, https://doi.org/10.1016/S1571-0866(07)09010-0 (2007).
29. Brunson, K. *et al*. Zooarchaeology, ancient mtDNA, and radiocarbon dating provide new evidence for the emergence of domestic cattle and caprines in the Tao River Valley of Gansu Province, northwest China. *J. Archaeol. Sci. Rep.* **31**, 102262, https://doi.org/10.1016/j.jasrep.2020.102262 (2020).
30. Cai, H. P., Shang, X., Hu, Y. W., Wang, Z. Y. & Xu, Y. C. Dietary analysis of Qin people in the Spring and Autumn period from the Matengkong site in Xi'an, Shaanxi Province. *Quat. Sci.* **43**, 1493–1502, https://doi.org/10.11928/j.issn.1001-7410.2023.05.26 (2023).
31. Cai, H. P., Ma, Q., Gao, M. L. & Hu, Y. W. Earliest direct evidence of horse husbandry and essential social network for sacrificial rituals during the Western Zhou Dynasty in China. *Quat. Sci. Rev.* **344**, 108997, https://doi.org/10.1016/j.quascirev.2024.108997 (2024).
32. Cao, D. Y. & He, J. Brief report on excavation of the Shijiahe Culture remains on Luojiachong site in Ningxiang City. *Hunan. Archaeology* **5**, 3–26 (2021).
33. Cao, K., Ma, P. & Qu, M. Y. Archaeological achievements and preliminary understandings from 2021–2022 excavation session at the Aketala complex in Shufu county, Xinjiang. *West. Reg. Stud.* **2**, 125–131 (2023).
34. Cao, Z. H. *et al*. Morphological characteristics of paddy fields, paddy soil profile, phytolith and fossil rice grain of the Neolithic age in Yangtze River Delta. *Acta Pedol. Sin.* **44**, 838–847 (2007).
35. Carbon-14 Laboratory. Radiocarbon dating of several archaeological samples. *Geochimica* **2**, 135–137 (1973).
36. Chai, Z. L., Zhang, W. J., Zhang, H. & Ruan, X. G. Excavation of the Zhou Dynasty Sanbanqiao site in Lujiang, Anhui Province. *Southeast Cult.* **3**, 52–68 (2021).
37. Chen, F. H. *et al*. Agriculture facilitated permanent human occupation of the Tibetan Plateau after 3600 BP. *Science* **347**, 248–250, https://doi.org/10.1126/science.1259172 (2015).
38. Chen, G. K. *et al*. Multipurpose animal utilization underpinned early Bronze Age subsistence of an oasis in an arid area of northwestern China. *Archaeol. Anthropol. Sci.* **16**, 66, https://doi.org/10.1007/s12520-024-01968-9 (2024).
39. Chen, J., Chen, Z. Y. & Li, C. H. Analysis of palaeoenvironment at Guangfulin site in Songjiang District, Shanghai. *Archaeology* **7**, 71–79 (2007).
40. Chen, J. L., Yang, J. C., Sun, B. J. & Pan, Y. Manufacture technique of bronze-iron bimetallic objects found in M27 of Liangdaicun Site, Hancheng, Shaanxi. *Sci. China Ser. E* **52**, 3038–3045, https://doi.org/10.1007/s11431-009-0138-9 (2009).
41. Chen, N. B. *et al*. Ancient genomes reveal tropical bovid species in the Tibetan Plateau contributed to the prevalence of hunting game until the late Neolithic. *Proc. Natl. Acad. Sci. USA.* **117**, 28150–28159, https://doi.org/10.1073/pnas.2011696117 (2020).
42. Chen, Q. H., Li, Z., Ma, Y. C., Zhou, Z. Y. & Yang, X. Y. Rice use history in Southeast China: Phytolith evidence from the Nanshan site in Fujian Province. *Sci. China Earth Sci.* **66**, 1108–1119, https://doi.org/10.1007/s11430-021-1091-9 (2023).
43. Chen, S. T. *et al*. Dietary evidence of incipient social stratification at the Dawenkou type site, China. *Quat. Int.* **521**, 44–53, https://doi.org/10.1016/j.quaint.2019.05.024 (2019).
44. Chen, T. M., Yuan, S. X., Wang, L. X. & Ma, L. Carbon-14 dating report (III). *Cult. Relics* **12**, 77–80 (1979).

45. Chen, T. M., Yuan, S. X., Wang, L. X., Ma, L. & Meng, Q. P. Carbon-14 dating report (VI). *Cult. Relics* **4**, 92–96 (1984).
46. Chen, T. M., Hedges, R. E. M. & Yuan, Z. X. Accelerator radiocarbon dating for Upper Cave of Zhoukoudian. *Acta Anthropol. Sin.* **8**, 216–221 (1989).
47. Chen, T. M., Hedges, R. E. M. & Yuan, Z. X. The second batch of accelerator radiocarbon dates for Upper Cave of Zhoukoudian. *Acta Anthropol. Sin.* **11**, 112–116 (1992).
48. Chen, T. T. *Analysis on agricultural development history and influential factors in the upper reaches of Wei River region during the 5500-2000 BP*. (Lanzhou University, Lanzhou, 2020).
49. Chen, X. L., Guo, X. N., Hu, Y. W., Wang, W. L. & Wang, C. S. Analysis of the subsistence practice at the Muzhuzhuliang site in Shenmu, Shaanxi. *Archaeol. Cult. Relics* **5**, 112–117 (2015).
50. Chen, X. L., Wu, Y. H. & Li, Z. P. Subsistence around 3rd millennium B.C. in Luoyang basin evidenced by human diets at Zhonggou and Wanggedang sites. *Quat. Sci.* **39**, 197–208, https://doi.org/10.11928/j.issn.1001-7410.2019.01.18 (2019).
51. Chen, X. L., Chang, H. Y. & Wang, D. Brief report of the 2021 excavation of the Shang and Zhou tombs at Zhangjiawa in Laishui County of Hebei. *Jianghan Archaeol.* **3**, 18–30 (2023).
52. Chen, X. X., Yu, S. Y., Underhill, A. P. & Fang, H. Radiocarbon dating and stable carbon isotopic analyses of Neolithic and Bronze Age staple crops in the lower Yellow River area and their paleodietary implications. *Geoarchaeology* **33**, 307–313, https://doi.org/10.1002/gea.21659 (2018).
53. Chen, X. X., Yu, S. Y., Wang, Q. Z., Cui, X. X. & Underhill, A. P. More direct evidence for early dispersal of bread wheat to the eastern Chinese coast ca. 2460–2210 BC. *Archaeol. Anthropol. Sci.* **12**, 233, https://doi.org/10.1007/s12520-020-01187-y (2020).
54. Chen, Y. L. *et al*. Holocene pedo-stratigraphic sequence and OSL chronology of the Erfangcun ruins in the Guanting basin of Qinghai Province. *Acta Geol. Sin.* **93**, 2960–2974 (2019).
55. Cheng, Z. J., Yang, Y. Z., Zhang, D. & Zhang, J. Z. Study on charred plant remains in Gongzhuang site in Linquan County of Anhui Province. *Agricult. Archaeol.* **3**, 13–19 (2019).
56. Cheng, Z. J. *et al*. Primitive agriculture in the Yangshao period revealed by charred plant remains from the Jiazhuang and Hougaolaojia sites in Xiangcheng, Henan province. *Acta Anthropol. Sin.* **41**, 85–95 (2022).
57. Cheng, Z. J. *et al*. Analysis on charred plant remains from four sites in Luohe city, Henan Province—on the agricultural structure in the southern upper Huaihe River Basin in the late Longshan era. *South. Cult. Relics* **1**, 188–194 (2023).
58. Crawford, G. W., Chen, X. X. & Wang, J. H. Houli Culture rice from Yuezhuang site. *Jinan. East. Archaeol.* **3**, 247–251 (2006).
59. Crawford, G. W., Chen, X. X., Luan, F. S. & Wang, J. H. A preliminary analysis on plant remains of the Yuezhuang site in Changqing District, Jinan city, Shandong Province. *Jianghan Archaeol.* **2**, 107–116 (2013).
60. Cui, M. J. *et al*. Farmers or nomads: Isotopic evidence of human–animal interactions (770BCE to 221BCE) in northern Shaanxi, China. *Front. Earth Sci.* **9**, 791323, https://doi.org/10.3389/feart.2021.791323 (2022).
61. Cui, T., Wang, Y. L., Liu, X. Y. & Xu, C. Q. Brief report on 2009–2011 excavation of Late Neolithic tombs at Laohudun Site, Jiang'an County, Jiangxi. *Cult. Relics Centr. China* **3**, 4–23 (2023).
62. Cui, X. L. & Li, X. Q. Carbon-14 dating report (VI). *Cult. Relics* **7**, 80–85 (1990).
63. Dai, J. Q. *et al*. Earliest arrival of millet in the South China coast dating back to 5,500 years ago. *J. Archaeol. Sci.* **129**, 105356, https://doi.org/10.1016/j.jas.2021.105356 (2021).
64. Dal Martello, R. *et al*. Early agriculture at the crossroads of China and Southeast Asia: Archaeobotanical evidence and radiocarbon dates from Baiyangcun, Yunnan. *J. Archaeol. Sci. Rep.* **20**, 711–721 (2018).
65. Dal Martello, R., Li, X. R. & Fuller, D. Q. Two-season agriculture and irrigated rice during the Dian: radiocarbon dates and archaeobotanical remains from Dayingzhuang, Yunnan, Southwest China. *Archaeol. Anthropol. Sci.* **13**, 62, https://doi.org/10.1007/s12520-020-01268-y (2021).
66. d'Alpoim Guedes, J., Jiang, M., He, K. Y., Wu, X. H. & Jiang, Z. H. Site of Baodun yields earliest evidence for the spread of rice and foxtail millet agriculture to south-west China. *Antiquity* **87**, 758–771, https://doi.org/10.1017/S0003598X00049449 (2013).
67. Dang, Z. H. *et al*. Early urban occupation in the Tarim Basin: recent fieldwork results from the fortified site of Kuiyukexiehai'er (Koyuk Shahri). *Antiquity* **96**, 463–470, https://doi.org/10.15184/aqy.2022.18 (2022).
68. Deng, Z. H. *et al*. From early domesticated rice of the Middle Yangtze Basin to millet, rice and wheat agriculture: Archaeobotanical macro-remains from Baligang, Nanyang Basin, Central China (6700–500 BC). *PLoS ONE* **10**, e0139885, https://doi.org/10.1371/journal.pone.0139885 (2015).
69. Deng, Z. H., Huang, H. C., Fan, X. C., Huang, Y. M. & Lu, H. Y. The ancient dispersal of millets in southern China: New archaeological evidence. *Holocene* **28**, 34–43, https://doi.org/10.1177/0959683617714603 (2018).
70. Deng, Z. H. *et al*. The first discovery of Neolithic rice remains in eastern Taiwan: phytolith evidence from the Chaolaiqiao site. *Archaeol. Anthropol. Sci.* **10**, 1477–1484, https://doi.org/10.1007/s12520-017-0471-z (2018).
71. Deng, Z. H. *et al*. Food and ritual resources in hunter-gatherer societies: Canarium nuts in southern China and beyond. *Antiquity* **93**, 1460–1478, https://doi.org/10.15184/aqy.2019.173 (2019).
72. Deng, Z. H., Yan, Z. H. & Yu, Z. Y. Bridging the gap on the southward dispersal route of agriculture in China: new evidences from the Guodishan site, Jiangxi province. *Archaeol. Anthropol. Sci.* **12**, 151, https://doi.org/10.1007/s12520-020-01117-y (2020).
73. Deng, Z. H. *et al*. Assessing the occurrence and status of wheat in late Neolithic central China: the importance of direct AMS radiocarbon dates from Xiazhai. *Veget. Hist. Archaeobot.* **29**, 61–73, https://doi.org/10.1007/s00334-019-00732-7 (2020).
74. Deng, Z. H., Huang, B. X., Zhang, Q. L. & Zhang, M. First farmers in the south China coast: New evidence from the Gancaoling site of Guangdong Province. *Front. Earth Sci.* **10**, 858492, https://doi.org/10.3389/feart.2022.858492 (2022).
75. Deng, Z. H., Kuo, S. C., Carson, M. T. & Huang, H. C. Early Austronesians cultivated rice and millet together: Tracing Taiwan's first Neolithic crops. *Front. Plant Sci.* **13**, 962073, https://doi.org/10.3389/fpls.2022.962073 (2022).
76. Deng, Z. H. *A study of the prehistoric agriculture in the middle and lower Han River Valley*. (Peking University, Beijing, 2015).
77. Ding, M. Y. *et al*. Ancient mitogenomes show plateau populations from last 5200 years partially contributed to present-day Tibetans. *Proc. R. Soc. B.* **287**, 20192968, https://doi.org/10.1098/rspb.2019.2968 (2020).
78. Ding, X. F. *et al*. New radiocarbon dates for Milu (*Elaphurus davidianus*) sub-fossils from southeast China. *Nucl. Instr. Meth. Phys. Res. B* **294**, 627–630, https://doi.org/10.1016/j.nimb.2012.08.044 (2013).
79. Dodson, J. R. *et al*. Origin and spread of wheat in China. *Quat. Sci. Rev.* **72**, 108–111. https://doi.org/10.1016/j.quascirev.2013.04.021.
80. Dong, G. H. *et al*. Mid-Holocene climate change and its effect on prehistoric cultural evolution in eastern Qinghai Province, China. *Quat. Res.* **77**, 23–30, https://doi.org/10.1016/j.yqres.2011.10.004 (2012).
81. Dong, G. H. *et al*. Spatial and temporal variety of prehistoric human settlement and its influencing factors in the upper Yellow River valley, Qinghai Province, China. *J. Archaeol. Sci.* **40**, 2538–2546, https://doi.org/10.1016/j.jas.2012.10.002 (2013).
82. Dong, G. H. *et al*. A comparative study of radiocarbon dating charcoal and charred seeds from the same flotation samples in the Late Neolithic and Bronze Age sites in the Gansu and Qinghai Provinces, Northwest China. *Radiocarbon* **56**, 157–163, https://doi.org/10.2458/56.16507 (2014).
83. Dong, G. H. *et al*. Chronology and subsistence strategy of Nuomuhong Culture in the Tibetan Plateau. *Quat. Int.* **426**, 42–49, https://doi.org/10.1016/j.quaint.2016.02.031 (2016).
84. Dong, G. H. *et al*. Prehistoric trans-continental cultural exchange in the Hexi Corridor, northwest China. *Holocene* **28**, 621–628, https://doi.org/10.1177/0309133319876802 (2018).

85. Dong, J. J. *et al*. Stable isotopic evidence for human and animal diets from the Late Neolithic to the Ming Dynasty in the middle-lower reaches of the Hulu River Valley, NW China. *Front. Ecol. Evol.* **10**, 905371, https://doi.org/10.3389/fevo.2022.905371 (2022).
86. Dong, W. M., An, C. B., Wang, Y. Q., Hu, W. L. & Zhang, J. Bone collagen stable isotope analysis of a Bronze Age site of Liushugou and its implication for subsistence strategy in arid northwest China. *Holocene* **31**, 194–202, https://doi.org/10.1177/0959683620970259 (2021).
87. Dong, W. M., An, C. B., Zhang, T. N. & Niyazi, A. Subsistence strategies of people from Chawuhu Culture in the middle of Tianshan Mountains: A case study of Mohuchahan site from Hejing County, Xinjiang. *Quat. Sci.* **42**, 80–91, https://doi.org/10.11928/j.issn.1001-7410.2022.01.07 (2022).
88. Dong, Y. *Eating identity: food, gender, and social organization in late Neolithic northern China*. (University of Illinois at Urbana-Champaign, Urbana, 2013).
89. Dong, Y., Lin, L. G., Zhu, X. T., Luan, F. S. & Underhill, A. P. Mortuary ritual and social identities during the late Dawenkou period in China. *Antiquity* **93**, 378–392, https://doi.org/10.15184/aqy.2019.34 (2019).
90. Dong, Y. *et al*. Social and environmental factors influencing dietary choices among Dawenkou culture sites, Late Neolithic China. *Holocene* **31**, 271–284, https://doi.org/10.1177/0959683620970273 (2021).
91. Elston, R. G. *et al*. New dates for the north China Mesolithic. *Antiquity* **71**, 985–993, https://doi.org/10.1017/S0003598X00085872 (1997).
92. Fan, J. *et al*. Brief report on excavation of the Shatangbeiyuan site in Longde, Ningxia in 2013. *Relics and Museol.* **6**, 3–12 (2017).
93. Flad, R., Li, S. C., Wu, X. H. & Zhao, Z. J. Early wheat in China: Results from new studies at Donghuishan in the Hexi Corridor. *Holocene* **20**, 955–965, https://doi.org/10.1177/0959683609358914 (2010).
94. Fu, L., Huang, Y. M., Yang, H. & Wang, X. T. Brief excavation report of the Hulushan site in Wuyishan, Fujian Province, 2014. *Southeast Cult.* **2**, 19–36 (2016).
95. Gao, G. S. *et al*. The largest headhunting event in prehistoric Asia: evidence of mass decapitation at the 4100-year-old Neolithic Age Honghe site, Heilongjiang, China. *Archaeol. Anthropol. Sci.* **15**, 144, https://doi.org/10.1007/s12520-023-01845-x (2023).
96. Gao, J. Y. *et al*. Vegetation history and survival patterns of the earliest village on the Qinghai–Tibetan Plateau. *Front. Plant Sci.* **13**, 903192, https://doi.org/10.3389/fpls.2022.903192 (2022).
97. Gao, J. Y. *Study of prehistoric human activities and its environment background around Lake Donggi Cona during mid-Holocene*. (Qinghai Normal University, Xining, 2019).
98. Gao, X. *et al*. Analysis of sedimentary-geomorphologic variation and the living environment of hominids at the Shuidonggou Paleolithic site. *Chin. Sci. Bull.* **53**, 2025–2032, https://doi.org/10.1007/s11434-008-0264-y (2008).
99. Gao, Y., Yang, J. S., Ma, Z. K., Tong, Y. & Yang, X. Y. New evidence from the Qugong site in the central Tibetan Plateau for the prehistoric Highland Silk Road. *Holocene* **31**, 230–239, https://doi.org/10.1177/0959683620941144 (2021).
100. Gao, Y. W. *Palynology and environmental archaeology of Jiangli site in Kunshan, Jiangsu Province*. (Nanjing Normal University, Nanjing, 2012).
101. Gong, G. Q. & Qin, D. H. The excavation of Jiawaairike cemetery in Qiemo County, Xinjiang. *Archaeology* **9**, 21–32 (1997).
102. Gong, Y. *The subsistence economy in Datong Basin during c. 4000a BP: Evidence from stable isotopes*. (Shanxi University, Taiyuan, 2003).
103. Gong, Y. W. *et al*. Investigation of ancient noodles, cakes, and millet at the Subeixi Site, Xinjiang, China. *J. Archaeol. Sci.* **38**, 470–479, https://doi.org/10.1016/j.jas.2010.10.006 (2011).
104. Gansu Provincial Institute of Cultural Relics and Archaeology & Research Office of Archaeology of the North at Jilin University. *Excavation report of the Donghuishan site in Minle–Excavation and study on the cemetery of Siba Culture*. (Science Press, Beijing, 1998).
105. Gu, Z. Q. *et al*. Food resources of the Khog Gzung site on the Tibetan Plateau revealed by sedimentary ancient DNA. *Sci. China Earth Sci.* **66**, 840–851, https://doi.org/10.1007/s11430-022-1051-8 (2023).
106. Guan, Y. *et al*. Evidence from plant starch residues of the function of early pottery and the plant diet of Neolithic inhabitants of Inner Mongolia, North China. *Quat. Int.* **608–609**, 215–225, https://doi.org/10.1016/j.quaint.2020.10.010 (2022).
107. Guan, Y. J., Xiong, Z. M., Ruan, X. D., Wang, H. J. & Terrasi, F. Evidences for the view of the importance of Hepu seaport in ancient China. *Nucl. Instr. Meth. Phys. Res. B* **294**, 688–691, https://doi.org/10.1016/j.nimb.2012.09.005 (2013).
108. Guo, L. *et al*. Case study of a special burial resulting from obstetric death at the Sanbulijia site, Shandong Province, China. *Int. J. Osteoarchaeol.* **33**, 361–370, https://doi.org/10.1002/oa.3205 (2023).
109. Guo, R. Z. *et al*. The carbonized plant remains of pre-Qin period from Shilipubei site, Heze City, Shandong province. *Agricult. Hist. China* **38**, 15–26 (2019).
110. Guo, W. M. The excavation of the Shanlonggang site in Linli County, Hunan in 2011. *J. Hunan Archaeol.* **14**, 1–55 (2019).
111. Guo, Z. Y. *et al*. AMS radiocarbon dating of the Fengxi site in Shaanxi, China. *Radiocarbon* **47**, 221–229, https://doi.org/10.1017/S003382220001972X (2005).
112. Han, F., He, Y. H., Du, W., Cai, L. H. & Lu, H. L. Technological strategy and mobility of Middle Holocene hunter-gatherers in the high-altitude Qinghai-Tibetan Plateau: a case study from Tshem gzhung kha thog. *Archaeol. Anthropol. Sci.* **12**, 242, https://doi.org/10.1007/s12520-020-01188-x (2020).
113. Han, W. X., Yu, L. P., Lai, Z. P., Madsen, D. & Yang, S. L. The earliest well-dated archeological site in the hyper-arid Tarim Basin and its implications for prehistoric human migration and climatic change. *Quat. Res.* **82**, 66–72, https://doi.org/10.1016/j.yqres.2014.02.004 (2014).
114. Hao, S. G., Ma, X. P., Yuan, S. X. & Southon, J. The Donghulin Woman from western Beijing: ^{14}C age and an associated compound shell necklace. *Antiquity* **75**, 517–522, https://doi.org/10.1017/S0003598X00088724 (2001).
115. Hao, S. G. *et al*. The early Holocene loess section in the Donghulin site near Zhaitang in Beijing. *Acta Geol. Sin.* **76**, 420–430 (2002).
116. Hao, X. X., Hu, T. T., Zuo, Z. Q., Sun, C. & Zhou, Z. Q. Excavation of the Neolithic remains of Guijiabao site in Yanyuan County, Sichuan. *Archaeology* **6**, 3–18 (2023).
117. He, J. & Cao, D. Y. Brief report on excavation of the No.1 building foundation in Luojiachong site, Ningxiang County, Hunan. *Cult. Relics Centr. China* **4**, 4–21 (2020).
118. He, K. Y. *et al*. Middle-Holocene sea-level fluctuations interrupted the developing Hemudu culture in the lower Yangtze River, China. *Quat. Sci. Rev.* **188**, 90–103, https://doi.org/10.1016/j.quascirev.2018.03.034 (2018).
119. He, K. Y. *et al*. Cultural response to Middle Holocene sea-level fluctuations in eastern China: a multi-proxy approach. *Boreas* **49**, 71–88, https://doi.org/10.1111/bor.12421 (2020).
120. He, K. Y. *et al*. Role of dynamic environmental change in sustaining the protracted process of rice domestication in the lower Yangtze River. *Quat. Sci. Rev.* **242**, 106456, https://doi.org/10.1016/j.quascirev.2020.106456 (2020).
121. He, K. Y. *et al*. Dynamic interaction between deforestation and rice cultivation during the Holocene in the Lower Yangtze River, China. *Front. Earth Sci.* **10**, 849501, https://doi.org/10.3389/feart.2022.849501 (2022).
122. He, K. Y. *et al*. Antipodal pattern of millet and rice demography in response to 4.2 ka climate event in China. *Quat. Sci. Rev.* **295**, 107786, https://doi.org/10.1016/j.quascirev.2022.107786 (2022).
123. He, K. Y. *et al*. Earliest Neolithic occupation and maritime adaptation on the West Pacific coast. *J. Archaeol. Sci.* **160**, 105874, https://doi.org/10.1016/j.jas.2023.105874 (2023).
124. He, K. Y. Re-understanding of the staging of Linjia site in Dongxiang, Gansu Province—Also on the staging, age and cultural attribute of Yingpanshan site. *Sichuan Cult. Relics* **4**, 29–39 (2011).

125. Hou, G. L., Lai, Z. P., Sun, Y. J. & Ye, M. L. Luminescence and radiocarbon chronologies for the Xindian Culture site of Lamafeng in the Guanting Basin on the NE edge of the Tibetan Plateau. *Quat. Geochronol.* **10**, 394–398, https://doi.org/10.1016/j.quageo.2012.02.024 (2012).
126. Hou, G. L., Dong, W. M., Cai, L. H., Wang, Q. B. & Qiu, M. H. The history and driving force for prehistoric human expansion upward to the hinterland of the Tibetan Plateau post–Last Glacial Maximum. *Sustainability* **13**, 7065, https://doi.org/10.3390/su13137065 (2021).
127. Hsu, Y. C., Huang, C. Y. & Lu, S. C. National Taiwan University radiocarbon measurements I. *Radiocarbon* **12**, 187–192, https://doi.org/10.1017/S0033822200036274 (1970).
128. Hu, G. & Fang, Q. Excavation report of two water wells (J1 and J2) at the Zhoutai site in Zaoyang City, Hubei Province. *Jianghan Archaeol.* **5**, 17–29 (2020).
129. Hu, S. M., Yang, T., Yang, M. M., Shao, J. & Di, N. Research on faunal remains from the Miaoliang site in Jingbian County, northern Shaanxi on the formation of animal husbandry in China. *Quat. Sci.* **42**, 17–31, https://doi.org/10.11928/j.issn.1001-7410.2022.01.02 (2022).
130. Hu, Y. W., Zhang, X. Y., Wang, T. T., Yang, Q. H. & Hu, S. M. Raising patterns of domestic animals at the Xinglefang Settlement, Huayin county, Shaanxi and their contribution to human meat resources. *Quat. Sci.* **40**, 399–406, https://doi.org/10.11928/j.issn.1001-7410.2020.02.10 (2022).
131. Huan, X. J. *et al*. The emergence of rice and millet farming in the Zang-Yi Corridor of southwest China dates back to 5000 years ago. *Front. Earth Sci.* **10**, 874649, https://doi.org/10.3389/feart.2022.874649 (2022).
132. Huan, X. J., Deng, Z. H., Xiang, J. H. & Lu, H. Y. New evidence supports the continuous development of rice cultivation and early formation of mixed farming in the Middle Han River Valley, China. *Holocene* **32**, 924–934, https://doi.org/10.1177/09596836221101253 (2022).
133. Huang, D. J., Zheng, D. & Wang, L. Excavation of the Neolithic remains at the Jiangjiadun site in Changzhou, Jiangsu Province. *Southeast Cult.* **5**, 27–40 (2023).
134. Huang, X. P. & Zhang, M. H. The second excavation of Songze site in Qingpu County, Shanghai. *Acta Archaeol. Sin.* **1**, 29–58 (1980).
135. Huang, Y. M. Brief report on the excavation of Pingfengshan shell-midden site in Xiapu County, Fujian. *Fujian Wenbo* **1**, 2–8 (2017).
136. Innes, J. B. *et al*. Environmental history, palaeoecology and human activity at the early Neolithic forager/cultivator site at Kuahuqiao, Hangzhou, eastern China. *Quat. Sci. Rev.* **28**, 2277–2294, https://doi.org/10.1016/j.quascirev.2009.04.010 (2009).
137. Institute for Preservation Technology of Cultural Relics. Carbon-14 dating using liquid scintillation method. *Cult. Relics* **5**, 70–74 (1978).
138. Institute for Preservation Technology of Cultural Relics. Carbon-14 dating report (II). *Cult. Relics* **2**, 82–85 (1980).
139. Institute for Preservation Technology of Cultural Relics. Carbon-14 dating report (III): Dating of shell and bone specimens. *Cult. Relics* **7**, 81–82 (1980).
140. Institute for Preservation Technology of Cultural Relics. Carbon-14 dating report (IV). *Cult. Relics* **4**, 88–93 (1982).
141. Institute for Preservation Technology of Cultural Relics. Carbon-14 dating report (V). *Cult. Relics* **4**, 87–91 (1984).
142. Institute of Archaeology, CASS. Report of radiocarbon dating (1). *Cult. Relics* **1**, 52–56 (1972).
143. Institute of Archaeology, CASS. Report of radiocarbon dating (2). *Cult. Relics* **5**, 56–58 (1972).
144. Institute of Archaeology, CASS. Report of radiocarbon dating (3). *Cult. Relics* **5**, 333–338 (1974).
145. Institute of Archaeology, CASS. Report of radiocarbon dating (4). *Cult. Relics* **3**, 200–204 (1977).
146. Institute of Archaeology, CASS. Report of radiocarbon dating (5). *Cult. Relics* **4**, 280–287 (1978).
147. Institute of Archaeology, CASS. Report of radiocarbon dating (6). *Cult. Relics* **1**, 89–96 (1979).
148. Institute of Archaeology, CASS. Report of radiocarbon dating (7). *Cult. Relics* **4**, 372–377 (1980).
149. Institute of Archaeology, CASS. Report of radiocarbon dating (8). *Cult. Relics* **4**, 363–369 (1981).
150. Institute of Archaeology, CASS. Report of radiocarbon dating (9). *Cult. Relics* **6**, 657–662 (1982).
151. Institute of Archaeology, CASS. Report of radiocarbon dating (10). *Cult. Relics* **4**, 280–287 (1983).
152. Institute of Archaeology, CASS. Report of radiocarbon dating (11). *Cult. Relics* **7**, 649–653 (1984).
153. Institute of Archaeology, CASS. Report of radiocarbon dating (12). *Cult. Relics* **7**, 654–658 (1985).
154. Institute of Archaeology, CASS. Report of radiocarbon dating (13). *Cult. Relics* **7**, 656–660 (1986).
155. Institute of Archaeology, CASS. Report of radiocarbon dating (14). *Cult. Relics* **7**, 653–659 (1987).
156. Institute of Archaeology, CASS. Report of radiocarbon dating (15). *Cult. Relics* **7**, 658–662 (1988).
157. Institute of Archaeology, CASS. Report of radiocarbon dating (16). *Cult. Relics* **7**, 657–661 (1989).
158. Institute of Archaeology, CASS. Report of radiocarbon dating (17). *Cult. Relics* **7**, 663–668 (1990).
159. Institute of Archaeology, CASS. Report of radiocarbon dating (18). *Cult. Relics* **7**, 657–663 (1991).
160. Institute of Archaeology, CASS. Report of radiocarbon dating (19). *Cult. Relics* **7**, 655–662 (1992).
161. Institute of Archaeology, CASS. Report of radiocarbon dating (20). *Cult. Relics* **7**, 645–649 (1993).
162. Institute of Archaeology, CASS. Report of radiocarbon dating (21). *Cult. Relics* **7**, 662–664 (1994).
163. Institute of Archaeology, CASS. Report of radiocarbon dating (22). *Cult. Relics* **7**, 655–659 (1995).
164. Institute of Archaeology, CASS. Report of radiocarbon dating (23). *Cult. Relics* **7**, 642–646 (1996).
165. Institute of Archaeology, CASS. Report of radiocarbon dating (24). *Cult. Relics* **7**, 611–628 (1997).
166. Institute of Archaeology, CASS. Report of radiocarbon dating (25). *Cult. Relics* **7**, 656–659 (1999).
167. Institute of Archaeology, CASS. Report of radiocarbon dating (26). *Cult. Relics* **8**, 754–758 (2000).
168. Institute of Archaeology, CASS. Report of radiocarbon dating (27). *Cult. Relics* **7**, 662–666 (2001).
169. Institute of Archaeology, CASS. Report of radiocarbon dating (28). *Cult. Relics* **7**, 625–634 (2002).
170. Institute of Archaeology, CASS. Report of radiocarbon dating (29). *Cult. Relics* **7**, 640–644 (2003).
171. Institute of Archaeology, CASS. Report of radiocarbon dating (30). *Cult. Relics* **7**, 642–647 (2004).
172. Institute of Archaeology, CASS. Report of radiocarbon dating (31). *Cult. Relics* **7**, 537–541 (2005).
173. Institute of Archaeology, CASS. Report of radiocarbon dating (32). *Cult. Relics* **7**, 641–643 (2006).
174. Institute of Archaeology, CASS. Report of radiocarbon dating (33). *Cult. Relics* **7**, 636–639 (2007).
175. Institute of Archaeology, CASS. Report of radiocarbon dating (34). *Cult. Relics* **7**, 661–663 (2008).
176. Institute of Archaeology, CASS. Report of radiocarbon dating (35). *Cult. Relics* **7**, 640–643 (2009).
177. Institute of Archaeology, CASS & Institute of Earth Environment, CAS. Report of radiocarbon dating (36). *Cult. Relics* **7**, 649–652 (2010).
178. Institute of Archaeology, CASS & Institute of Earth Environment, CAS. Report of radiocarbon dating (37). *Cult. Relics* **7**, 641–643 (2011).
179. Institute of Archaeology, CASS & Institute of Earth Environment, CAS. Report of radiocarbon dating (38). *Cult. Relics* **7**, 664–667 (2012).
180. Institute of Archaeology, CASS & Institute of Earth Environment, CAS. Report of radiocarbon dating (39). *Cult. Relics* **7**, 712–714 (2013).
181. Institute of Archaeology, CASS & Institute of Earth Environment, CAS. Report of radiocarbon dating (40). *Cult. Relics* **7**, 707–709 (2014).

182. Institute of Archaeology, CASS & Institute of Earth Environment, CAS. Report of radiocarbon dating (41). *Cult. Relics* **7**, 827–829 (2015).
183. Institute of Archaeology, CASS. Report of radiocarbon dating (42). *Cult. Relics* **7**, 817–821 (2016).
184. Institute of Archaeology, CASS. Report of radiocarbon dating (43). *Cult. Relics* **7**, 802–807 (2017).
185. Institute of Archaeology, CASS. Report of radiocarbon dating (44). *Cult. Relics* **7**, 802–806 (2018).
186. Institute of Archaeology, CASS, Radiocarbon Laboratory, PKU & AMS ^{14}C Laboratory, LZU. Report of radiocarbon dating (45). *Cult. Relics* **7**, 812–815 (2019).
187. Institute of Archaeology, CASS, AMS ^{14}C Laboratory, LZU & Radiocarbon laboratory, PKU. Report of radiocarbon dating (46). *Cult. Relics* **7**, 837–840 (2020).
188. Institute of Archaeology, CASS & AMS ^{14}C Laboratory, LZU. Report of radiocarbon dating (47). *Cult. Relics* **7**, 798–802 (2021).
189. Institute of Archaeology, CASS, AMS ^{14}C Laboratory, LZU & Radiocarbon laboratory, PKU. Report of radiocarbon dating (48). *Cult. Relics* **7**, 772–777 (2022).
190. Institute of Archaeology, CASS. Report of radiocarbon dating (49). *Cult. Relics* **7**, 819–823 (2023).
191. Institute of Archaeology, CASS, Guangxi Cultural Relics Work Team, Zengpiyan Site Museum of Guilin & Guilin Cultural Relics Work Team. *Guilin Zengpiyan*. (Cultural Relics Press, Beijing, 2003).
192. Institute of Archaeology, CASS, Aksu Cultural Relics Bureau of Xinjiang & Baicheng Cultural Relics Bureau. *Duogang Cemetery of Baicheng County*. (Cultural Relics Press, Beijing, 2014).
193. Institute of Cultural Relics and Archaeology of Hunan. *Pengtoushan and Bashidang*. (Science Press, Beijing, 2006).
194. Institute of Cultural Relics in Henan Province. *Wuyang Jiahu*. (Science Press, Beijing, 1999).
195. Institute of Cultural Relics in Henan Province. *Yuzhou Wadian*. (World Publishing Corporation, Beijing, 2006).
196. Institute of Geochemistry, CAS. *Method and application of carbon-14 dating*. (Science Press, Beijing, 1977).
197. Institute of Geology, CAS. Dating of natural radiocarbon. *Sci. Geol. Sin.* **4**, 383–384 (1974).
198. Jaffe, Y. *et al*. Complex pathways towards emergent pastoral settlements: New research on the Bronze Age Xindian Culture of Northwest China. *J. World Prehist.* **34**, 595–647, https://doi.org/10.1007/s10963-021-09160-w (2021).
199. Ji, D. X. *Environmental archaeological perspective: Dispersal of anatomically modern human and origin of agriculture in northern China-A case study in Gansu and Ningxia*. (Lanzhou University, Lanzhou, 2007).
200. Jia, P. W., Betts, A. & Wu, X. H. New evidence for Bronze Age agricultural settlements in the Zhunge'er (Junggar) Basin, China. *J. Field Archaeol.* **36**, 269–280, https://doi.org/10.1179/009346911X13140904382057 (2011).
201. Jia, P. W., Betts, A., Cong, D. X. & Doumani Dupuy, P. Adunqiaolu: new evidence for the Andronovo in Xinjiang, China. *Antiquity* **91**, 621–639, https://doi.org/10.15184/aqy.2017.67 (2017).
202. Jia, T. J. *et al*. Archaeological stratigraphy of the Tingchigang Neolithic site in Funing, northern Jiangsu. *J. Stratigr.* **36**, 741–746 (2012).
203. Jia, X. *et al*. The development of agriculture and its impact on cultural expansion during the late Neolithic in the Western Loess Plateau, China. *Holocene* **23**, 85–92, https://doi.org/10.1177/0959683612450203 (2013).
204. Jia, X. *et al*. The transition of human subsistence strategies in relation to climate change during the Bronze Age in the West Liao River Basin, Northeast China. *Holocene* **26**, 781–789, https://doi.org/10.1177/0959683615618262 (2016).
205. Jia, X. *et al*. Agricultural adaptations to topography and climate changes in Central China during the mid- to late-Holocene. *Holocene* **31**, 1705–1715 (2021).
206. Jia, X. *Agricultural adaptations to topography and climate changes in Central China during the mid- to late-Holocene*. (Lanzhou University, Lanzhou, 2012).
207. Jiang, H. E. *et al*. Evidence for early viticulture in China: proof of a grapevine (*Vitis vinifera* L., Vitaceae) in the Yanghai Tombs, Xinjiang. *J. Archaeol. Sci.* **36**, 1458–1465, https://doi.org/10.1016/j.jas.2009.02.010 (2009).
208. Jiang, H. E., Wu, Y., Wang, H. H., Ferguson, D. K. & Li, C. S. Ancient plant use at the site of Yuergou, Xinjiang, China: implications from desiccated and charred plant remains. *Veget. Hist. Archaeobot.* **22**, 129–140, https://doi.org/10.1007/s00334-012-0365-z (2013).
209. Jiang, H. E. *et al*. Ancient *Cannabis* burial shroud in a central Eurasian cemetery. *Econ. Bot.* **70**, 213–221, https://doi.org/10.1007/s12231-016-9351-1 (2016).
210. Jiang, M. *et al*. Result and analysis of plant remain floatation of Gaoshangucheng site, Dayi County in 2013. *Archaeol. Discov. Chengdu* **2016**, 390–402 (2018).
211. Jin, D., Shang, X. & Guo, X. N. A study on the utilization of plant resources during the Zhou Dynasty at Juede site in Yan'an, Shaanxi Province. *Quat. Sci.* **43**, 1483–1492, https://doi.org/10.11928/j.issn.1001-7410.2023.05.25 (2023).
212. Jin, G. Y. *et al*. Study on the remains of carbonized plants in Longshan culture in Zhaojiazhuang site, Jiaozhou, Shandong. *Sci. Archaeol.* **3**, 36–53 (2011).
213. Jin, G. Y., Wu, W. W., Zhang, K. S., Wang, Z. B. & Wu, X. H. 8000-Year old rice remains from the north edge of the Shandong Highlands, East China. *J. Archaeol. Sci.* **51**, 34–42, https://doi.org/10.1016/j.jas.2013.01.007 (2014).
214. Jin, G. Y., Wagner, M., Tarasov, P. E., Wang, F. & Liu, Y. C. Archaeobotanical records of Middle and Late Neolithic agriculture from Shandong Province, East China, and a major change in regional subsistence during the Dawenkou Culture. *Holocene* **26**, 1605–1615, https://doi.org/10.1177/0959683616641746 (2016).
215. Jin, G. Y. *et al*. The Beixin Culture: archaeobotanical evidence for a population dispersal of Neolithic hunter-gatherer-cultivators in northern China. *Antiquity* **94**, 1426–1443, https://doi.org/10.15184/aqy.2020.63 (2020).
216. Jin, H. T. *et al*. A primary study on AMS ^{14}C dating of phytolith at Tianluoshan site, Zhejiang Province. *Quat. Sci.* **34**, 1–7, https://doi.org/10.3969/j.issn.1001-7410.2014.01 (2014).
217. Jin, J. H. *et al*. Chronology of a late Neolithic site along the coast of the east China sea. *Quat. Geochronol.* **48**, 171–179, https://doi.org/10.1016/j.quageo.2018.10.001 (2018).
218. Jin, J. H., Li, F. S., Ling, Z. Y. & Li, Z. Z. New chronological evidence reveals a continuously inhabited Neolithic–historical settlement in south China. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* **600**, 111081, https://doi.org/10.1016/j.palaeo.2022.111081 (2022).
219. Jin, S. M. *et al*. Prehistoric human occupation and adaptation on the hinterland of the Tibetan Plateau in the Early Holocene. *Prog. Phys. Geogr.* **47**, 931–949, https://doi.org/10.1177/03091333231197168 (2023).
220. Kan, X. H., Zhou, Q., Qian, R. F. & Wang, Y. H. Excavation of Tomb M1 of the Spring and Autumn Period at Shuangdun, Bengbu, Anhui. *Cult. Relics* **3**, 4–18 (2010).
221. Lee, G. A. & Bestel, S. Contextual analysis of plant remains at the Erlitou-Period Huizui Site, Henan, China. *Bull. Indo-Pacific Prehist. Assoc.* **27**, 49–60 (2007).
222. Lee, G. A., Crawford, G. W., Liu, L. & Chen, X. C. Plants and people from the Early Neolithic to Shang periods in North China. *Proc. Natl. Acad. Sci. U.S.A.* **104**, 1087–1092, https://doi.org/10.1073/pnas.0609763104 (2007).
223. Leipe, C., Long, T., Sergusheva, E. A., Wagner, M. & Tarasov, P. E. Discontinuous spread of millet agriculture in eastern Asia and prehistoric population dynamics. *Sci. Adv.* **5**, eaax6225, https://doi.org/10.1126/sciadv.aax6225 (2019).
224. Li, B. *et al*. Relationship between environmental change and human activities in the period of the Shijiahe culture, Tanjialing site, Jianghan Plain, China. *Quat. Int.* **308–309**, 45–52, https://doi.org/10.1016/j.quaint.2013.05.041 (2013).
225. Li, B. *et al*. Radiocarbon chronology and settlement patterns in the Bronze Age of the Qaidam Basin, Northwestern China. *Sci. Rep.* **14**, 28117, https://doi.org/10.1038/s41598-024-79638-y (2024).

226. Li, C. H., Chen, J. & Wang, W. M. Pollen records from Guangfulin relics, Songjiang District of Shanghai. *Acta. Micropalaeontol. Sin.* **23**, 175–181 (2006).
227. Li, C. X. *et al*. Earliest ceramic drainage system and the formation of hydro-sociality in monsoonal East Asia. *Nat. Water* **1**, 694–704, https://doi.org/10.1038/s44221-023-00114-4 (2023).
228. Li, F. *et al*. A report on the 2009 reconnaissance of Paleolithic remains in the Shuiluo and Qingshui River Valley, Gansu Province. *Acta Anthropol. Sin.* **30**, 137–148 (2011).
229. Li, F. *et al*. A report on dating of the Xujiacheng Paleolithic site in Gansu Province, north China. *Acta Anthropol. Sin.* **32**, 432–440 (2013).
230. Li, F., Kuhn, S. L., Gao, X. & Chen, F. Y. Re-examination of the dates of large blade technology in China: A comparison of Shuidonggou Locality 1 and Locality 2. *J. Hum. Behav.* **64**, 161–168, https://doi.org/10.1016/j.jhevol.2012.11.001 (2013).
231. Li, F. *et al*. The excavation of the remains of the Shang and Zhou Dynasties at Dengjiatuo site in Zhongxian County, Chongqing. *Cult. Relics* **2**, 50–60 (2017).
232. Li, F., Li, J. Y., Lu, Y., Bai, P. & Cheng, H. F. New discoveries related to ancient agriculture at the Neolithic site of Donghuishan in Minle County, Gansu. *Agricult. Archaeol.* **1**, 56–69 (1989).
233. Li, G. Q., Dong, G. H., Wen, L. J. & Chen, F. H. Overbank flooding and human occupation of the Shalongka site in the Upper Yellow River Valley, northeast Tibet Plateau in relation to climate change since the last deglaciation. *Quat. Res.* **82**, 354–365, https://doi.org/10.1016/j.yqres.2014.07.005 (2014).
234. Li, H., An, C. B., Dong, W. M., Wang, S. Z. & Dong, G. H. The charcoal records of Qijia sites in Longdong Basin and its significance. *Quat. Sci.* **34**, 35–42, https://doi.org/10.3969/j.issn.1001-7410.2014.01.05 (2014).
235. Li, H. M. *et al*. Water and soil management strategies and the introduction of wheat and barley to northern China: an isotopic analysis of cultivation on the Loess Plateau. *Antiquity* **96**, 1478–1494, https://doi.org/10.15184/aqy.2022.138 (2022).
236. Li, H. M. *et al*. Spatiotemporal variation of agricultural patterns in different geomorphologic and climatic environments in the eastern Loess Plateau, north-central China during the late Neolithic and Bronze Ages. *Sci. China Earth Sci.* **65**, 934–948, https://doi.org/10.1007/s11430-021-9879-x (2022).
237. Li, H. M. *et al*. Agricultural economic transformations and their impacting factors around 4000 BP in the Hexi Corridor, Northwest China. *Land* **12**, 425, https://doi.org/10.3390/land12020425 (2023).
238. Li, H. M. *Study on the utilization strategies of major crops from Neolithic to historical periods in the western Loess Plateau*. (Lanzhou University, Lanzhou, 2018).
239. Li, K. K. *et al*. New radiocarbon dating and archaeological evidence reveal the westward migration of prehistoric humans in the drylands of the Asian interior. *Holocene* **31**, 1555–1570, https://doi.org/10.1177/09596836211025968 (2021).
240. Li, L. *et al*. Transgression records between 7500-5400BC on the stratum of the Luotuodun site in Yixing, Jiangsu Province. *Acta Geogr. Sin.* **63**, 1189–1197 (2008).
241. Li, M. L., Mo, D. W., Mao, L. J., Sun, G. P. & Zhou, K. S. Paleosalinity in the Tianluoshan site and the correlation between the Hemudu culture and its environmental background. *J. Geogr. Sci.* **20**, 441–454, https://doi.org/10.1007/s11442-010-0441-1 (2010).
242. Li, S., Zhao, D. Y., Li, H. C. & Min, R. Brief report on the excavation in 2017 of burials in Haimenkou site, Jianchuan County, Yunan. *Archaeology* **5**, 46–62 (2021).
243. Li, S. Y., Lv, E. G., Liu, X. T., Qian, Y. P. & Yu, J. J. Briefing of the excavation of Jialekesikayinte Cemetery in Nilka County, Xinjiang. *Archaeol. Cult. Relics* **5**, 20–29 (2011).
244. Li, W. *et al*. Subsistence economy of Erlitou Culture from regional perspective: Based on new evidences of stable carbon and nitrogen isotope from Luohe area, Henan Province. *Quat. Sci.* **43**, 1444–1459, https://doi.org/10.11928/j.issn.1001-7410.2023.05.22 (2023).
245. Li, X. *et al*. Archaeological and palaeopathological study on the third/second century BC grave from Turfan, China: Individual health history and regional implications. *Quat. Int.* **290–291**, 335–343, https://doi.org/10.1016/j.quaint.2012.05.010 (2013).
246. Li, X. *et al*. Transformation of animal utilization strategies from the late Neolithic to the Han Dynasty in the Hexi Corridor, northwest China: Zooarchaeological and stable isotopic evidence. *Front. Earth Sci.* **10**, 1064803, https://doi.org/10.3389/feart.2022.1064803 (2023).
247. Li, X. Q. *et al*. The earliest archaeobiological evidence of the broadening agriculture in China recorded at Xishanping site in Gansu Province. *Sci. China Ser. D* **50**, 1707–1714, https://doi.org/10.1007/s11430-007-0066-0 (2007).
248. Li, X. Q., Shang, X., Dodson, J. & Zhou, X. Y. Holocene agriculture in the Guanzhong Basin in NW China indicated by pollen and charcoal evidence. *Holocene* **19**, 1213–1220, https://doi.org/10.1177/0959683609345083 (2009).
249. Li, Y. *et al*. Early evidence for mounted horseback riding in northwest China. *Proc. Natl. Acad. Sci. USA.* **117**, 29569–29576, https://doi.org/10.1073/pnas.2004360117 (2020).
250. Li, Y. *et al*. Pastoral subsistence and mounted fighting in the Eastern Tianshan Mountain region: New insights from the Shirenzigou worked bone assemblage. *PLoS ONE* **16**, e0259985, https://doi.org/10.1371/journal.pone.0259985 (2021).
251. Li, Y. C., Xu, Q. H., Duan, H. Z. & Jane, B. M. Environmental context of a Neolithic site at Beifudi, north-west Hebei Province, China. *J. Archaeol. Sci.* **38**, 2502–2508, https://doi.org/10.1016/j.jas.2011.01.008 (2011).
252. Li, Y. Q. & Yang, Y. C. The report of the 2015 systematic excavation in Xiaonanshan III settlement. *Heilongjiang Province. Archaeology* **8**, 3–20 (2019).
253. Li, Y. Q. *et al*. Farming strategies of 1st millennium CE agro-pastoralists on the southern foothills of the Tianshan Mountains: A geoarchaeological and macrobotanical investigation of the Mohuchahangoukou (MGK) site, Xinjiang, China. *PLoS ONE* **14**, e2017171, https://doi.org/10.1371/journal.pone.0217171 (2019).
254. Li, Y. X., Chen, G. K., Qian, W., Chen, J. L. & Wang, H. Research of the metallurgical remains in the Xitugou site at Dunhuang. *Dunhuang Res.* **168**, 131–140 (2018).
255. Li, Y. X. Brief report on the investigation of Gebusailu Cemetery in Zhada County, Tibet. *Archaeology* **6**, 39–44 (2001).
256. Li, Y. Y. Palaeoecological records of environmental change and cultural development from the Liangzhu and Qujialing archaeological sites in the middle and lower reaches of the Yangtze River. *Quat. Int.* **227**, 29–37, https://doi.org/10.1016/j.quaint.2010.05.015 (2010).
257. Librado, P. *et al*. The origins and spread of domestic horses from the Western Eurasian steppes. *Nature* **598**, 634–640, https://doi.org/10.1038/s41586-021-04018-9 (2021).
258. Lin, L. G., Gan, H. Y. & Yan, L. The excavation of the Shunshanji site of Neolithic Age in Sihong County, Jiangsu. *Acta Archaeol. Sin.* **4**, 519–562 (2014).
259. Lin, S. *et al*. AMS-^{14}C chronology of Yujiagou site in Nihewan Basin and its archeological significance. *J. Earth Environ.* **9**, 149–158 (2018).
260. Liu, D. C. *et al*. Preliminary comments on the paleoenvironments of the Shuidonggou locality 12. *Acta Anthropol. Sin.* **27**, 295–303, https://doi.org/10.3969/j.issn.1000-3193.2008.04.002 (2008).
261. Liu, D. C. *et al*. Progress in the stratigraphy and geochronology of the Shuidonggou site, Ningxia, North China. *Chin. Sci. Bull.* **54**, 3880–3886, https://doi.org/10.1007/s11434-009-0652-y (2009).
262. Liu, H., Song, G. D. & Li, S. T. Analysis of carbonized macroremains from the Zhangdeng site, Henan, China. *Acta Anthropol. Sin.* **40**, 1063–1071, https://doi.org/10.16359/j.cnki.cn11-1963/q.2020.0075 (2021).
263. Liu, H. G. *Human activities and plant-animal utilization from Paleolithic to Bronze Age in northwest Yunnan province*. (Lanzhou University, Lanzhou, 2016).

264. Liu, K. X. *et al*. AMS radiocarbon dating of bone samples from the Xinzhai site in China. *Radiocarbon* **47**, 21–25, https://doi.org/10.1017/S0033822200052152 (2005).
265. Liu, K. X. *et al*. Radiocarbon dating of oracle bones of late Shang period in ancient China. *Radiocarbon* **96**, 155–175, https://doi.org/10.1017/RDC.2020.90 (2021).
266. Liu, L., Bestel, S., Shi, J. M., Song, Y. H. & Chen, X. C. Paleolithic human exploitation of plant foods during the last glacial maximum in North China. *Proc. Natl. Acad. Sci. USA*. **110**, 5380–5385, https://doi.org/10.1073/pnas.1217864110 (2013).
267. Liu, X. *A study on the dating and livelihood of Wangwan III Culture*. (Sun Yat-Sen University, Guangzhou, 2019).
268. Liu, X. K. *et al*. The strategy and environmental significance of Neolithic subsistence in the Mu Us Desert, China. *Quat. Int*. **574**, 68–77, https://doi.org/10.1016/j.quaint.2020.12.006 (2021).
269. Liu, X. Y., Jones, M. L., Zhao, Z. J., Liu, G. X. & O'Connell, T. C. The earliest evidence of millet as a staple crop: New light on Neolithic foodways in North China. *Am. J. Phys. Anthropol*. **149**, 283–290, https://doi.org/10.1002/ajpa.22127 (2012).
270. Liu, X. Y. *et al*. From necessity to choice: dietary revolutions in west China in the second millennium BC. *World Archaeol*. **46**, 661–680, https://doi.org/10.1080/00438243.2014.953706 (2014).
271. Liu, X. Y. *et al*. The virtues of small grain size: Potential pathways to a distinguishing feature of Asian wheats. *Quat. Int*. **426**, 107–119, https://doi.org/10.1016/j.quaint.2016.02.059 (2016).
272. Liu, X. Y. *et al*. Journey to the east: Diverse routes and variable flowering times for wheat and barley en route to prehistoric China. *PLoS ONE* **12**, e0187405, https://doi.org/10.1371/journal.pone.0187405 (2017).
273. Liu, Y., Sheng, P. F., Zhang, P. C. & Shang, X. Preliminary analysis of the macrobotanical plant remains discovered from flotation from the Banshang site in Fuxian county, Shaanxi. *Archaeol. Cult. Relics* **1**, 116–124 (2019).
274. Long, T. W. *et al*. The early history of wheat in China from ^{14}C dating and Bayesian chronological modelling. *Nat. Plants* **4**, 272–279, https://doi.org/10.1038/s41477-018-0141-x (2018).
275. Lu, H. L. *et al*. Early agropastoral settlement and cultural change in central Tibet in the first millennium BC: Excavations at Bangga. *Antiquity* **95**, 955–972, https://doi.org/10.15184/aqy.2020.185 (2021).
276. Lu, H. L. *et al*. Sding Chung: an early multi-burial cave site on the Tibetan Plateau. *Antiquity* **96**, 745–753, https://doi.org/10.15184/aqy.2022.42 (2022).
277. Lu, H. Y. *et al*. Earliest domestication of common millet (*Panicum miliaceum*) in East Asia extended to 10,000 years ago. *Proc. Natl. Acad. Sci. USA*. **106**, 7367–7372, https://doi.org/10.1073/pnas.0900158106 (2009).
278. Lu, M. X. *et al*. Environmental influences on human subsistence strategies in southwest China during the Bronze Age: A case study at the Jiangxifen site in Yunan. *Front. Earth Sci*. **9**, 662053, https://doi.org/10.3389/feart.2021.662053 (2021).
279. Lu, Y. X. *et al*. Diversification of faunal exploitation strategy and human-climate interaction in Southern China and Southeast Asia during the last deglaciation. *Quat. Sci. Rev*. **322**, 108420, https://doi.org/10.1016/j.quascirev.2023.108420 (2023).
280. Luo, W. H. *et al*. Evidence for crop structure from phytoliths at the Dongzhao site on the Central Plains of China from Xinzhai to Erligang periods. *J. Archaeol. Sci. Rep*. **17**, 852–859, https://doi.org/10.1016/j.jasrep.2017.12.018 (2018).
281. Luo, Y. B. *et al*. Brief report on 2021 excavation of Zhengjiahu Cemetery in Yunmeng County. *Hubei. Archaeology* **2**, 3–21 (2022).
282. Lv, E. G., Wang, L. & Guo, W. A study on the staging and Dating of Yanghai cemetery. *J. Turfan Stud*. **1**, 1–18 (2017).
283. Lv, E. G. Brief report on excavation at Xintala site in Heshuo, Xinjiang. *Archaeology* **5**, 399–407 (1988).
284. Lv, J. Y. Excavation report on Xiakenglong site in Songxi County, Fujian Province. *Fujian Wenbo* **2**, 11–15 (2022).
285. Ma, M. M. *et al*. Process of paleofloods in Guanting basin, Qinghai Province, China and possible relation to monsoon strength during the mid-Holocene. *Quat. Int*. **321**, 88–96, https://doi.org/10.1016/j.quaint.2012.05.031 (2012).
286. Ma, M. M., Lu, M. X., Zhang, S. J., Min, R. & Dong, G. H. Asynchronous transformation of human livelihoods in key regions of the trans-Eurasia exchange in China during 4000–2200 BP. *Quat. Sci. Rev*. **291**, 107665, https://doi.org/10.1016/j.quascirev.2022.107665 (2022).
287. Ma, M. M. *et al*. Understanding the transport networks complex between South Asia, Southeast Asia and China during the late Neolithic and Bronze Age. *Holocene* **33**, 147–158, https://doi.org/10.1177/09596836221131698 (2023).
288. Ma, M. M. *et al*. Asynchronicity of dietary transformation in different regions along the Bronze Age Eastern Silk Road. *Palaeogeogr. Palaeoclimatol. Palaeoecol*. **610**, 111348, https://doi.org/10.1016/j.palaeo.2022.111348 (2023).
289. Ma, M. M. *et al*. Forager-farmer transition at the crossroads of East and Southeast Asia 4900 years ago. *Sci. Bull*. **69**, 103–113, https://doi.org/10.1016/j.scib.2023.10.015 (2023).
290. Ma, X. F., Hu, X. J. & Qiu, M. H. Radiocarbon-refined archaeological chronology and the history of human activity in the southern Tarim Basin. *Land* **13**, 477, https://doi.org/10.3390/land13040477 (2024).
291. Ma, Z. K. *et al*. Analysis of grain storage pit of the Shirenzigou site in Balikun County, east Tianshan area, Xinjiang. *Quat. Sci*. **41**, 214–223, https://doi.org/10.11928/j.issn.1001-7410.2021.01.19 (2021).
292. Ma, Z. K. *et al*. Analysis of grain storage pit of the Shirenzigou site in Balikun County, east Tianshan area, Xinjiang. *Agronomy* **13**, 1272, https://doi.org/10.3390/agronomy13051272 (2023).
293. Madsen, D. B. *et al*. The Loess/Paleosol record and the nature of the younger Dryas climate in central China. *Geoarchaeology* **13**, 847–869 (1998). 10.1002/(SICI)1520-6548(199812)13:8<847::AID-GEA4>3.0.CO;2-6.
294. Madsen, D. B. *et al*. Dating Shuidonggou and the upper palaeolithic blade industry in North China. *Antiquity* **75**, 706–716, https://doi.org/10.1017/S0003598X00089213 (2001).
295. Madsen, D. B. *et al*. The Late Upper Paleolithic occupation of the northern Tibetan Plateau margin. *J. Archaeol. Sci*. **33**, 1433–1444, https://doi.org/10.1016/j.jas.2006.01.017 (2006).
296. Madsen, D. B. *et al*. Early foraging settlement of the Tibetan Plateau highlands. *Archaeol. Res. Asia* **11**, 15–26, https://doi.org/10.1016/j.ara.2017.04.003 (2017).
297. Mao, X., Li, C. A., Zhang, Y. F., Chen, X. & Liu, H. Impact of Middle to Late Holocene climate changes on human activities at Tanjialing site, Tianmen, Hubei Province. *Earth Sci. J. China Univ. Geosci*. **39**, 1445–1452 (2014).
298. Min, R. & Wan, J. Brief report of the excavation of Yinsuodao site in Haidong, Dali, Yunnan. *Archaeology* **8**, 23–41 (2009).
299. Min, R. A comprehensive study on Haimenkou site in Jianchuan County. *Xueyuan* **15**, 6–9 (2013).
300. Mo, L. H. & Xu, W. H. The excavation of Maiziyuan site in Taojiang County, Hunan Province. *J. Hunan. Archaeol*. **10**, 67–104 (2014).
301. N Museum & S Museum *Shunshanji: Report on the excavation of Neolithic sites in Sihong County*. (Science Press, Beijing, 2016).
302. Pan, Y. *Resource production in the Yangzi delta and Qiantang drainage from 10000 to 6000 BP: A palaeoethnobotanical and human ecological investigation*. (Fudan University, Shanghai, 2011).
303. Panel of Xia-Shang-Zhou Chronology Project. *Report of phased achievements of Xia-Shang-Zhou Chronology Project (1996-2000)*. (World Publishing Corporation, Beijing, 2000).
304. Pei, S. W. *et al*. The Shuidonggou site complex: new excavations and implications for the earliest Late Paleolithic in North China. *J. Archaeol. Sci*. **39**, 3610–3626, https://doi.org/10.1016/j.jas.2012.06.028 (2012).
305. Peng, F. *et al*. An engraved artifact from Shuidonggou, an Early Late Paleolithic Site in Northwest China. *Chin. Sci. Bull*. **57**, 4594–4599, https://doi.org/10.1007/s11434-012-5317-6 (2012).
306. Pu, Z. F. & Nan, Y. Q. Excavation report of Xindian cultural tombs in Lianhuatai, Linxia, Gansu Province. *Cult. Relics* **3**, 7–19 (1988).
307. Qian, J. C., Wang, L. X., Yuan, S. X., Chen, T. M. & Ma, L. Carbon-14 dating report (IV). *Cult. Relics* **12**, 81–83 (1979).

308. Qian, R. F. & Wang, J. H. Brief report on excavation of the ritual architecture foundation at the Longshan Culture Yuhui site in Bengbu City, Anhui. *Archaeology* **1**, 7–31 (2013).
309. Qiao, H. & Ma, Q. Brief report on the excavation of the tomb area of Zongri site in Tongde County, Qinghai Province in 2020. *Sichuan Cult. Relics* **5**, 4–18 (2022).
310. Qiu, M. H. *et al*. Diversification in feeding pattern of livestock in Early Bronze Age northwestern China. *Front. Ecol. Evol.* **10**, 908131, https://doi.org/10.3389/fevo.2022.908131 (2022).
311. Qiu, M. H. *et al*. Earliest systematic coal exploitation for fuel extended to ~3600 B.P. *Sci. Adv.* **9**, adh0549, https://doi.org/10.1126/sciadv.adh0549 (2023).
312. Qiu, S. H. & Cai, L. Z. The radiocarbon chronology frame in Xia-Shang-Zhou Chronology Project. *Archaeology* **1**, 90–100 (2001).
313. Qiu, Y. H. *et al*. New radiocarbon dates and the prehistoric human occupation at the Lake Qinghai Basin, northeast Tibetan Plateau. *Quat. Int.* **655**, 27–36, https://doi.org/10.1016/j.quaint.2023.02.003 (2023).
314. Qiu, Z. W., Jiang, H. E., Ding, J. L., Hu, Y. W. & Shang, X. Pollen and phytolith evidence for rice cultivation and vegetation change during the Mid-Late Holocene at the Jiangli site, Suzhou, East China. *PLoS ONE* **9**, e97541, https://doi.org/10.1371/journal.pone.0097541 (2014).
315. Qiu, Z. W., Shang, X., Ferguson, D. K. & Jiang, H. E. Archaeobotanical analysis of diverse plant food resources and palaeovegetation at the Zhumucun site, a late Neolithic settlement of the Liangzhu Culture in east China. *Quat. Int.* **426**, 75–85, https://doi.org/10.1016/j.quaint.2016.01.010 (2016).
316. Qiu, Z. W., Liu, B. S., Li, Y. Q., Shang, X. & Jiang, H. E. Analysis of plant remains at the Neolithic Yangjia Site, Wuxi City, Jiangsu Province (East China). *Sci. China Earth Sci.* **59**, 1803–1816, https://doi.org/10.1007/s11430-016-5326-4 (2016).
317. Qiu, Z. W., Zhuang, L. N., Yu, H. N. & Lin, L. G. Excavation report of the Xuenan site in Sihong, Jiangsu Province in 2017. *J. Natl. Museum China* **8**, 6–23 (2022).
318. Qiu, Z. W., Zhuang, L. N., Rao, H. Y., Lin, L. G. & Zhuang, Y. J. Excavation at Hanjing site yields evidence of early rice cultivation in the Huai River more than 8000 years ago. *Sci. China Earth Sci.* **65**, 910–920, https://doi.org/10.1007/s11430-021-9885-x (2022).
319. Qiu, Z. W., Wu, X. H., Guo, M. J. & Wang, G. Floatation result and analysis of plant remains from Xinglong site, Kangbao County, Hebei in 2018–2019. *Archaeology* **1**, 106–120 (2023).
320. Qu, Y. T., Zhu, J. X., Yang, H. & Zhou, L. L. Food, cooking and potteries in the Neolithic Mijiaya site, Guanzhong area, North China, revealed by multidisciplinary approach. *Herit. Sci.* **11**, 107, https://doi.org/10.1186/s40494-023-00950-3 (2023).
321. Radiocarbon Laboratory of Peking University. Preliminary report on carbon-14 dating using liquid scintillation method. *Cult. Relics* **12**, 80–84 (1976).
322. Radiocarbon Laboratory of Peking University. Carbon-14 dating report (sequel of I). *Cult. Relics* **5**, 75–76 (1978).
323. Radiocarbon Laboratory of Peking University. Carbon-14 dating report (VIII). *Cult. Relics* **11**, 90–92 (1989).
324. Radiocarbon Laboratory of Peking University. Carbon-14 dating report (X). *Cult. Relics* **6**, 91–95 (1996).
325. Ren, L. L. *et al*. Dating human settlement in the east-central Tibetan Plateau during the Late Holocene. *Radiocarbon* **60**, 137–150, https://doi.org/10.1017/RDC.2017.117 (2018).
326. Ren, L. L. *et al*. Foraging and farming: archaeobotanical and zooarchaeological evidence for Neolithic exchange on the Tibetan Plateau. *Antiquity* **94**, 637–652, https://doi.org/10.15184/aqy.2020.35 (2020).
327. Ren, L. L. *et al*. Direct dating of the earliest domesticated cattle and caprines in northwestern China reveals the history of pastoralism in the Gansu-Qinghai region. *J. Archaeol. Sci.* **144**, 105627, https://doi.org/10.1016/j.jas.2022.105627 (2022).
328. Rhode, D., Brantingham, P. J., Perreault, C. & Madsen, D. B. Mind the gaps: testing for hiatuses in regional radiocarbon date sequences. *J. Archaeol. Sci.* **52**, 567–577, https://doi.org/10.1016/j.jas.2014.02.022 (2014).
329. Ruan, Q. R. Excavation of the Biesituobie Cemetery in Xinyuan County, Xinjiang, 2010. *Archaeology* **9**, 30–36 (2012).
330. Ruan, Q. R., Wang, Y. Q. & Niyazi, A. Excavation of the Kuokesuxi II Cemetery in Tekes County, Xinjiang. *Archaeology* **9**, 3–16 (2012).
331. Ruan, Q. R. Studies on the discoveries of Andronovo affiliation found in Xinjiang. *China. West. Archaeol.* **7**, 125–154 (2013).
332. Schröder, O. *et al*. Ancient DNA identification of domestic animals used for leather objects in Central Asia during the Bronze Age. *Holocene* **26**, 1722–1729, https://doi.org/10.1177/0959683616641741 (2016).
333. Shang, X. *et al*. The preliminary study of early Neolithic farming in Xiahe site, Shaanxi. *Archaeol. Cult. Relics* **4**, 55–59 (2012).
334. Shelach, G. The earliest Neolithic cultures of northeast China: Recent discoveries and new perspectives on the beginning of agriculture. *J. World Prehist.* **14**, 363–413, https://doi.org/10.1023/A:1011124209079 (2000).
335. Shen, H. *et al*. Wood usage and fire veneration in the Pamir, Xinjiang, 2500 yr BP. *PLoS ONE* **10**, e0134847. https://doi.org/10.1371/journal.pone.0134847.
336. Sheng, P. F. *et al*. North-south patterning of millet agriculture on the Loess Plateau: Late Neolithic adaptations to water stress, NW China. *Holocene* **28**, 1554–1563, https://doi.org/10.1177/0959683618782610 (2018).
337. Sheng, P. F., Zhou, H., Liu, J. Y. & Jiang, H. E. Some like it hot: Sichuan pepper (*Zanthoxylum bungeanum*) and other spices from a late Bronze Age kingdom (Chu State) in Hubei, China. *Archaeol. Anthropol. Sci.* **12**, 249, https://doi.org/10.1007/s12520-020-01201-3 (2020).
338. Sheng, P. F., Shang, X. & Zhang, P. C. An exploration of crop selection by early inhabitants from the Late Longshan period to the Early Xia Dynasty in the Yulin Region. *Archaeol. Cult. Relics* **2**, 114–121 (2020).
339. Sheng, P. F., Storozum, M., Tian, X. H. & Wu, Y. Tian Foodways on the Han dynasty's western frontier: Archeobotanical and isotopic investigations at Shichengzi, Xinjiang, China. *Holocene* **30**, 1174–1185 (2020).
340. Sheng, P. F. *et al*. Feeding Shimao: Archaeobotanical and isotopic investigation into early urbanism (4200-3000 BP) on the northern Loess Plateau, China. *Environ. Archaeol.* **29**, 425–439, https://doi.org/10.1080/14614103.2021.2009995 (2021).
341. Shu, J. W., Wang, W. M., Jiang, L. P. & Takahara, H. Early Neolithic vegetation history, fire regime and human activity at Kuahuqiao, Lower Yangtze River, East China: New and improved insight. *Quat. Int.* **227**, 10–21, https://doi.org/10.1016/j.quaint.2010.04.010 (2010).
342. Si, H. W., Zhang, Y. Y. & Zhang, Y. H. Brief excavation report of the Dingjiacun site in Zhenjiang, Jiangsu Province. *Southeast Cult.* **1**, 39–55 (2017).
343. Song, A. Q. & Dou, H. F. Analysis of plant food composition of human sacrifices in Xitou site, Xunyi County, Shaanxi Province during the late Shang and early Zhou periods: Evidence from starch grains and phytoliths in dental calculus. *Quat. Sci.* **43**, 242–255, https://doi.org/10.11928/j.issn.1001-7410.2023.01.20 (2023).
344. Song, J., Zhou, L. J. & Chen, J. Excavations of Guangfulin site in Songjiang district, Shanghai from 1999 to 2000. *Archaeology* **10**, 32–48 (2002).
345. Song, J. X. *et al*. Farming and multi-resource subsistence in the third and second millennium BC: Archaeobotanical evidence from Karuo. *Archaeol. Anthropol. Sci.* **13**, 47, https://doi.org/10.1007/s12520-021-01281-9 (2021).
346. Song, Y., Wu, X. H., Pan, Y., Liu, G. X. & Wang, M. H. The absolute chronology and related issues of the Dadianzi site. *Archaeology* **12**, 97–106 (2022).
347. Stuiver, M. Yale Natural radiocarbon measurements IX. *Radiocarbon* **11**, 545–658, https://doi.org/10.1017/S0033822200011413 (1969).
348. Su, K., Zhu, C., Sun, B. & Jin, G. Y. A chronology for moat construction and sedimentation at Chengziya–A late Neolithic urban settlement in Eastern China. *J. Archaeol. Sci. Rep.* **29**, 102046, https://doi.org/10.1016/j.jasrep.2019.102046 (2020).

349. Su, B. *et al*. Archaeological discovery and research at Bianbiandong early Neolithic cave site, Shandong, China. *Quat. Int.* **348**, 169–182, https://doi.org/10.1016/j.quaint.2014.06.013 (2018).
350. Sun, C. *et al*. Brief report on 2011 text excavation of Henglanshan site in Daxing Township, Xichang City. *Archaeol. Discov. Chengdu* **2012**, 78–91 (2014).
351. Sun, J. *et al*. Palaeoenvironmental evolution and human activities of Xiawangdu site in Zhejiang Province during the Mid–Late Holocene. *Acta Metall. Sin.* **26**, 209–217, https://doi.org/10.16108/j.issn1006-7493.2019029 (2020).
352. Sun, J. Z. & Zhao, J. B. *Quaternary Geology in the Loess Plateau*. (Science Press, Beijing, 1991).
353. Sun, N. & Li, X. Q. The Quantitative reconstruction of the palaeoclimate between 5200 and 4300 cal yr BP in the Tianshui Basin. *Clim. Past* **8**, 625–636, https://doi.org/10.5194/cp-8-625-2012 (2012).
354. Sun, Z. Recent radiocarbon dates for the Panlongcheng site. *Jianghan Archaeol.* **6**, 103–115 (2020).
355. Sun, Z. Y. The discovery of Pre-Zhou fruits-vegetables storage pit in Zhouyuan site and relational issues. *Archaeology* **10**, 69–75 (2010).
356. Tan, N. & Zhang, T. N. Report on archaeological excavation of Basikalasuxi Cemetery in Zhaosu County. *Cult. Relics Xinjiang* **2**, 75–79 (2014).
357. Tang, G. S., Chen, Y. & Kan, X. H. The excavations of the Houjiazhai site of the Neolithic Age in Dingyuan, Anhui. *Acta Archaeol. Sin.* **1**, 63–108 (2019).
358. Tang, L., Shu, J. W., Chen, J. & Wang, Z. H. Mid- late Holocene vegetation change recorded at a Neolithic site in the Yangtze coastal plain, East China. *Quat. Int.* **519**, 122–130, https://doi.org/10.1016/j.quaint.2018.12.031 (2019).
359. Tang, L. *et al*. Prehistoric agricultural decision making in the western Himalayas: Ecological and social variables. *Antiquity* **96**, 1214–1231, https://doi.org/10.15184/aqy.2022.80 (2022).
360. Tang, L. *et al*. Paleoproteomic evidence reveals dairying supported prehistoric occupation of the highland Tibetan Plateau. *Sci. Adv.* **9**, adf0345, https://doi.org/10.1126/sciadv.adf0345 (2023).
361. Tang, L. Y., Han, K., Ma, M. Z. & Zhao, Z. J. The dispersals of crops: A study on the remains of carbonized plants in the Neolithic age at Longgangsi site in Hanzhong, Shaanxi Province. *Quat. Sci.* **40**, 512–524, https://doi.org/10.11928/j.issn.1001-7410.2020.02.20 (2020).
362. Tang, L. Y., Liu, J. Q., Shan, S. W., Yu, X. Y. & Zhao, Z. J. The identification and study of prehistoric plant remains from the Zoumaling site in Shishou, Hubei. *Jianghan Archaeol.* **3**, 109–115 (2021).
363. Teerbayier *et al*. The excavation of the ancient tombs along the Nilka section of the Dunna highway in Ili Prefecture, Xinjiang. *Archaeology* **12**, 3–20 (2020).
364. Tian, D. *et al*. Barley production in early Xinjiang: Evidence from archaeobotanical remains in the Shirenzigou site, northern Tianshan Mountains. *Agricult. Hist. China* **3**, 44–55 (2021).
365. Tian, D. *et al*. New evidence for supplementary crop production, foddering and fuel use by Bronze Age transhumant pastoralists in the Tianshan Mountains. *Sci. Rep.* **11**, 13718, https://doi.org/10.1038/s41598-021-93090-2 (2021).
366. Tian, D., Ma, J., Wang, J. X. & Zhao, Z. J. Analysis of plant remains of Barkol Shirenzigou site III F1 in Xinjiang. *Archaeol. Cult. Relics* **5**, 121–128 (2022).
367. Tian, D. *et al*. Varying cultivation strategies in eastern Tianshan corresponded to growing pastoral lifeways between 1300 BCE and 300 CE. *Front. Ecol. Evol.* **10**, 966366, https://doi.org/10.3389/fevo.2022.966366 (2022).
368. Tian, D. *et al*. Unveiling the dynamics of millet spread into Xinjiang: New evidence of the timing, pathways, and cultural background. *Agronomy* **13**, 1802 (2023).
369. Tian, H., Huo, D. F. & Song, J. F. Excavation report of Nandaokou site in Dongning City, Heilongjiang. *North. Cult. Relics* **6**, 4–14 (2021).
370. Tian, X. H., Wu, Y. & Niyazi, A. Yuergou and Alagou Cemetery in Urumqi. *Archaeology* **4**, 19–35 (2014).
371. Tong, H. W. *et al*. Mammalian biostratigraphy of Tianyuan Cave, compared with that of Upper Cave at Zhoukoudian. *Acta Anthropol. Sin.* **25**, 68–81 (2006).
372. Tong, J. Y. *et al*. Chronology of the Tianshanbeilu Cemetery in Xinjiang, northwestern China. *Radiocarbon* **63**, 343–356, https://doi.org/10.1017/RDC.2020.96 (2021).
373. Tong, T., Li, L. H., Ciren, C. & Yao, Y. The Gurugyam Cemetery and Chuvthag Cemetery in Ngari Prefecture, Tibet. *Archaeology* **7**, 29–50 (2015).
374. Van Der Woerd, J. *et al*. Uniform postglacial slip-rate along the central 600 km of the Kunlun fault (Tibet), from ^{26}Al, ^{10}Be, and ^{14}C dating of riser offsets, and climatic origin of the regional morphology. *Geophys. J. Int.* **148**, 356–388, https://doi.org/10.1046/j.1365-246x.2002.01556.x (2002).
375. Wang, B. Y. *et al*. Patterns of spread and adoption of millet agriculture along the eastern rim of the Tibetan Plateau: Archaeobotanical evidence from Houzidong, Southwest China (4200–4000 cal. BP). *Archaeol. Res. Asia* **35**, 100448, https://doi.org/10.1016/j.ara.2023.100448 (2023).
376. Wang, C. *et al*. The spatial pattern of farming and factors influencing it during the Peiligang culture period in the middle Yellow River valley, China. *Sci. Bull.* **62**, 1565–1568, https://doi.org/10.1016/j.scib.2017.10.003 (2017).
377. Wang, C. *et al*. Temporal changes of mixed millet and rice agriculture in Neolithic-Bronze Age Central Plain, China: Archaeobotanical evidence from the Zhuzhai site. *Holocene* **28**, 738–754, https://doi.org/10.1177/0959683617744269 (2018).
378. Wang, C. *et al*. The development of Yangshao agriculture and its interaction with social dynamics in the middle Yellow River region, China. *Holocene* **29**, 173–180, https://doi.org/10.1177/0959683618804640 (2019).
379. Wang, C., Xia, Y. P., Yu, H. Y., Pei, Y. & Liu, Q. B. Harvest of the 2015–2017 excavation at Dongtuanshan site in Jilin City. *Jilin Province. North. Cult. Relics* **6**, 36–41 (2022).
380. Wang, C. X. *et al*. A preliminary report on excavation at Shuidonggou Locality 8 in Ningxia Hui Autonomous Region, North China. *Acta Anthropol. Sin.* **34**, 478–491 (2015).
381. Wang, L. Z., Cao, Y. & Zhao, G. G. The excavation of Tanglin site at Xidongting in Changde City, Hunan. *J. Hunan Archaeol.* **15**, 69–85 (2021).
382. Wang, F., Yuan, C. & Yuan, S. L. Radiocarbon dating and diet: The Jiaojia site in China. *Radiocarbon* **62**, 1515–1523, https://doi.org/10.1017/RDC.2020.47 (2020).
383. Wang, H. & Yang, M. Brief report on the test excavation of Caowa site in Haiyuan, Ningxia. *Archaeology* **3**, 206–209 (1990).
384. Wang, H. R. *et al*. Human genetic history on the Tibetan Plateau in the past 5100 years. *Sci. Adv.* **9**, add5582, https://doi.org/10.1126/sciadv.add5582 (2023).
385. Wang, L. J. *et al*. Inner Asian agro-pastoralism as optimal adaptation strategy of Wupu inhabitants (3000–2400 cal BP) in Xinjiang, China. *Holocene* **31**, 203–216, https://doi.org/10.1177/0959683620941139 (2021).
386. Wang, L. Z., Wu, R. J., Zhang, S. X. & Zhang, K. Brief report on investigation, exploration, and excavation of the Qixingdun site in Huarong County, Hunan in 2018. *Archaeology* **2**, 3–19 (2021).
387. Wang, L. Z. Brief report of excavations on the Huacaoping site in Ningxiang City, Hunan Province. *Jianghan Archaeol.* **5**, 50–69 (2021).
388. Wang, Q. Z. *et al*. New archaeomagnetic directions from Late Neolithic sites in Shandong province, China. *Geophys. J. Int.* **232**, 1159–1172, https://doi.org/10.1093/gji/ggac381 (2023).
389. Wang, Q. Z. *et al*. The first discovery of Shang period smelting slags with highly radiogenic lead in Yingcheng and implications for the Shang political economy. *J. Archaeol. Sci.* **149**, 105704, https://doi.org/10.1016/j.jas.2022.105704 (2023).

390. Wang, T. T. *et al*. Tianshanbeilu and the Isotopic Millet Road: Reviewing the late Neolithic/Bronze Age radiation of human millet consumption from north China to Europe. *Natl. Sci. Rev.* **6**, 1024–1039, https://doi.org/10.1093/nsr/nwx015 (2019).
391. Wang, W. *et al*. Human diet and subsistence strategies from the Late Bronze Age to historic times at Goukou, Xinjiang, NW China. *Holocene* **28**, 640–650, https://doi.org/10.1177/0959683617735588 (2018).
392. Wang, W., Duan, F. T., Zhang, J., Nie, Y. & An, C. B. Gender differences in millet consumption in arid Inner Asia during the Iron Age documented by stable isotopes: A case study from Shihuyao, Xinjiang. *Quat. Sci. Rev.* **312**, 108187, https://doi.org/10.1016/j.quascirev.2023.108187 (2023).
393. Wang, X. *et al*. Millet manuring as a driving force for the Late Neolithic agricultural expansion of north China. *Sci. Rep.* **8**, 5552, https://doi.org/10.1038/s41598-018-23315-4 (2018).
394. Wang, X. *et al*. Paleodiet reconstruction of human and animal bones at the Dalujiao cemetery in Early Iron Age Xinjiang, China. *Int. J. Osteoarchaeol.* **32**, 258–266, https://doi.org/10.1002/oa.3060 (2022).
395. Wang, X. C. *et al*. Environmental changes and human activities at a fortified site of the Liangzhu culture in eastern China: Evidence from pollen and charcoal records. *Quat. Int.* **438B**, 189–197, https://doi.org/10.1016/j.quaint.2017.05.001 (2017).
396. Wang, X. K., Wei, J., Chen, Q. J., Tang, Z. W. & Wang, C. X. A preliminary study on the excavation of the Jinsitai cave site. *Acta Anthropol. Sin.* **29**, 15–32 (2010).
397. Wang, X. M., Xie, F., Mei, H. J. & Gao, X. Intensive exploitation of animal resources during Deglacial times in North China: a case study from the Yujiagou site. *Archaeol. Anthropol. Sci.* **11**, 4983–5000, https://doi.org/10.1007/s12520-019-00852-1 (2019).
398. Wang, X. Y. *et al*. Strontium isotope evidence for a highly mobile population on the Pamir Plateau 2500 years ago. *Sci. Rep.* **6**, 35162, https://doi.org/10.1038/srep35162 (2016).
399. Wang, Y. L., Zhou, L. C., Tang, J. Q. & Wu, Y. Brief report on excavation of No.3 and No.7 tombs in Guozishan Cemetery. *Zhangshu City, Jiangxi. Cult. Relics South. China* **2**, 40–50 (2023).
400. Wang, Y. Q. & Tian, X. H. Brief report on the excavation of Baiyanghe cemetery, Tacheng, Xinjiang. *Archaeology* **9**, 17–29 (2012).
401. Wang, Y. Q., Yuan, X. & Ruan, Q. R. Preliminary understanding of Jirentaigoukou site in Nilka County, Xinjiang after the archaeological excavation in 2015–2018. *West. Reg. Stud.* **1**, 133–138 (2019).
402. Wang, Y. Q. *et al*. The rise of urbanism and exchange network: reconstruction of a 4000-year local history of Xinjiang, northwestern China. *Herit. Sci.* **12**, 240, https://doi.org/10.1186/s40494-024-01358-3 (2024).
403. Wang, Y. R. *et al*. New evidence for early human habitation in the Nyingchi Region, Southeast Tibetan Plateau. *Holocene* **31**, 240–246, https://doi.org/10.1177/0959683620970255 (2021).
404. Wang, Y. R. *et al*. Human-animal-environment dynamics and formation of pastoralism in the southern Tibetan Plateau during the Middle-Late Holocene. *Quat. Res.* **114**, 30–51 (2023).
405. Wang, Z. H. *et al*. Relations between the evolution of palaeogeography–palaeoenvironment and the development of ancient cultures at Guangfulin site during the Holocene. In: *Shanghai Museum. Proceedings on the excavation at Guang Fu Lin*. (Shanghai Ancient Books Publishing House, Shanghai, 2014)
406. Wang, Z. K. & Shui, T. Report on excavation of Heshuijiuzhan site in Gansu. *Collect. Stud. Archaeol.* **3**, 300–460 (1997).
407. Wang, Z. L. *et al*. Prehistoric human activity and changes in living environment at Shalongka site, Northeast Tibetan Plateau. *Quat. Sci.* **41**, 201–213, https://doi.org/10.11928/j.issn.1001-7410.2021.01.18 (2021).
408. Wei, W. Y. *et al*. Human planting strategies and its relation to climate change during ~4,800–3,900 BP in the mid-lower Hulu River Valley, northwest China. *Front. Earth Sci.* **11**, 1137528, https://doi.org/10.3389/feart.2023.1137528 (2023).
409. Womack, A. *et al*. The Majiayao to Qijia transition: exploring the intersection of technological and social continuity and change. *Asian Archaeol.* **4**, 95–120, https://doi.org/10.1007/s41826-021-00041-x (2021).
410. Wu, L. *et al*. Prehistoric flood events recorded at the Zhongqiao Neolithic Site in the Jianghan Plain, Central China. *Acta Geogr. Sin.* **70**, 1149–1164 (2015).
411. Wu, L. *et al*. Mid-Holocene palaeoflood events recorded at the Zhongqiao Neolithic cultural site in the Jianghan Plain, middle Yangtze River Valley, China. *Quat. Sci. Rev.* **173**, 145–160, https://doi.org/10.1016/j.quascirev.2017.08.018 (2017).
412. Wu, M. Y., Ge, W. & Chen, Z. S. Diets of a late Neolithic maritime settlement: Carbon and nitrogen stable isotope analysis of human bones from the Tanshishan site. *Acta Anthropol. Sin.* **35**, 246–256 (2016).
413. Wu, S. D. & He, G. Excavation of a Shell-mound site at Songxikou, Chenxi. *Hunan. Cult. Relics* **6**, 4–16 (2001).
414. Wu, W. New thinking on the transmission route of rice agriculture in southeast coast of China during Neolithic Age. *Agricult. Archaeol.* **4**, 62–65 (2018).
415. Wu, W. W., Jin, G. Y. & Wang, X. H. Plant cultivation and the subsistence of Houli culture: Evidence from Zhangmatun site, Jinan city. *Agricult. Hist. China* **2**, 3–13 (2015).
416. Wu, W. W., Si, H. W., Wang, S. M. & Li, Y. J. Preliminary analysis of the carbonized plant remains from the Dingjiacun site in Zhenjiang, Jiangsu Province. *Southeast Cult.* **5**, 78–88 (2017).
417. Wu, X. H. & Wei, X. T. The radiocarbon dating and ages of relational remains of the Nanjiaokou site. In: Institute of Cultural Relics in Henan Province. *Sanmenxia Nanjiaokou*. (Science Press, Beijing, 2009).
418. Wu, X. H. *et al*. The radiocarbon chronology of Zhongba site, Zhongxian, Chongqing. *Archaeology* **7**, 80–91 (2007).
419. Wu, X. H. *et al*. Early pottery at 20,000 years ago in Xianrendong Cave, China. *Science* **336**, 1696–1700, https://doi.org/10.1126/science.1218643 (2012).
420. Wu, X. H., Ran, H. L. & Lei, Y. Radiocarbon dating analysis on K4 Sacrificial pit of Sanxingdui site in Guanghan, Sichuan. *Sichuan Cult. Relics* **2**, 117–120 (2021).
421. Wu, Y. *et al*. Red pigments and Boraginaceae leaves in mortuary ritual of late Neolithic China: A case study of Shengedaliang site. *Microsc. Res. Tech.* **80**, 231–238, https://doi.org/10.1002/jemt.22791 (2016).
422. Wu, Y. *et al*. Dedan Cave: Extending the evidence of the Hoabinhian technocomplex in southwest China. *J. Archaeol. Sci.* **44**, 103524, https://doi.org/10.1016/j.jasrep.2022.103524 (2022).
423. Xia, X. M. *et al*. Analysis of phytoliths from the Wangyangpan site, Yulin, North Shaanxi. *Acta Anthropol. Sci.* **35**, 257–266 (2016).
424. Xia, X. M., Yin, Y. P., Xu, W. H. & Wu, Y. The discovery and discussion of rice remains from the archaeological site of Dongyang, Huaxian County, Shaanxi Province. *Acta Anthropol. Sci.* **38**, 119–131 (2019).
425. Xia, X. M. *et al*. An analysis of agricultural activities in Nanyang Basin during the Pre-Qin period from the plant remains in the Wenkangoudong locality. *Acta Anthropol. Sci.* **41**, 899–912 (2022).
426. Xia, Z. K., Wang, Z. H. & Zhao, Q. C. Extreme flood events and climate change around 3500 a BP in the Central Plains of China. *Sci. China Ser. D* **47**, 599–606, https://doi.org/10.1360/03yd0287 (2004).
427. Xia, Z. K., Zhang, X. H., Chu, X. L. & Zhang, J. N. Discovery and significance of buried paleoearthquake of the early Shang Dynasty (1260–1520 BC) in Xuecun, Xingyang, Henan Province, China. *Chin. Sci. Bull.* **55**, 1186–1192, https://doi.org/10.1007/s11434-009-0141-3 (2010).
428. Xia, Z. K., Zhang, J. N., Liu, J., Zhao, C. H. & Wu, X. H. Analysis of the ecological environment around 10000 a BP in Zhaitang area, Beijing: A case study of the Donghulin Site. *Chin. Sci. Bull.* **57**, 360–369, https://doi.org/10.1007/s11434-011-4772-9 (2012).
429. Xiang, H. *et al*. Early Holocene chicken domestication in northern China. *Proc. Natl. Acad. Sci. U.S.A.* **111**, 17564–17569, https://doi.org/10.1073/pnas.1411882111 (2014).
430. Xiang, H. *et al*. Origin and dispersal of early domestic pigs in northern China. *Sci. Rep.* **7**, 5602, https://doi.org/10.1038/s41598-017-06056-8 (2017).
431. Xiao, M. H. & Wan, Y. Excavation on Mayutian Bronze Age Cemetery in Gejiu City, Yunnan. *Archaeology* **3**, 15–25 (2013).

432. Xiao, Q. Y. *Analysis of carbonized plant remains in Jijiazhuang site, Datong*. (Shanxi University, Taiyuan, 2022).
433. Xinjiang Institute of Cultural Relics and Archaeology. *Xiabandi Cemetery in Xinjiang*. (Cultural Relics Press, Beijing, 2012).
434. Xinjiang Institute of Cultural Relics and Archaeology. *Saensayi Cemetery in Xinjiang*. (Cultural Relics Press, Beijing, 2013).
435. Xinjiang Institute of Cultural Relics and Archaeology. *Mohuchahan Cemetery in Xinjiang*. (Science Press, Beijing, 2016).
436. Xinjiang Institute of Cultural Relics and Archaeology, School of Cultural Heritage, NWU, Hami Bureau of Cultural Relics & Yiwu Administration of Cultural Relics. *Xinjiang Bechir Cemetery: Excavation Report 2004–2005*. (Cultural Relics Press, Beijing, 2020).
437. Xu, B. *et al*. Radiocarbon dating the ancient city of Loulan. *Radiocarbon* **59**, 1215–1226, https://doi.org/10.1017/RDC.2017.21 (2017).
438. Xu, C. & Li, J. Z. The Qiedaoba cemetery of Caiyuancun site in Haiyuan County, Ningxia. *Acta Archaeol. Sin.* **4**, 415–448 (1989).
439. Xu, H. P. *Collected Essays in Commemoration of 60th Anniversary of the Discovery of Liang Zhu Culture*. (Hainan International Press and Publication Center, Haikou, 1996).
440. Xu, J. J., Zhou, J. B. & Gan, H. Y. The 2018–2019 excavation at the Kaizhuang site in Dongtai, Jiangsu Province. *Southeast Cult.* **3**, 20–42 (2021).
441. Xu, J. J. *Mid- to Late Holocene environmental archaeology in Chengdu Plain, China*. (Nanjing University, Nanjing, 2017).
442. Xu, Z. Y. Skim on the Neolithic Cultural site of Jijiatun. *Southeast Cult.* **5**, 297–298 (1990).
443. Xinjiang Uygur Autonomous Region Museum & Xinjiang Institute of Archaeology. *Sampula in Xinjiang of China*. (Xinjiang People's Publishing House, Urumqi, 2001).
444. Xue, Y. N. *et al*. Post-Neolithic broadening of agriculture in Yunnan, China: Archaeobotanical evidence from Haimenkou. *Archaeol. Res. Asia* **30**, 100364, https://doi.org/10.1016/j.ara.2022.100364 (2022).
445. Yan, X., Jiang, M., Zuo, Z. Q. & Bu, Q. Analysis report on plant remains unearthed from Shapingzhan site, Xichang in 2014. *Archaeol. Discov. Chengdu* **2014**, 155–162 (2019).
446. Yang, J. S. *et al*. Sustainable intensification of millet–pig agriculture in Neolithic North China. *Nat. Sustain.* **5**, 780–786, https://doi.org/10.1038/s41893-022-00905-9 (2022).
447. Yang, L. *et al*. How did trans-Eurasian exchanges affect spatial-temporal variation in agricultural patterns during the late prehistoric period in the Yellow River valley (China)? *Holocene* **31**, 247–257, https://doi.org/10.1177/0959683620941140 (2021).
448. Yang, L. *et al*. Asynchronous transformation of cropping patterns from 5800–2200 cal BP on the Southern Loess Plateau, China. *Land* **12**, 343, https://doi.org/10.3390/land12020343 (2023).
449. Yang, L. H. *et al*. The subsistence patterns of Taiyuan Basin during the Longshan Culture Period by carbon and nitrogen stable isotopes analysis of human and animal bones from Xidiannan site, Yangqu County, Shanxi, China. *Quat. Sci.* **43**, 212–226, https://doi.org/10.11928/j.issn.1001-7410.2023.01.18 (2023).
450. Yang, L. P. Discussion on the chronology of Yangguanzhai site and cemetery. *Archaeol. Cult. Relics* **4**, 53–60 (2018).
451. Yang, Q. J. *et al*. Prehistoric agriculture and social structure in the southwestern Tarim Basin: multiproxy analyses at Wupaer. *Sci. Rep.* **10**, 14235, https://doi.org/10.1038/s41598-020-70515-y (2020).
452. Yang, R. P. *et al*. Investigation of cereal remains at the Xiaohe Cemetery in Xinjiang, China. *J. Archaeol. Sci.* **49**, 42–47, https://doi.org/10.1016/j.jas.2014.04.020 (2014).
453. Yang, W., Jiang, Z. L., Yao, H. Y. & Chen, X. X. A study on the agricultural structure of the Shizhaishan Culture in Dian Lake area, Yunnan Province, China: From the perspective of the plant remains at Hebosuo site. *Agricult. Hist. China* **2**, 36–47 (2021).
454. Yang, X. Y. *et al*. New radiocarbon evidence on early rice consumption and farming in South China. *Holocene* **27**, 1045–1051, https://doi.org/10.1177/0959683616678465 (2017).
455. Yang, Y. *The analysis of charred plant seeds at Jinchankou site and Lijiaping site during Qijia culture period in the Hehuang region, China*. (Lanzhou University, Lanzhou, 2014).
456. Yang, Y. S. *et al*. Refined chronology of prehistoric cultures and its implication for re-evaluating human-environment relations in the Hexi Corridor, northwest China. *Sci. China Earth Sci.* **62**, 1578–1590, https://doi.org/10.1007/s11430-018-9375-4 (2019).
457. Yang, Y. S. *et al*. Study on food structure of people in workshop sites of Early Iron Age in northwest China: Case study from jade mine site at Jingbaoer in the region of Mazong Mountains. *Agricult. Hist. China* **4**, 32–44 (2021).
458. Yang, Y. S. *et al*. Shift in subsistence crop dominance from broomcorn millet to foxtail millet around 5500 BP in the western Loess Plateau. *Front. Plant Sci.* **13**, 939340, https://doi.org/10.3389/fpls.2022.939340 (2022).
459. Yang, Y. S. *The transition of human subsistence strategy and its influencing factors during prehistoric times in the Hexi Corridor, northwest China*. (Lanzhou University, Lanzhou, 2017).
460. Yang, Y. Z. *et al*. Characteristics and development of agriculture during Xia and Shang Dynasties based on carbonized plant analysis at the Dongzhao site, Central China. *Acta Anthropol. Sin.* **36**, 119–130 (2017).
461. Yang, Y. Z. *et al*. Phytolith evidence for the prehistoric agriculture development at the Qujialing site in Jingmen, Hubei Province. *Quat. Sci.* **40**, 462–471, https://doi.org/10.3389/10.11928/j.issn.1001-7410.2020.02.16 (2020).
462. Yao, A., Darré, V., Jiang, Z. L., Lam, W. C. & Yang, W. Bridging the time gap in the Bronze Age of Southeast Asia and Southwest China. *Archaeol. Res. Asia* **22**, 100189, https://doi.org/10.1016/j.ara.2020.100189 (2020).
463. Yao, A. Recent developments in the archaeology of southwestern China. *J. Archaeol. Res.* **18**, 203–239, https://doi.org/10.1007/s10814-010-9037-7 (2010).
464. Yasuda, Y. *et al*. Environmental archaeology at the Chengtoushan site, Hunan Province, China, and implications for environmental change and the rise and fall of the Yangtze River civilization. *Quat. Int.* **123–125**, 149–158, https://doi.org/10.1016/j.quaint.2004.02.016 (2004).
465. Yi, M. J. *et al*. A preliminary report on investigations in 2009 of some prehistoric sites in the Tibetan Plateau marginal region. *Acta Anthropol. Sin.* **30**, 124–136 (2011).
466. Yidilisi, Frankfurt, G. D., Liu, G. R. & Zhang, Y. Z. An overview on the archaeological investigation of the Keriya River Basin, Xinjiang. *Archaeology* **12**, 28–37 (1998).
467. Yin, J. S. The excavation of the Qianjiaping Neolithic site in Guiyang County, Hunan. *J. Hunan Archaeol.* **15**, 1–36 (2021).
468. Yonenobu, H. & Itoh, T. ^{14}C dating of the Niya site in the Tarim Basin. *Nucl. Instr. Meth. Phys. Res. B* **172**, 741–744, https://doi.org/10.1016/S0168-583X(00)00400-6 (2000).
469. Yunnan Provincial Institute of Cultural Relics and Archaeology. *Shifodong in Gengma*. (Cultural Relics Press, Beijing, 2010).
470. Yu, C., You, Y., Luo, J. M. & Ruan, Q. R. The Late Bronze Age pastoralist settlement at Halehaxite in the Tianshan Mountains, Xinjiang, China, a zooarchaeological perspective. *J. Archaeol. Sci. Rep.* **45**, 103595, https://doi.org/10.1016/j.jasrep.2022.103595 (2022).
471. Yu, J. J. *et al*. Tongtian Dong site in Jimunai County, Xinjiang. *Archaeology* **7**, 3–14 (2018).
472. Yu, S. Y. *et al*. Extreme flooding of the lower Yellow River near the Northgrippian-Meghalayan boundary: Evidence from the Shilipu archaeological site in southwestern Shandong Province, China. *Geomorphology* **350**, 106878, https://doi.org/10.1016/j.geomorph.2019.106878 (2020).
473. Yu, S. Y. *et al*. Towards a precise timing of groundwater use in the lower Yellow River area during the late Bronze age: Bayesian inference from the radiocarbon ages of ancient water wells at the Liang'ercun site, north China. *Quat. Geochronol.* **66**, 101214, https://doi.org/10.1016/j.quageo.2021.101214 (2021).
474. Yuan, F. Y. *A study of Meishan Culture*. (Wuhan University, Wuhan, 2020).
475. Yuan, R. *Plant macrofossil analysis of Xiaozhao site in Yongji of Shanxi Province*. (Shanxi University, Taiyuan, 2023).
476. Yuan, S. X., Chen, T. M., Wang, L. X., Meng, Q. P. & Ma, L. Carbon-14 dating report (V). *Cult. Relics* **6**, 92–94 (1982).

477. Yuan, S. X., Chen, T. M., Hu, Y. Q., Meng, Q. P. & Ma, L. Carbon-14 dating report (IX). *Cult. Relics* **11**, 89–92 (1987).
478. Yuan, S. X., Chen, T. M., Ma, L. & Meng, Q. P. Carbon-14 dating report (VII). *Cult. Relics* **4**, 89–95 (1994).
479. Yuan, S. X., Zhao, C. H., Zhu, X. D., Yan, J. Z. & Yan, Y. M. Chronology and cultural study of the Shizitan site in Jixian, Shanxi Province. *Archaeology* **6**, 57–62 (1998).
480. Zhang, C. & Hung, H. C. The Neolithic of Southern China–Origin, Development, and Dispersal. *Asian Perspect.* **47**, 299–329 (2008).
481. Zhang, C. R. *et al*. Elite chariots and early horse transport at the Bronze Age burial site of Shijia. *Antiquity* **97**, 636–653, https://doi.org/10.15184/aqy.2023.54 (2023).
482. Zhang, F. *et al*. Hydrological changes and settlement migrations in the Keriya River delta in central Tarim Basin ca. 2.7–1.6 ka BP: Inferred from 14C and OSL chronology. *Sci. China Earth Sci.* **54**, 1971–1980, https://doi.org/10.1007/s11430-011-4206-1 (2011).
483. Zhang, G. L. *et al*. Ancient plant use and palaeoenvironmental analysis at the Gumugou cemetery, Xinjiang, China: implication from desiccated plant remains. *Archaeol. Anthropol. Sci.* **9**, 145–152, https://doi.org/10.1007/s12520-015-0246-3 (2017).
484. Zhang, G. L., Wang, Y. Q., Spate, M., Wang, S. Z. & Jiang, H. E. Investigation of the diverse plant uses at the South Aisikexiaer Cemetery (~2700–2400 years BP) in the Hami Basin of Xinjiang, Northwest China. *Archaeol. Anthropol. Sci.* **11**, 699–711, https://doi.org/10.1007/s12520-017-0563-9 (2019).
485. Zhang, J. *et al*. Research on the charred plant remains from the Diaoyutai site in Bengbu City, Anhui Province. *Quat. Sci.* **38**, 393–405, https://doi.org/10.11928/j.issn.1001-7410.2018.02.11 (2018).
486. Zhang, J. F. *et al*. Optically stimulated luminescence dating of cave deposits at the Xiaogushan prehistoric site, northeastern China. *J. Human. Evol.* **59**, 514–524, https://doi.org/10.1016/j.jhevol.2010.05.008 (2010).
487. Zhang, J. F. *et al*. The Paleolithic site of Longwangchan in the middle Yellow River, China: chronology, paleoenvironment and implications. *J. Archaeol. Sci.* **38**, 1537–1550, https://doi.org/10.1016/j.jas.2011.02.019 (2011).
488. Zhang, J. N., Xia, Z. K. & Zhang, X. H. Research on charred plant remains from the Neolithic to the Bronze Age in Luoyang Basin. *Chin. Sci. Bull.* **59**, 3388–3397, https://doi.org/10.1360/N972013-00022 (2014).
489. Zhang, J. P. *et al*. Phytolith evidence for rice cultivation and spread in Mid-Late Neolithic archaeological sites in central North China. *Boreas* **39**, 592–602, https://doi.org/10.1111/j.1502-3885.2010.00145.x (2010).
490. Zhang, J. P. *et al*. Early mixed farming of millet and rice 7800 years ago in the middle Yellow River region, China. *PLoS ONE* **7**, e52146, https://doi.org/10.1371/journal.pone.0052146 (2012).
491. Zhang, J. Z., Harbottle, G., Wang, C. S. & Kong, Z. C. Oldest playable musical instruments found at Jiahu early Neolithic site in China. *Nature* **401**, 366–368. https://doi.org/10.1038/43865.
492. Zhang, P. & Zhang, T. N. First excavation at the cemetery near the Kizil Reservoir in Baicheng County. *Archaeology* **6**, 14–29 (2002).
493. Zhang, S. S. A brief report of the tentative excavation in Ma'anshan Paleolithic site. *Acta Anthropol. Sin.* **7**, 64–74 (1988).
494. Zhang, T., Zhu, Y. Z., Yang, Y. Z. & Shao, J. AMS-^{14}C dating of the Holocene loess sequence at the Lantian, Shaanxi and reflected environmental change. *J. Desert Res.* **31**, 678–682 (2011).
495. Zhang, X. L. & Shuo, Z. The excavation of the site of the Zhou Dynasty at Daijiayuan in Huoshan County, Anhui. *Acta Archaeol. Sin.* **1**, 125–166 (2016).
496. Zhang, X. L. *et al*. The radiocarbon dating of the Xichengyi site in Zhangye City and a preliminary analysis of the obtained data. *Huaxia Archaeol.* **4**, 38–45 (2015).
497. Zhang, X. L., Pei, S. W., Wu, X. H. & Bar-Yosef, O. Qingshuiyuan Dadong: A newly discovered Late Paleolithic site in Guizhou province, China. *Archaeol. Res. Asia* **9**, 13–21, https://doi.org/10.1016/j.ara.2016.12.002 (2017).
498. Zhang, X. L. *et al*. A preliminary report on the excavation at Qingshuiyuan Dadong (QSYDD) site in Guizhou. *Acta Anthropol. Sin.* **36**, 512–526 (2017).
499. Zhang, Y. *et al*. Zooarchaeological perspectives on the Chinese Early and Late Paleolithic from the Ma'anshan site (Guizhou, South China). *J. Archaeol. Sci.* **37**, 2066–2077, https://doi.org/10.1016/j.jas.2010.03.012 (2020).
500. Zhang, Y. F. *et al*. Holocene environmental changes around Xiaohe Cemetery and its effects on human occupation, Xinjiang, China. *J. Geogr. Sci.* **27**, 752–768, https://doi.org/10.1007/s11442-017-1404-6 (2017).
501. Zhang, Y. P. *et al*. Pastoralism and millet cultivation during the Bronze Age in the temperate steppe region of northern China. *Front. Earth Sci.* **9**, 748327, https://doi.org/10.3389/feart.2021.748327 (2021).
502. Zhang, Y. Z. The Suodunbulake Cemetery in Qapqal County, Xinjiang. *Archaeology* **8**, 17–28 (1999).
503. Zhang, Z. G. & Yao, Y. Main harvest of the excavation at Dongshancun site in Zhangjiagang. *Southeast Cult.* **4**, 28–38 (1999).
504. Zhang, Z. W. *et al*. The importance of localized hunting of diverse animals to early inhabitants of the Eastern Tibetan Plateau at the Neolithic site of Xiaoenda. *Quat. Int.* **529**, 38–46, https://doi.org/10.1016/j.quaint.2019.09.019 (2019).
505. Zhao, C. H. & Wu, X. H. The discovery and dating technique of early Chinese pottery and preliminary discussion on its technology. *J. Ceram.* **4**, 228–234 (2000).
506. Zhao, C. H. The Donghulin prehistoric site in Mentougou District, Beijing. *Archaeology* **7**, 3–8 (2006).
507. Zhao, H. *et al*. Radiocarbon-dating an early minting site: the emergence of standardised coinage in China. *Antiquity* **95**, 1161–1178, https://doi.org/10.15184/aqy.2021.94 (2021).
508. Zhao, J. L. *et al*. Brief report on excavation of Qiaocun I site in Lingtai, Gansu. *Archaeol. Cult. Relics* **2**, 14–25 (2022).
509. Zhao, K. L., Li, X. Q., Shang, X., Zhou, X. Y. & Sun, N. Agricultural characteristics of Middle-late Bronze Age in Western Liaoning Province. *Chin. Bull. Bot.* **44**, 718–724 (2009).
510. Zhao, K. L., Li, X. Q., Zhou, X. Y., Dodson, J. & Ji, M. Impact of agriculture on an oasis landscape during the late Holocene: Palynological evidence from the Xintala site in Xinjiang, NW China. *Quat. Int.* **311**, 81–86, https://doi.org/10.1016/j.quaint.2013.06.035 (2013).
511. Zhao, M., Shen, G. J., He, J. N., Cao, B. & Li, H. C. AMS ^{14}C dating of the hominin archaeological site Chuandong Cave in Guizhou Province, southwestern China. *Quat. Int.* **447**, 102–110, https://doi.org/10.1016/j.quaint.2017.04.037 (2017).
512. Zhao, M. Y., Jiang, H. E. & Grassa, C. J. Archaeobotanical studies of the Yanghai cemetery in Turpan, Xinjiang, China. *Archaeol. Anthropol. Sci.* **11**, 1143–1153, https://doi.org/10.1007/s12520-018-0719-2 (2019).
513. Zhao, Y. F. *et al*. 2016 excavation report from Sunjiagang site in Li County, Hunan. *Jianghan Archaeol.* **3**, 15–40 (2018).
514. Zhao, Z. J. & Chen, J. The results of flotation and analysis of the Yingpanshan site, Maoxian, Sichuan. *Cult. Relics South. China* **3**, 60–67 (2011).
515. Zhao, Z. J. The development of agriculture in the time of Yangshao culture and the establishment of agricultural society: An analysis on the flotation result of Yuhuazhai site. *Jianghan Archaheol.* **6**, 98–108 (2017).
516. Zheng, J. F., Xiao, X. M. & Hua, Y. B. Brief report on excavation of Hebian site in Xifeng County, Liaoning. *North. Cult. Relic* **2**, 16–27 (2023).
517. Zheng, Y. F. *et al*. Rice fields and modes of rice cultivation between 5000 and 2500 BC in east China. *J. Archaeol. Sci.* **36**, 2609–2616, https://doi.org/10.1016/j.jas.2009.09.026 (2009).
518. Zheng, Y. F., Sun, G. P. & Chen, X. G. Response of rice cultivation to fluctuating sea level during the Mid-Holocene. *Chin. Sci. Bull.* **57**, 370–378, https://doi.org/10.1007/s11434-011-4786-3 (2012).
519. Zhong, H., Wang, T., Zhu, G. H. & Yuan, G. K. The primary research of subsistence pattern from the late Beixin culture to early Dawenkou culture period–The flotation analysis of plant remains unearthed from the Helou site, Dingtao, Shandong province. *Cult. Relics South. China* **1**, 164–172 (2021).
520. Zhong, Z. B. & Liu, Z. F. The excavation of the Xiaoqinglong Neolithic site in Tonglu, Zhejiang. *Cult. Relics* **11**, 4–15 (2013).

521. Zhou, R. K., Hu, Y. F., Qian, C. F. & Qian, J. Brief report on excavation of Songze Cultural burial M90 at Dongshancun site in Zhangjiagang City, Jiangsu. *Archaeology* **3**, 3–19 (2015).
522. Zhou, W. J. *et al.* Study on the ancient copper-mining and smelting relic site in Ruichang, Jiangxi by using ^{14}C-AMS. *Geochimica* **5**, 491–494 (2004).
523. Zhou, X. Y. *et al.* Early agricultural development and environmental effects in the Neolithic Longdong basin (eastern Gansu). *Chin. Sci. Bull.* **56**, 762–771, https://doi.org/10.1007/s11434-010-4286-x (2011).
524. Zhou, X. Y. *et al.* Land degradation during the Bronze Age in Hexi Corridor (Gansu, China). *Quat. Int.* **254**, 42–48, https://doi.org/10.1016/j.quaint.2011.06.046 (2012).
525. Zhou, X. Y., Li, X. Q., Dodson, J. & Zhao, K. L. Rapid agricultural transformation in the prehistoric Hexi corridor, China. *Quat. Int.* **426**, 33–41, https://doi.org/10.1016/j.quaint.2016.04.021 (2016).
526. Zhou, X. Y. *et al.* 5,200-year-old cereal grains from the eastern Altai Mountains redate the trans-Eurasian crop exchange. *Nat. Plants* **6**, 78–87, https://doi.org/10.1038/s41477-019-0581-y (2020).
527. Zhou, Z. Brief report on excavation of Shanmenjiao site in Ningyuan County, Hunan. *Cult. Relics South. China* **1**, 24–32 (2006).
528. Zhou, Z. Q. *et al.* Brief report on 2017 investigation of Maanzi site in Huili County. *Archaeol. Discov. Chengdu* **2016**, 79–116 (2018).
529. Zhou, Z. Q., Huang, Y. S., Zuo, Z. Q., Liu, L. H. & Tang, X. Brief report on 2015 investigation of Liantang site in Huili County. *Archaeol. Discov. Chengdu* **2017**, 79–116 (2019).
530. Zhu, C., Song, J., You, K. Y. & Han, H. Y. A study on the causes of cultural faults at the Maqiao site in Shanghai. *Chin. Sci. Bull.* **41**, 148–152 (1996).
531. Zhu, G. P., Liang, J. M., Zhao, Y. Z. & Tian, Y. R. The Dongyuan Neolithic site in Funing County, Jiangsu. *Archaeology* **6**, 7–21, 97–99 (2004).
532. Zhu, G. P., Wang, Q. Z. & Wang, Z. K. Excavation on the Tianmu-Mountain city-site of the Western Zhou period in Jiangyan City, Jiangsu Province. *Acta Archaeol. Sin.* **1**, 129–154, 165–170 (2009).
533. Zhu, J. S. *et al.* The Baigetuobie cemetery: New discovery and human genetic features of Andronovo community's diffusion to the Eastern Tianshan Mountains (1800–1500 BC). *Holocene* **31**, 217–229, https://doi.org/10.1177/0959683620970260 (2021).
534. Zhu, S. Q. *Molecular archaeological study of Equus ovodovi unearthed from three sites in Northern China*. (Jilin University, Changchun, 2020).
535. Zong, Y. B. *et al.* Selection for oil content during soybean domestication revealed by X-Ray tomography of ancient beans. *Sci. Rep.* **7**, 43595, https://doi.org/10.1038/srep43595 (2017).
536. Zou, G. N. *et al.* Geochronology and paleoenvironment of the Taoshan site, northeastern China, and archaeological implications. *Quat. Int.* **463**, 6–17, https://doi.org/10.1016/j.quaint.2017.06.073 (2018).
537. Zou, H. B. *50 years of Jiangsu archaeology*. (Nanjing Press, Nanjing, 2000).
538. Zuo, X. X. *et al.* Dating rice remains through phytolith carbon-14 study reveals domestication at the beginning of the Holocene. *Proc. Natl. Acad. Sci. USA.* **114**, 6486–6491, https://doi.org/10.1073/pnas.1704304114 (2017).
539. Zuo, X. X. *et al.* Microfossil evidence of rice cultivation on the Southeast China Coast 7500 years ago. *Sci. China Earth Sci.* **65**, 2115–2126, https://doi.org/10.1007/s11430-022-9995-3 (2022).
540. Zuo, Z. Q. *et al.* A brief report of the 2015 investigation and excavation of Guijiabao site in Yanyuan County. *Archaeol. Discov. Chengdu* **2015**, 18–52 (2017).
541. Zuo, Z. Q. *et al.* A brief report of the investigation of Dashanbao site in Huidong County. *Archaeol. Discov. Chengdu* **2015**, 448–454 (2017).
542. Zuo, Z. Q. *et al.* A brief report of the investigation of Tuanshanbao site in Huidong County. *Archaeol. Discov. Chengdu* **2015**, 455–465 (2017).
543. Zuo, Z. Q. *et al.* Report on 2014 excavation at Raojiadi site in Huili County. *Archaeol. Discov. Chengdu* **2015**, 53–90 (2017).
544. Bird, D. *et al.* p3k14c, a synthetic global database of archaeological radiocarbon dates. *Sci. Data* **9**, 27, https://doi.org/10.1038/s41597-022-01118-7 (2022).
545. Bronk Ramsey, C. Bayesian analysis of radiocarbon dates. *Radiocarbon* **51**, 337–360, https://doi.org/10.1017/S0033822200033865 (2009).
546. Reimer, P. *et al.* The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). *Radiocarbon* **62**, 725–757, https://doi.org/10.1017/RDC.2020.41 (2020).
547. Qiu, M. H. *et al.* Chronology of early China: A radiocarbon databank for Chinese archaeology [Data set], *Zenodo*, https://doi.org/10.5281/zenodo.17107786 (2025).
548. Xia, N. *The origin of Chinese civilization*. (Cultural Relics Press, Beijing, 1985).
549. Yan, W. M. The diversity and unity of Chinese prehistoric cultures. *Cult. Relics* **3**, 38–50 (1987).
550. Su, B. Q. *A new exploration of the origin of Chinese civilization.* (SDX Joint Publishing Company, Beijing, 2000).
551. Dong, G. H. *et al.* Dispersal of crop-livestock and geographical-temporal variation of subsistence along the Steppe and Silk Roads across Eurasia in prehistory. *Sci. China Earth Sci.* **65**, 1187–1210, https://doi.org/10.1007/s11430-021-9929-x (2022).
552. Renfrew, C. & Liu, B. The emergence of complex society in China: the case of Liangzhu. *Antiquity* **92**, 975–990, https://doi.org/10.15184/aqy.2018.60 (2018).
553. Gao, Y., Dong, G. H., Yang, X. Y. & Chen, F. H. A review on the spread of prehistoric agriculture from southern China to mainland Southeast Asia. *Sci. China Earth Sci.* **63**, 615–625, https://doi.org/10.1007/s11430-019-9552-5 (2020).

Acknowledgements

The research for this article is an output of the Horsepower research project co-funded by European Research Council (ERC) synergy grant (101071707) and UK Research and Innovation (UKRI) (EP/X042332/1). This article is made Open Access through the support of a UKRI Open Access Block Grant.

Author contributions

All authors contributed substantially to the databank and the manuscript. M.Q.: Methodology, Investigation, Formal analysis, Writing–Original Draft, Writing–Review & Editing, Visualization. L.D.: Investigation, Formal analysis, Writing–Original Draft, Writing–Review & Editing, Visualization. R.S.: Methodology, Formal analysis, Writing–Original Draft. Z.Y.: Investigation, Formal analysis. T.Y.: Investigation, Formal analysis. H.C.: Formal analysis. C.G.: Resources, Supervision. R.L.: Conceptualization, Formal analysis, Writing–Original Draft, Writing–Review & Editing, Funding acquisition. G.D.: Resources, Supervision.

Competing interests

The authors declare no competing interests.

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