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Editorial: Human-Environmental Interactions in Prehistoric Periods – Volume II

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Editorial on the Research Topic
Human-Environmental Interactions in Prehistoric Periods – Volume II

The interaction between human evolution and living environment change has been increasingly concerned and discussed in recent decades, with the rapid accumulation of archaeological and paleo-environmental data and the promotion of inter-disciplinary research (Dearing et al., 2006; Dong et al., 2020). Environments provide necessary habitats and resources of living and production for the survival and development of humans and their societies. Meanwhile, humans have gradually adapted to diverse living environments since the migration waves of archaic humans that were driven by climate change (Timmermann and Friedrich, 2016; Timmermann et al., 2022), and humans have begun to influence the natural environment in regional and even global scales at least since the late Neolithic and Bronze Age (Ruddiman et al., 2016; Huang et al., 2017). Overall, the patterns of human-environment interaction varied notably in the prehistoric era, especially during the late Paleolithic, Neolithic, and Bronze periods.

The impact of human activities on the natural environment was variable during the Paleolithic era, while significant climate events generally resulted in ecosystem change which influenced the living space of hunting-gathering groups (Magill et al., 2013; Robinson et al., 2017). Human habitats extensively expanded to high altitude and latitude areas during the late Paleolithic period (Pitulko et al., 2016; Zhang et al., 2018). Foragers improved their adaptability by adjusting their subsistence strategies, such as the so-called "Broad Spectrum Revolution" (Stiner et al., 2000). During the Neolithic and Bronze Ages, substantial climatic and environmental changes were considered essential triggers for the rise and fall of ancient civilizations and cultures (Weiss and Bradley, 2001; Dong et al., 2017). However, the scope and intensity of human colonization in Eurasia during this period far exceeded those in the Paleolithic Age, which was facilitated by the "Agriculture and Neolithic Revolution" and the extensive dispersal of new technologies and ideologies across the Old World (Chen et al., 2015; Frachetti et al., 2017). Farming and herding groups settled in many ecosystems of mid-latitude Eurasia since the late Neolithic period (Liu et al., 2019; Dong et al., 2022) and might have significantly influenced ecosystem and soil dynamics in local and regional scales during the Bronze Age (Zhang et al., 2017; Cheng et al., 2018).

Though significant progress has been achieved focusing on prehistoric human-environment interaction evolution, some important Research Topic remain unclear or debated. For example, how have humans adapted to harsh environments in different geographical conditions and cultural landscapes? Could prehistoric groups respond to the same climate events in other ways? Was the general decline of forest vegetation in the East Asian Monsoon region since the late mid-Holocene primarily triggered by human activities or natural climate change? Have prehistoric groups migrated to build trans-regional exchange or mitigate survival pressure? The twelve case studies in this Research Topic provide valuable new data and perspectives to promote the research on the above mentioned Research Topic.

Recent archaeological studies indicated that northern Xinjiang of northwest China acted as key passageways for the dispersal of modern humans during the late Paleolithic (Li et al., 2020) and trans-Eurasian exchange during the late Neolithic and Bronze Age (Zhou et al., 2020; Qiu et al., 2023). Liu et al. explore the environmental background for prehistoric human occupations in the area based on the application of optically stimulated luminescence dating and analysis of pollen and multiple paleoclimate proxies from a loess-paleosol sequence in the Ili Valley of northwest Xinjiang. The results suggest that the environment was cold and dry with frequent dust storms during ~36–22 ka B.P. Meanwhile, vegetation recovered, and the climate warmed and precipitation increased since ~22 ka B.P. in the area. Yin et al. examine the relationship between geomorphic features and economic strategies of the 127 archaeological sites and cemeteries dated between 3,000–200 BCE in Xinjiang. They propose that humans adopted to different livelihoods to inhabit diverse landscapes in Xinjiang during the Bronze and early Iron Ages. For instance, sites near mountains were more likely to develop a mixed pastoral-hunting economy, and oasis communities of a specific size were more likely to build a mixed agricultural-pastoral economy.

Pollen analysis has also been applied to detect the effects of prehistoric human activities on natural environments. In South China, the influence of human activities on vegetation succession was traced back to ~6,000 BP (Cheng et al., 2018). To investigate the anthropogenic impact on the vegetation cover in the Lower Yangtze region, Deng et al. drill a sediment core from a rice field outside the Luotuodun Neolithic site and conduct radiocarbon dating and palynological and paleoclimatic indexes analysis. Their work suggests that human activities influenced regional marshland landscapes since ~7,500 BP, much earlier than deforestation around 6,500 BP. Based on the simulation of forest vegetation change in the northeastern Qinghai-Tibet Plateau, Wende et al. suggest that forest vegetation roughly expanded from the early Holocene to 6,000 BP and was scarcely disturbed by human activities, while the shrinking trend of forest vegetation during 5,300–2,600 BP was affected by human activities. The significant disturbance of prehistoric humans on vegetation cover in the northeastern Qinghai-Tibet Plateau occurred between 4,000 and 2,600 BP, which was induced by forest resource exploitation related to agricultural development and pastoralism expansion.

The transport networks for massive human migrations and trans-regional exchange in Eurasia during the prehistoric era have been intensively discussed recently (Li et al., 2020; Ma et al., 2022). The Qinghai-Tibet Plateau (QTP) is generally identified as a barrier for human migrations during prehistoric times. Lancuo et al. reconstruct the communication routes for human societies on the QTP from the Neolithic to Bronze Age through high-precision route simulation. They propose that river valleys on the QTP were often chosen as routes to facilitate ancient humans' adaptation to the cold, hypoxia, and gradually increasing altitude promoted by the interaction between agricultural and pastoral groups during the Neolithic and Bronze periods. In the lower reach of the Yangtze River, it is unclear the pathway for ancestors of the Liangzhu culture (5,300–4,200 BP) migrated northward from the Taihu Lake Plain to the Jianghuai region. Xiao et al. suggest the area between Changzhou-Jiangyin-Zhangjiagang should be the best place for Liangzhu groups to cross the Yangtze River. This work also discusses the potential routes based on the comprehensive analysis of archaeological, paleogeographic, and dating datasets in the areas where the Liangzhu sites are scattered.

The studies of prehistoric human strategies in response to significant global climate deterioration events are compelling questions in the research of human-environment interaction. How Paleolithic groups adapted to the harsh environment in arid areas of northwestern China during the cold-dry Younger Dryas event (~12,900–11,700 BP) remains enigmatic due to the absence of archaeobotanical and zooarchaeological data in sites dated to that period. Zheng et al. explore the research topic based on the archaeobotanical analysis in the Pigeon Mountain site location 10. Macro-plant remains from culture layers were dated to ~12,400–12,100 BP. They propose that humans might have utilized wild plant resources, including *Agriophyllum squarrosum* and *Artemisia sieversiana*, in addition to hunting prey in Pigeon Mountain ca. 12,000 to 13,000 years ago. This interesting case study suggests the exploitation of wild plant resources potentially enhanced foragers' adaptability to arid and cold habitats before the dawn of the Neolithic era.

How Neolithic groups responded to the well-known 4.2 ka event at transitional periods between the middle and late Holocene is an intensively debated Research Topic. Zhang and Zhang analyze thousands of document-based data on archaeological sites and compared two pairs of successive cultural types, i.e., the Majiayao (5,300–4,000 BP)-Qijia (4,200–3,600 BP) cultures and the Longshan (4,600–3,900 BP)-Yueshi (3,900–3,500 BP) cultures in both ends of northern China, using the one-way analysis of variance (one-way ANOVA) and standard deviational ellipse (SDE) with its parameters and frequency histogram. They find that the locations of prehistoric settlements for the "inherited" (i.e., the Qijia and Yueshi) cultures became more decentralized on the regional scale. Such a pattern is explained by human resilience (including adaptation and even migration) for pursuing better living conditions in response to the 4.2 ka climate event. Focusing on the same Research Topic, Wei et al. analyze the assemblage of plant remains, grain size, and carbon isotope of millet macro-fossils from two excavated sites that were dated between ~4,800 and 4,400 BP and ~4,200–3,900 BP in the mid-lower Hulu River Valley, western Loess Plateau. They conclude that local Neolithic farmers might have adopted a strategy of expanding cultivated lands to promote social development under a relatively cold-dry climate during ~4,200–3,900 BP rather than improving cultivation management or altering cropping patterns that occurred around 5,500 BP in the same area (Yang et al., 2022; Ma et al., 2023). These studies suggest that Neolithic groups may adopt different strategies to adapt to the same climate deterioration events on local to regional scales, implying human-environment interaction became complicated during the late prehistoric period, which was affected by both natural and social factors, such as spatial differences in geographical environment, and human subsistence strategies.

The spatial-temporal variation of human subsistence strategies during late prehistoric times is a research focus. Zooarchaeological and isotopic analysis serve as essential approaches to reconstruct ancient human livelihoods. Most zooarchaeological studies focused on the variations in the proportions of terrestrial mammal (especially livestock) remains from the Neolithic to Bronze Age. However, how prehistoric humans utilized fish resources has not been well understood. Yu and Cui investigate the relation between the body size and age of modern Chinese sea bass in different regions of coastal China. They provide a empirical analysis to explore the body size and age of Chinese sea bass remains identified from the Guyue Neolithic site in the Pearl River Delta region. Understanding human strategies for using fishery resources in coastal areas of south China during the late Neolithic period is valuable. The spatial patterns of human livelihoods in East Asia changed remarkably compared to the Neolithic era, after the introduction of wheat, barley, sheep/goats, and cattle that were first domesticated in West Asia. Lu et al. obtain and analyze new isotopic data from Bronze sites in the Hengduan Mountain Region of southwestern China, and inferred that humans adopted diverse subsistence strategies in the context of the trans-Eurasia exchange, to adapt the spatial heterogeneity of local environments in the Hengduan Mountian Region during ~2,750 BP–2,450 BP.

Most studies of human subsistence strategy in East Asia are often focused on Neolithic-Bronze Age. Whereas, the variation in livihood for the early historical period is not fully understood. Wang et al. report new zooarchaeological data from the excavation at the Nantou Locale of Xitou site in the Guanzhong region. The results show that pigs were the dominant animal subsistence in the site during ~5,000–2,000 BCE, the importance of cattle and caprines in animal subsistence increased between ~11th and 8th centuries BCE, while pigs became the most important livestock again during the Han-Tang periods (~2nd century BCE -10th century C.E.). The variation of animal resource exploitation strategies in the Guanzhong region from the Neolithic to historical periods was affected by both social and natural factors, which is valuable in understanding the significance of changing animal utilization strategies in human-environment interaction evolution throughout prehistoric and historical periods.

In summary, the 12 case studies in the Research Topic "Human-Environmental Interactions in Prehistoric Periods II" discussed different aspects of prehistoric human-environment interaction in East Asia, spanning from the late Paleolithic, Neolithic, Bronze Age, early Iron Age to historical periods. These works contribute to a better understanding of the trajectories, patterns, and influencing factors of the evolution of human-environment interaction from a long-term perspective. However, the interaction between human activities and their living environment in human history is very complex and varies significantly in both time and space. More interdisciplinary research, especially between archaeology and earth sciences, and the application of new methods (e.g., sedimentary ancient DNA) are crucial to promoting the advancement in this research field in the near future.

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GD: Writing–original draft, Writing–review and editing. HL: Writing–original draft, Writing–review and editing. RL: Writing–original draft, Writing–review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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