Several hundred sites belonging to the period between 7000 and 5000 cal BCE have been identified in China’s northeast and north-central regions.\(^1\) Archaeologists have associated this wealth of sites with the mid-Holocene climatic optimum, as the warm and wet conditions of monsoonal China enabled settlements to flourish.\(^2\) Most sites are situated in mountainous basins or near hills or at the base of mountains.\(^3\) These sites are characterized by structures which could be interpreted as ‘dwellings’, storage pits, burials, and sometimes by ditched enclosures. Pottery vessels and grinding stones are prevalent in this period. Polished stone tools increase in proportion over time, but chipped stones and microliths continue to be found. It has been widely accepted that these settlements and material assemblages represent the initial development of sedentary life in China. Spreading from Daxinganling to the Taihang and Funiu mountains north to south, and from Yitai to the Qinling mountains east to west, these settlements constitute the ‘early Neolithic’ in northern China.

Alongside the use of other plants and animals, many of those early Neolithic sites are believed to have been associated with the cultivation of two types of millet: broomcorn millet (*Panicum miliaceum*) and foxtail millet (*Setaria italica*), referred to as *shu* and *su* in Classical Chinese (see Chapter 12). Collection of small grain grasses, including millet, may be traced back to the terminal Pleistocene (between about 15,000 and 11,500 years ago) and may well have been a part of the broad spectrum subsistence during the upper

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Palaeolithic (which dates from about 40,000 years ago).\(^4\) Turning from the Pleistocene to the early Holocene, it has been suggested on the basis of phytolith and starch residue evidence that broomcorn and foxtail millet were already in use in northern China prior to 7000 BCE.\(^5\) Nonetheless, the most abundant macrofossil evidence of broomcorn and foxtail millet is found in association with the early Neolithic sites post-7000 BCE.

Drawing on typological lineages of ceramics, archaeologists group the early Neolithic sites into a number of types of material culture.\(^6\) These are: the Xinglongwa-Xinle culture in the Xiliao region, the Cishan-Beifudi culture in Hebei, the Houli culture in Shandong, the Peiligang culture in Henan, and the Baijia-Dadiwan culture in eastern Gansu and western Shaanxi. Recent advances using flotation systems in China (see Figure 12.1) have revealed dozens of millet assemblages from sites belonging to all five culture groups.\(^7\)

The sites of the Xinglongwa culture are distributed to the southeast of the Daxinganling mountains, in a hilly area that is often referred to in the literature as Liaoxi region, which is mostly in present-day Chifeng in the Inner Mongolia Autonomous Region. Xinglongwa sites are also found in western Liaoning province and northern Hebei. The culture constitutes an early stage in the prehistoric sequence in Chifeng, where there are at least six local subcultures forming a chronological sequence: Xiaohexi (7000–6200 cal BCE), Xinglongwa (6200–5400 cal BCE), Zhaobaogou (5400–4500 cal BCE), Hongshan (4500–3000 cal BCE), Xiaoyeyan (3000–2400 cal BCE), and lower Xiajadian (2200–1600 cal BCE).\(^8\) About a hundred sites of the Xinglongwa culture have been found and dozens of them have been excavated. Well-known sites include Xinglongwa and Xinglongou in Aohan, Baiyinchanghan in Linxi, Nantaizi in Keshiketeng, and Chahai in Fuxin.\(^9\) Among them, Xinglonggou is the most frequently referenced, on account of its rich materials, structured residential patterns, and important early millet finds.

\(^6\) Liu and Chen, \textit{Archaeology of China}. 7 Liu et al., ‘River valleys and foothills’.
\(^8\) X. Li, Development of Social Complexity in the Liaoxi Area, Northeast China (Oxford: Archaeopress, 2008).
Xinglonggou was discovered in 1982. During the survey of 1998, a joint team from the Institute of Archaeology, Chinese Academy of Social Sciences, and the Aohan Banner Museum, Chifeng, recognized three localities, belonging respectively to the early Neolithic Xinglongwa culture, the middle/late Neolithic Hongshan culture, and the Bronze Age lower Xiajiadian culture. Before the excavation, rows of house plans were discernible on the ground’s surface. These house plans were particularly distinct after ploughing. In total, 145 house plans were identified, all aligned in rows running northeast–southwest. In 2001–3, targeted excavations were conducted, uncovering an area of over 5,600 m² (see Figure 13.1). Excavations revealed house plans from every period of occupation. They can be divided into three phases and three localities (Xinglonggou I, II, and III).

Figure 13.1 Post-excavation plan of Xinglonggou I. Each dot represents a ‘pit structure’.

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Excavations revealed house plans from every period of occupation. They can be divided into three phases and three localities (Xinglonggou I, II, and III).

hereafter). Among the three localities, Xinglonggou I is materially the richest. Abundant debris was found on the ‘floors’, including tools, ornaments, ceramic vessels, potsherds, animal bones, and occasionally human bones. Many materials may indeed relate to agricultural activities and food processing. For example, grinding debris, such as slabs, hand tools, mortars, and pestles, constitute an important part of household activities. There were also large numbers of microliths, used as blades for notched bone knives and fish spears.

A flotation programme at Xinglonggou I yielded more than 1,500 charred grains of broomcorn millet, together with about 20 grains of foxtail millet. Direct radiocarbon analysis indicates that the broomcorn millet dates to c. 7,700 cal BP. It constitutes one of the earliest records of millet in northern China and the oldest directly dated millet so far. Stable isotopic analysis has revealed that early Neolithic humans living at Xinglonggou I consumed millet as their staple food. The following account considers five distinct aspects of Xinglonggou Neolithic lives in association with millet agriculture: landscape, material culture, settlement, production, and consumption. While our ultimate focus is the period of the early Neolithic, we shall introduce this discussion with a consideration of chronological change in the prehistoric ways of life.

Landscape

The three localities of Xinglonggou are all on the left bank of the Mangniu River to the north of the Qilaotu mountains. The early Neolithic settlement, Xinglonggou I, is situated on a sloped loess accumulation on the second terrace of the river (Figure 13.2). The advantage of such a location to early farmers was its spatially constricted but highly productive soils that accumulate in the catchments of springs and seasonal streams. At those locations, until very recently, a small-scale horticultural version of what is generally known as ‘catchment farming’ has largely been practised. As the East Asian monsoon reached its Holocene maximum, the flow of water was

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12 Z. Zhao, ‘Zhiwu kaoguxue ji qin jinzhan (Achievements of palaeoethnobotanical study in China)’, *Kaogu*, 93 (2005), 522–9.
more substantial than today. Vegetation growth was constrained by the seasonality of water flow from springs and streams, favouring annual grasses. The composition of the resulting grassy stands could be modified by selective clearance. This would in particular be true on northern slopes, because on the southern foothills the fluvial dynamic would be higher, favouring deep-rooted perennials. Such a dynamic is still visible today: Figure 13.3 illustrates a northern foothill in Chifeng where two weedy forms of millet, *Setaria viridis* and *Panicum miliaceum var. ruderale*, are flourishing in the uncultivated area alongside the cultivated fields of broomcorn millet and maize.

Xinglonggou I is one of a number of early Neolithic sites in this region situated in such a location: Xinglongwa, Baiyinchanghan, Chahai, and Nantaizi, for example, are all located on the slope of north-facing foothills. This is in contrast to sites of the late Neolithic Hongshan period and the Bronze Age lower Xiajiadian period, which are typically situated closer to the courses of rivers. No early Neolithic sites are found on a flat valley floor, and few are found on the higher mountains far from major rivers. Twelve of the
sites from the Xinglongwa period are located on upland slopes, typically more than 40–50 m above river channels.\textsuperscript{15} It appears that the dynamic between the Holocene hydrological system in Chifeng and the Quaternary loess accumulation is the key to understanding the human occupation systems of different episodes in prehistory. A geoarchaeological study has hypothesized three stages of the development of the Chifeng riverine system in relation to locations of Neolithic and Bronze Age sites.\textsuperscript{16} The initial development of the fluvial system in southern Chifeng dates to between 6000 and 4500 BCE. During this period, the landscape was dominated by loess slopes and loess plains between hills and young rivers. Early Neolithic anthropogenic deposits of the Xinglongwa culture are often situated on top of the Quaternary loess accumulation. As the fluvial system developed, a significant downcutting happened between 4500 and 2000 BCE.


forming the second terrace of the rivers. Many late Neolithic anthropogenic activities of the Hongshan period are found on the alluvial sediments of this terrace, indicating that they are younger than the formation of the terrace. A subsequent downcutting after 2000 BCE formed the first terrace of the rivers. The Bronze Age cultural layers of the lower Xiajiadian period are often found either on the first terrace or on top of the Holocene loess deposits of the second terrace. Although the model is based on the integration of wider geographic surveys, the topographical relations of Xinglonggou I, II, and III are broadly in accord with it. The same topographical preference is observed at a number of other early Neolithic sites across northern China and further resonates with the geographic settings of early agricultural sites in Southwest Asia: in the Jordan valley, for example, Claudio Vita-Finzi observed a similar three-stage development of site locations and noted the ‘geographic opportunism’ of the first farmers there.

Material assemblage

In some respects the early Neolithic communities of China occupying similar topographical locations formed a network, their interconnections demonstrated both by the rare but diagnostic materials like jade that passed between them and by their sharing of a common typology in objects such as pottery vessels and stone tools, as indeed their shared cultural name, the Xinglongwa culture, indicates. Their ceramic vessels are simple in form and dominated by the bucket-shaped pot. They are sand tempered, brownish in colour, and made with the coiling method. Typical decorations on pots consist of belts of net-patterns, zigzag patterns, mat impressions, ‘V’ shape patterns, and point impression zones from top to bottom. The tool assemblage consists of both refined bone tools and stone tools. The former include awls, needles, spoons, and notched knives and notched fish spears embedded with microlithic blades. Stone tools include chipped stone hoes, spades, and knives. There are also a large number of microliths, as blades for notched bone knives and fishing spears. Grinding stones, such as slabs, handstones, mortars, and pestles, constitute an important part of the tool assemblage.

Various studies have explored the functions of the grinding tools and grinding activities at these sites. A physical anthropological study of human
skeletons from Xinglongwa culture sites suggests that young females had deformed knees, probably resulting from prolonged kneeling while using grinding stones.\textsuperscript{21} Residue analyses of grinding stones from Baiyinchanghan and Xinglonggou have revealed that these tools were indeed used for processing plants, including yams, acorn, and many types of grass.\textsuperscript{22}

Xinglonggou has also provided one of the oldest records of jade objects in China (Figure 13.4). There are many types, including slit rings (the most abundant type), scoop-shaped objects, arcs, tubes, axes, adzes, and chisels. The material, colour, and social significance of the Xinglonggou jade have been discussed by numerous authors.\textsuperscript{23} All Xinglonggou jades were made of nephrite, chalcedony, and other soft rock materials.\textsuperscript{24} To make such jade objects, various procedures needed to be performed, including percussion, pecking, grinding, sawing, drilling, scraping, and mirror polishing. Traces left

\begin{enumerate}
\item Liu and Chen, \textit{Archaeology of China}, 130.
\item H. Yang et al., \textit{The Origin of Jades in East Asia: Jades of the Xinglongwa Culture} (Centre for Chinese Archaeology and Art, Chinese University of Hong Kong, 2007).
\item Ibid., 275–98.
\end{enumerate}
on different types of jades indicate that the shape and size of the object affected the choice of technique. Sometimes more than one technique was employed on the same part of the object: the slits of the slit rings, for example, show differences in the processes by which they were cut, with evidence of both string-sawing and blade-sawing.\textsuperscript{25}

In terms of mineral choice for making the ornaments, there appears to have been a colour preference for yellow-green nephrite. More than fifty nephrite jade objects have been recovered from Xinglongwa cultural sites, including many from Xinglonggou, and they are all yellow-green. The choice of this colour is interesting in its distinctness in relation to the colours of local minerals. The latter consist of chalcedony, marble, pyrophyllite, talc, and jasper, materials that were mostly red, black, or white. To date, no nephrite has been found in the Liaoxi region, the nearest nephrite mine being in Xiuyan in Liaoning province, a few hundred miles from Xinglonggou, and its material is yellow-green. It has therefore been suggested that the jades of the Xinglongwa culture were the result of long-distance exchange networks.\textsuperscript{26}

The original colour of the raw material of Xiuyan nephrite, however, would have been hard to recognize, as the cortex is covered with various false colours hiding the jade’s true colour from the collector: it would only have been exposed when the rock was broken up.

Although the preference for green-yellow stone can be traced back to the Palaeolithic in East Asia, scholars have called for caution in automatically assuming that high value was attributed to jade of this colour at Xinglonggou and other Xinglongwa sites. It has been argued that gradations of value were not pronounced during the Xinglongwa period and that the evidence is not strong that the jades themselves were graded in value, whereas in later periods some of the types that exist in Xinglongwa contexts certainly developed into symbolically charged objects.\textsuperscript{27}

Houses, burial, and settlement

The locality of Xinglonggou I is one of the few completely excavated settlements in early Neolithic China with well-preserved settlement plans. As with many sites in northeastern China of the period, Xinglonggou I comprises rectangular pit-based structures. The settlement was divided into three

\textsuperscript{25} Ibid. \textsuperscript{26} Ibid. \textsuperscript{27} R. Flad, ‘Xinglongwa jades and genesis of value in northeast China’, in C. Deng and G. Liu (eds.), The Origins of Chinese Jade Culture: Xinglongwa Jades Research and Catalogue (Chinese University of Hong Kong Press, 2008), 224–34.
different sectors during its early phase of occupation, each with about fifty or fewer pit structures, all aligned in rows. Most Xinglongwa cultural sites are surrounded by a ditched enclosure, yet Xinglonggou itself has no such structure. The 2001–3 excavations exposed 145 of those pit structures over an area of 5,600 m², aligned northeast–southwest in closely packed rows (Figure 13.5).

The ground plans of the pit structures range between 30 and 80 m² in extent. Some studies interpret them as residential dwellings. Others call for caution about intuitive assumptions that house-like structures are invariably habitations and suggest that such structures could have been used for non-domestic purposes such as preparing food, storage, or communal gathering. Each pit structure contained an orderly arrangement of four to six post holes, often laid out symmetrically on the northeast and southwest sides of an

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intermediate hearth. Deer and pig skulls were found in some of the pit structures; some were perforated, arranged in clusters (Figure 13.6), and placed on the ‘floor’.\textsuperscript{30} Excavation also produced artefacts of pottery, stone, jade, bone, tooth, and shell, and ornamental plaques made from human skulls, mostly also placed on the ‘floor’ of the pit structures. Many pit structures contained human burials, a feature known from other Xinglongwa cultural sites, such as Xinglongwa, Baiyinchanghan, and Chahai.\textsuperscript{31} At Xinglonggou I, 28 out of 145 pits yielded burials inside the pit structures.

Although the focus of the excavation between 2001 and 2003 was the early phase of Xinglonggou occupation (Xinglonggou I), excavations were also carried out in 2003 at Xinglonggou II and III.\textsuperscript{32} Xinglonggou II is a late Neolithic settlement of the Hongshan period, and Xinglonggou III is a Bronze Age settlement of the lower Xiajiadian period. Archaeological investigations have primarily focused on the monumental architecture and large cemeteries of those two periods. Up until now we have had only limited

\textsuperscript{30} Liu, ‘Xinglonggou yizhi’.
\textsuperscript{31} G. Liu, ‘Xinglongwa wenhua jushi zangsu zai renshi (Rethinking residential burials of the Xinglongwa culture)’, \textit{Huaxia Kaogu}, 1 (2003), 43–51.
\textsuperscript{32} Liu et al., ‘Excavation at Xinglonggou site between 2002 and 2003’.
knowledge about the settlement patterns of ordinary villages in the Hongshan and lower Xiajiadian periods, and together with other recent studies, Xinglonggou II and III provide an attempt to understand ordinary lives in, respectively, the late Neolithic and Bronze Age.

At Xinglonggou II, excavations exposed four rectangular pit structures and thirty-one storage pits over an area of 1,500 m². The settlement was surrounded by a ditched enclosure. Although the pits are external to the pit structures, it may be assumed that those ‘houses’ owned storage facilities. For example, nine storage pits were found surrounding the ‘house’ F7, and seven were found outside F8. Each ‘house’ has a fireplace in the centre. Excavation produced artefacts of pottery, stone, and shell, mostly from the pits. In a subsequent excavation in 2012, a terracotta statue was recovered (Figure 13.7).

The area excavated at Xinglonggou III is smaller than the other two localities. Three pit structures were recovered from 250 m². The settlement was again surrounded by a ditched enclosure, which has been interpreted by the excavators as a genuinely defensive structure. Among the three pit structures, only F1 was well preserved. On the northeastern side of the ‘house’, a ‘fire channel’ was also recovered, which the excavators interpret as a heating system.

One of the key differences of settlement pattern between the three localities of Xinglonggou is in the relation between houses and storage. As demonstrated by Flannery and Plog, the way storage facilities are distributed within a site and among the domestic structures is a good indication of economic strategies and the type of access people had to economic resources.33 In Xinglonggou I, storage pits were normally located outside pit structures and evenly distributed in each sector, so their contents may well have been shared among members of the community. There is no evidence, however, for the exchange of goods between sectors. Various authors have suggested that the kinds of settlement seen in the Xinglongwa culture were units of landholding, economic production, redistribution, and ceremonial activity.34 Contrasting with Xinglonggou I, Xinglonggou II


probably presents a situation in which households had their own storage facilities, and seems to be akin to what Plog calls ‘restricted sharing’, where resources are shared among members of the household but much less between different households.\textsuperscript{35} If so, ‘restricted sharing’ seemingly intensified in the

\textsuperscript{35} Plog, ‘Agriculture, sedentism, and environment’, 190.
Bronze Age. While the excavation of Xinglonggou III was relatively small in scale, drawing from other recent excavations of lower Xiajiadian settlements it has been proposed that each lower Xiajiadian settlement may have been a sociopolitical unit within an overarching political structure.\(^{36}\) However, each may have had the economic means to sustain itself, with each enclosure within the site representing a family household. Most of those enclosures also have one or two small circular installations built of stone and identified by the excavators as ‘granaries’.\(^{37}\)

The change of settlement pattern in Xinglonggou during its three phases of occupation resonates with that of a number of other sites in northern China. From the early to late Neolithic, villages across northern China experienced a development from shared storage facilities and relatively uniform dwelling size to the formation of large multi-family households. As Peterson and Shelach put it, from the early Neolithic onwards, decisions regarding economic activities were no longer made by the whole residential community, but rather at the household level.\(^{38}\) Such an arrangement is typical of societies in which risk is assumed at the level of the family. By the Bronze Age, people were living in more compact settlements, the internal organization of which suggests an increase in the intensity of inter-household interaction.

In summary, somewhere between the early and late Neolithic, villages in Chifeng appear to have been organized according to ‘restricted sharing’ as defined by Plog, characterized by restricted land tenure and growing privatization of storage. In Flannery’s terms, from Xinglonggou I to II and continuing in Xinglonggou III, there was a shift in risk from the village collective to individual nuclear families. In this context, we can imagine that there was widespread pooling and sharing of food at Xinglonggou I, with an acceptance of risk and reward being shared by the group as a whole, and plant food storage and animal husbandry taking place communally, beyond the secure perimeter of each dwelling space. By contrast, in Xinglonggou II and III


societies display a more ‘closed’ site plan, one which has either widely spaced household units or closed-in eating and storage areas.39

Millet production inside and outside the settlement

How people managed the resources available to them is one of the fundamental issues that every study of an early sedentary community must address. In the following sections we discuss food production and consumption in the context of the social spaces of Xinglonggou I, II, and III, in order to address how staple crops were produced, processed, and distributed among members of the community, and consumed or manipulated to acquire status or wealth.

Although the focus of the flotation programme directed by Zhijun Zhao at Xinglonggou was the early Neolithic occupation of the site, samples were also taken from Xinglonggou II and III, representing the first systematic flotation programme in China. The flotation at Xinglonggou I yielded more than 1,500 charred grains of broomcorn millet (see Figure 12.3), together with about 20 of foxtail millet. The broomcorn millet was directly radiocarbon dated to c. 7,700 cal BP. Both broomcorn and foxtail millet were recovered from Xinglonggou II and III.

As the progenitor of broomcorn millet (Panicum miliaceum) is unknown, our knowledge about how the domesticated form of broomcorn was selected from its wild ancestor is relatively limited. It has been noticed, however, that millet grains from three localities of Xinglonggou show a gradual increase in size and change in shape over time. Zhao has observed that the broomcorn millet from Xinglonggou I is intermediate in caryopsis size and shape between modern domesticated and wild forms, and therefore represents an early stage of domestication.40 On a broader geographic scale, broomcorn millet grains recovered from various sites across northern China also show a gradual increase in size over time.41 This process of morphological change had been associated with the relative increase of foxtail millet and decrease of broomcorn millet in assemblages.

40 Z. Zhao, ‘Cong Xinglonggou yizhi fuxuan jieguo tan Zhongguo beifang zaoqi nongye qiyuan wenti (Addressing the origins of agriculture in North China based on the results of flotation from the Xinglonggou site)’, Dongya Guwu, 12 (2004), 188–99.
41 Liu and Chen, Archaeology of China, 85.
Turning from the remains of the crops themselves to the accompanying plant taxa, millet grains from Xinglonggou I account for only 15 per cent of all grains recovered by flotation. A great quantity of *Cerastium glomeratum* (*Caryophyllaceae*) and *Astragalus* sp. (*Leguminosae*) was identified from Xinglonggou I. More than 50 per cent of seeds identified from Xinglonggou I belong to these two species. *Cerastium glomeratum* is an annual herb widely distributed in China, often appearing on foothill landscapes in northern China. *Amaranthus* spp. (*Amaranthaceae*) and *Chenopodium* spp. (*Chenopodiaceae*) were also common within Xinglonggou I assemblages. All four genera occur as weed infestations of crops today.42 Some nine species of *Amaranthus* and eight species of *Chenopodium* are reported as common weeds. *Chenopodium album* is reported as one of the major weeds infesting the fields of crops in northern China.43 All these species produce edible grains maturing roughly at the same time as millet, suggesting that the field system at Xinglonggou I was quite different from our notion of an agricultural or horticultural field today. In Xinglonggou II, millet accounts for an even lower proportion of all identifiable plant remains. A great number of fruits and nuts were recovered by the flotation, including *Pyrus betulaefolia*, *Prunus armeniaca*, *Quercus* sp., *Corylus heterophylla*, and *Juglans mandshurica*. Contrasting with the patterns of Xinglonggou I and II, in Xinglonggou III crops predominate in flotation samples. Apart from broomcorn and foxtail millet, charred soybean was recovered.

The majority of the carbonized evidence from Xinglonggou I was recovered from houses. An interesting feature of these assemblages and the site in general was the absence of chaff – either free chaff or chaff attached to grains. The grains were all recovered as clean caryopses. This reverses the pattern from later sites in this region, such as Sanzuodian, a large lower Xiajiadian period site contemporaneous with Xinglonggou III. In Sanzuodian, more than 5,500 charred grains of broomcorn millet and about 5,000 foxtail millet grains were identified from 102 samples.44 Millet remains were recovered from almost every house, from floor areas and the space between the two concentric walls of the house. Moreover, there was plentiful evidence for millet chaff, and millet grains were found in association with fragments of lemma and palea of broomcorn millet as well as with fragments of broken millet embryos. Both constitute evidence of the de-husking stage of millet processing.

These differences may reflect changes in the social organization of crop processing. In the Bronze Age lower Xiajiadian period, the routine processing activities took place inside ‘households’, where de-husking was probably carried out in a piecemeal manner. As suggested by ethnographic observations, in such a scenario, both the products and the by-products of those activities have a higher probability of reaching household fires and therefore entering archaeological contexts as charred botanical material. The house structure of this period, consisting of a ‘dwelling’ and ‘granary’ enclosed by narrow stone walls, formed an enclosure within which food was shared between members, with the substantial stone boundaries separating the sharing of food from other ‘households’. In short, there was a boundedness of production and consumption at the family level. By contrast, the crop evidence from Xinglonggou I implies a rather different organization of settlement life, involving the participation and co-operation of a larger community: the grains had been fully threshed beyond these core units, indicating that the processing activities had happened somewhere else beyond the settlement core.

Millet consumption

All species of millet photosynthesize through the Hatch-Slack or C\textsubscript{4} pathway. During photosynthesis, C\textsubscript{4} plants discriminate against atmospheric \textsuperscript{13}CO\textsubscript{2} less than C\textsubscript{3} plants, yielding higher \(\delta^{13}C\) values than C\textsubscript{3} plants (approximate mean values of \(-12.5\)% and \(-26.5\)% respectively), with no overlap. In the northern latitudes of Eurasia the only indigenous domesticated C\textsubscript{4} crops are broomcorn and foxtail millet. The consumption of millet grains consequently generates an isotopically characteristic C\textsubscript{4} signature in human and animal bone collagen. Stable carbon isotopic measurements of human and animal skeletal samples can thus be used to infer levels of millet consumption across space and time.

Systematic isotopic research was carried out in Chifeng. Human and animal skeletal specimens from a range of sites, including Xinglonggou I, II, and III, were selected for isotopic analysis\textsuperscript{45}. The results indicate that substantial millet consumption by humans in Chifeng began at Xinglonggou I. Although the isotopic values do not directly inform us about the domestication process, of which we still have a limited understanding, the significant dietary input of millet in Xinglonggou I indicates that millet was certainly

\textsuperscript{45} Liu et al., ‘Earliest evidence of millet’.

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used as a staple food. Throughout the Neolithic and into the Bronze Age in Chifeng, the proportion of $C_4$ foods in the diet increased. The absence of strongly $C_4$ isotopically labelled animals in the early Neolithic indicates that the $C_4$ signal in humans of that period was not derived from the consumption of animals fed on millet, but from humans directly eating millet. In the Bronze Age, the $C_4$ signal in humans may be interpreted as derived from increased consumption of either millet or animals fed on millet, since the contemporaneous animals also have a $C_4$ signal.

Further reading


