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ORIGINAL ARTICLE

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Human diet and land use in the time of the Khans—Archaeobotanical research in the capital of the Mongolian Empire, Qara Qorum, Mongolia

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Abstract Archaeobotanical investigations at Qara Qorum (Karakorum), Mongolia, reveal information about diet and land use from the 13th to the 15th century A.D. People grew *Panicum miliaceum*, *Hordeum vulgare*, *Triticum aestivum* and *Setaria italica* in nearby irrigated fields but additionally imported all other known cereals, including *Oryza sativa*, in small amounts as well as oil and fibre plants and pulses. The most common oil and fibre plant was *Cannabis sativa*. At least ten species of vegetables and spices such as *Carum carvi*, *Coriandrum sativum*, *Apium graveolens*, *Beta vulgaris*, *Lycium chinense* and *Piper nigrum* were either gathered from the wild, grown locally or imported. Apart from some wild gathered species like *Pinus sibirica* and *Fragaria vesca*, most of the fruits and nuts as for instance *Vitis vinifera*, *Ficus carica*, *Ziziphus jujuba*, *Prunus dulcis*, *P. insititia*, *P. avium* and *P. persica*, *Cucumis melo* and *Juglans regia* must also have been imported from quite long distances. First pollen results from lake Ugii Nuur, 50 km north of Qara Qorum indicate a much earlier beginning of agriculture than in the high and late Medieval.

Keywords Mongolia · High and late medieval · Human diet and land use · Town

Introduction

Qara Qorum (Karakorum) was the capital of the Mongolian empire since its foundation by Čingis Qayan (Genghis Khan) in the early 13th century A.D. (Barkmann 2002). Qara Qorum is situated at 47° 11.63′ N, 102°47.3′ E, 1495 m above sea level where the Orchon river leaves the Changai mountains and widens its valley to a broad plain. The town in the Orchon valley at the north-western border of the Changai mountains, located about 350 km west of Ulan Bataar, covered an area of more than 2 km^2 and was constructed by Chinese craftsmen (Roth 2002) (Fig. 1). Wilhelm von Rubruk, a Franciscan monk, who came to visit Mongolia as an envoy of the French king Louis the Holy, described the town, its people and economy. The town lost its role as the empire's capital A.D. 1264 when Qubilai Qayan became emperor of China and moved the residence to Beijing. During the long-lasting wars after the fall of the Yuan dynasty in China in A.D. 1368, the town was completely destroyed in the early 15th century and never rebuilt. In the 15th century the Buddhist monastery Erdene Zuu, which still exists today, was founded in its direct neighbourhood.

Excavations took place at the site 1948/49 by a Russian/Mongolian team (Kiyselyev et al. 1965), a Japanese survey in 1997 (Shiraishi 2001), and since 1999 by a German/Mongolian team, organized by the Mongolian Academy of Science, the German Archaeological Institute (Kommission für Allgemeine und Vergleichende Archäologie), and by the University of Bonn. The present excavations are situated in the Qayan's palace and in the town-centre where the craftsmen and tradesmen used to live (Roth 2002; Erdenebat and Pohl 2002). The excavation will be continued until 2006. Afterwards, the results will be presented in an exposition when Mongolia celebrates the 800th anniversary of the capital's foundation by Čingis Qayan.

According to common opinion the ancient Mongolians ate mainly meat, sometimes even raw. On the other hand, the quality of the archaeological finds at Qara Qorum, the pottery, the coins, glasswork and porcelain for example, indicate a high state of civilization. Furthermore, Rubruk reports cereals available at the town's market. This fact and the discovery of "celtic fields" near the town in aerial photographs (Roth and Erdenebat 2002, plate 2) were the reasons for botanical investigations.

The climate is continental and semi-arid with short, hot summers, long, very cold dry winters and short transition phases. The annual average temperature is about 0°C, the annual precipitation less than 300 mm. The wettest period is the summer.

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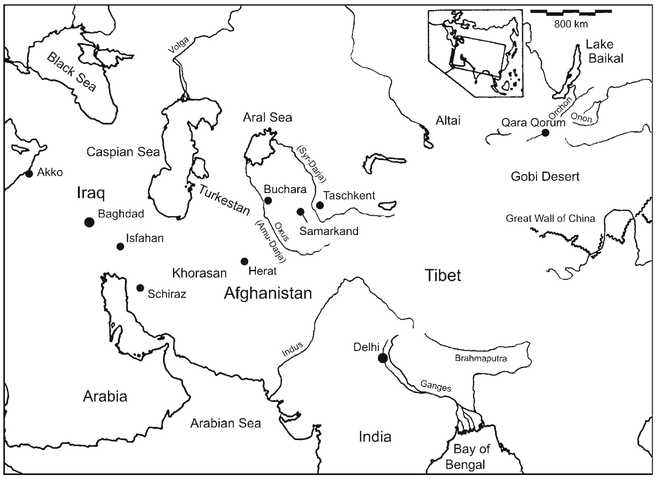

Fig. 1 The geographical position of Qara Qorum, and the main source areas for imported food in eastern and central Asia (from Brent 1976, modified)

The present vegetation is dominated by steppe with *Artemisia* and *Stipa* and by *Larix sibirica* and *Betula platyphylla* woods, especially on the northern slopes of the mountains (Walther and Breckle 1986, 296ff.). The patterns of the woodland-steppe distribution in connection with the partly extremely high grazing pressure and the unregulated wood exploitation suggest that the present vegetation is highly influenced by humans. In particular, much more woodland might be expected under natural climatic conditions. Husbandry is dominated by domestic animals—especially horse, goat and sheep grazing, connected with nomadic or semi-nomadic lifestyle. In some places, however, we could observe un- irrigated arable fields with *Setaria italica*, *Triticum aestivum* or *Panicum miliaceum*. But even in the wet summers 2003 and 2004 the growth of the individual plants was very moderate, they were low and had small ears. In all observed cases we estimated the expected yields to less than 10 dt/ha. To summarize, cereal growing without irrigation has reached its climatic limit here because the annual distribution of precipitation is not favourable and the risk is high since dry years would prevent any yield at all.

Under these circumstances the existence of local cereal production in the medieval period without or with irrigation is a central question of this investigation, as well as the possible import of food plants and the influence of people on vegetation. Therefore, two main questions need to be answered: Did people manage local agriculture without irrigation? Has the present steppe been formed by the climate or by humans and their grazing animals? Present observations of woodland-steppe patterns and grazing support the second hypothesis.

Material and methods

The excavations at the khan' palace up till now have yielded only two soil samples with plant remains. From the excavation in the centre of the city with cultural layers of more than 5 m thickness containing the remains of houses formerly inhabited by craftsmen and tradesmen, about 100 soil samples were collected during the summers of the years 2002–2004. In these samples different distinctive features are represented: Charred layers and the contents of heating channels with a lot of charcoal but with a very low concentration of seeds and fruits; mixed cultural layers with gravel, charcoal, animal bones and charred as well as uncharred plant material; cesspits or similar features with fruitstones and nuts in high concentration; concentrations of charred cereals and other "closed find assemblages" such as pot contents or chaff concentrations with uncharred material, which are often very well preserved by copper salts, to mention the most important feature types.

About 90 of these samples have been, at least partly, studied. The sample size was normally between 10 and 20 l. In special cases, especially when dealing with small features like pot contents and so on, they are naturally smaller. The samples were wet sieved, using the river Orchon water by means of a motor pump and a four-piece sieve set with a diameter of 40 cm and a finest mesh width of 0.5 mm. The sieve residues were wrapped in cloth, dried in the air, and the plant remains sorted using binocular microscopes and 10-fold magnification. As identification help we could only use our European reference collection and the usual literature used in Europe. We started to build up a herbarium and macrofossil reference collection for Mongolia. This is a difficult and long-lasting process. As a further obstacle, the only Flora of Mongolia is in Russian. We used the English translation of the Flora of USSR that covers Mongolia, too. The nomenclature of the scientific names follows Zander (2002).

To our great surprise not only charred, but also uncharred, desiccated plant remains were found in spite of the fact that the site and its soil is not waterlogged, but on the contrary, due to low precipitation, rather dry. The main reason for the preservation of uncharred organic material—wood as well—is the very low soil temperature; in deeper layers this is constant during the year and corresponds to the annual average temperature of about 0°C. These are not suitable conditions for microbial soil activity. Accordingly in the uppermost 2 m, where the soil temperature and water content changes during the year, only charred material is preserved.

Coring for pollen analysis in the Orchon valley was not successful because the fillings of the old Orchon branches consisted of coarse gravel. Pollen analysis of a deep core from the centre of Lake Ugii Nuur (Walther 2002), about 50 km north of Qara Qorum, is in preparation. First results are presented.

Results and discussion

In total nearly 50000 plant remains were identified. The results are summarized in the tables. Table 1 shows presence and abundance of the food plants. The list is not shorter than in most European medieval towns like Köln, Konstanz, Freiburg, Braunschweig or Lüneburg (Knörzer 1987; Küster 1989; Sillmann 2002; Hellwig 1990; Wiethold 1995). At the moment, we can only differentiate between the palace and the town centre. The latter material is from a trench of 30×20 m^2 and dates between the early 13th and late 14th century A.D. A differentiation according to features and settlement phases will be possible when the archaeological analysis is completed. Some plant remains are shown in Fig. 2

In the palace, charred grains of *Hordeum vulgare* and *Triticum aestivum/durum/turgidum* and a charred rachis fragment of *Triticum aestivum* were found. Uncharred remains of *Pinus sibirica*, *Ziziphus jujuba*, *Juglans regia*, *Prunus dulcis*, *Corylus avellana*, *Panicum miliaceum* and

Table 1 Food plants from medieval Qara Qorum; abbreviations: sp: state of preservation, uc: uncarbonised, c: carbonised, mi: mineralised

Taxon cereals	Town					Palace	
	remain	sp	Abundance items	Constancy samples	Constancy %	Abundance items	remarks
Panicum miliaceum	glume	uc	33039	36	40.4	270	locally grown
Panicum miliaceum	caryopsis	c	706	19	21.3		
Panicum miliaceum	spikelet	uc	2029	11	12.4		
Panicum miliaceum	caryopsis	uc	7	4	4.5		
Panicum miliaceum	glume	c	1	1	1.1		
Hordeum vulgare	caryopsis	c	596	40	44.9	9	locally grown
Hordeum vulgare (*hulled*)	caryopsis	c	3635	12	13.5		
Hordeum vulgare (*hulled*)	rachis fragment	c	120	6	6.7		
Hordeum vulgare (*hulled*)	rachis fragment	uc	2	1	1.1		
Hordeum vulgare (*naked*)	rachis fragment	uc	1	1	1.1		
Hordeum vulgare (*naked*)	rachis fragment	c	2	1	1.1		
Hordeum vulgare (*naked*)	caryopsis	c	46	11	12.4		
Triticum aestivum/durum/ turgidum	caryopsis	c	90	22	24.7	5	locally grown
Triticum aestivum/compactum	rachis fragment	c	142	9	10.1	4	
Triticum aestivum/compactum	rachis fragment	uc	2	1	1.1		
Setaria italica	caryopsis	uc	14	7	7.9	1	locally grown
Setaria italica	spikelet	uc	5	3	3.4		
Setaria italica	caryopsis	c	16	8	9		
Setaria italica	glume	uc	1	1	1.1		
Avena sp.	caryopsis	c	7	8	9		imported
Avena sativa	spikelet	c	1	1	1.1		imported
Triticum spelta	caryopsis	c	6	3	3.4		imported
Triticum spelta	glumr base	c	1	1	1.1		
Secale cereale	caryopsis	c	4	4	4.5		imported
Oryza sativa	glume	uc	2	2	2.2		imported
Triticum monococcum	caryopsis	c	2	2	2.2	1	
Triticum dicoccum	caryopsis	c	3	3	3.4		
Triticum aest./dur./turg./spelta	caryopsis	c	1	1	1.1		
Cerealia	spikelet	c	1	1	1.1		
Cerealia	caryopsis	c	39	22	24.7		
Cerealia	stem	uc	1	3	3.4		
Cerealia	stem	c	355	7	7.9		
Oil and fibre plants							
Cannabis sativa	seed	uc	40	11	12.4		locally grown/ wild, gathered
Cannabis sativa	seed	c	1	1	1.1		
Brassica rapa	seed	uc	8	3	3.4	1	
Brassica rapa	seed	c	4	3	3.4		
Camelina cf. sativa	seed	c	6	6	6.7		
Camelina cf. sativa	seed	uc	1	2	2.2	1	
Pulses							
Lens culinaris	seed	c	6	5	5.6		
Pisum sativum	seed	c	3	3	3.4		
Vicia faba	seed	c	1	2	2.2		
Fabaceae (cult.)	seed	c	1	4	4.5		
Vegetables, spices							
Lycium chinense	seed	uc	415	7	7.9		imported
Carum carvi	mericarp	uc	21	7	7.9		wild, gathered
Coriandrum sativum	fruit	uc	2	2	2.2		
Apium graveolens	mericarp	mi	1	1	1.1		
Apium graveolens	mericarp	c	1	1	1.1		
Beta vulgaris	coil	c	1	1	1.1		
Beta vulgaris	seed	uc	1	1	1.1		
Beta vulgaris	seed	c	1	1	1.1		
cf. Petroselinum crispum	mericarp	uc	4	1	1.1		
Foeniculum vulgare	mericarp	uc	1	1	1.1		
Humulus lupulus	seed/fruit	c	1	1	1.1		
Piper nigrum	fruit	c	1	1	1.1		imported
Piper nigrum	fruit	uc	1	1	1.1		imported
Juniperus	seed	uc	1	1	1.1		wild, gathered
Allium	seed	uc	1	1	1.1		
Allium	seed	c	1	1	1.1		
Fruits/nuts, cultivated							
Vitis vinifera	seed	uc	263	31	34.8		imported

Table 1 (continued)

Taxon cereals	Town					Palace	
	remain	sp	Abundance items	Constancy samples	Constancy %	Abundance items	remarks
Vitis vinifera	seed	c	17	2	2.2		
Ficus carica	nutlet	uc	109	11	12.4		imported
Ziziphus jujuba	seed	uc	41	12	13.5	2	imported
Ziziphus jujuba	seed	c	5	5	5.6		
Prunus insititia	fruit	uc	7	4	4.5		imported
Prunus dulcis	fruit	uc	6	6	6.7	1	imported
Cucumis melo	seed	uc	2	2	2.2		imported
Prunus avium	fruitstone	uc	2	2	2.2		imported
Prunus avium	fruitstone	c	1	1	1.1		
Prunus persica	fruitstone	uc	1	1	1.1		imported
Prunus sp.	fruitstone	uc	2	4	4.5		
Prunus sp.	fruitstone	c	1	3	3.4		
Pomoideae	seed	uc	4	3	3.4		imported
Malus/Pyrus	carpel fragment	uc	1	2	2.2		
Pomoideae	seed	c	1	1	1.1		
Pomoideae	carpel fragment	uc	1	1	1.1		
Juglans regia	fruit	uc	1	1	1.1	2	imported
Morus sp.	seed	uc	1	1	1.1		imported
Hibiscus	seed	uc	1	1	1.1		
Physalis alkekengi	seed	uc	3	2	2.2		imported
Fruits/nuts, gathered from the wild							
Pinus sibirica	seed	uc	480	60	67.4	20	
Pinus sibirica	seed	c	33	29	32.6		
Pinus sibirica	cotyledon	c	2	3	3.4		
Fragaria vesca	nutlet	uc	693	19	21.3		
Prunus padus	fruitstone	uc	6	3	3.4		
Sorbus sp.	seed	uc	1	1	1.1		
Sorbus sp.	seed	c	1	1	1.1		

charred remains of *Triticum aestivum/durum/turgidum* and *Hordeum vulgare* from another sample are younger and date back to the 15th century, already the early Buddhist period.

In the town, the most common cereal is *Panicum miliaceum* with a constancy of 40% in the samples for its uncharred glumes. More than three quarters of all plant remains are uncharred *Panicum* glumes. Several pot contents consist mainly of desiccated grain remains of *Panicum*, several uncharred chaff concentrations were found as well as concentrations of charred grains.

The next cereal to mention is *Hordeum vulgare*, present mainly as the hulled form, but also as naked barley (Fig. 2). More than 4000 charred caryopses and also some barley chaff was found. Charred caryopses of *Hordeum vulgare* are much more abundant than those of *Panicum miliacum*, so barley was the most important crop, bearing in mind also that its grains are much bigger.

The third important cereal is *Triticum aestivum* (Fig. 2). Its grains are less common than those of *Hordeum*, but its rachis fragments are more numerous. They allow the identification of hexaploid naked wheat (*Triticum aestivum*). But keeping in mind the huge amount of *Hordeum* grains and the well-known fact that *Hordeum* rachis fragments are rather badly represented in the archaeobotanical record (Maier 2001), we can suggest that barley was of higher economic importance than bread wheat. *Setaria italica* is much rarer, occurring regularly in combination with large amounts of *Panicum miliaceum* (Fig. 2).

All other cereals known in the medieval period of Europe are also present, but rare, as are *Avena sativa*, *Triticum spelta*, *Secale cereale*, *T. monococcum* and *T. dicoccum* (Fig. 2). As last, but perhaps an important cereal, *Oryza sativa* has to be mentioned, only observed in a few uncharred glume fragments (Fig. 2).

The four most common cereals are obligate or preferable spring or summer crops. Winter crop cultivation in Mongolia would be impossible due to low winter temperatures down to –40°C. The occurrence of cereal chaff, straw and grains of these most common cereals in the charred remains from stores, as well as this dominance of summer crops, seems to confirm the hypothesis of local production. On the other hand, traditional Mongolian nomadic people imported cereals as complete plants and did the crop processing themselves, using chaff and straw as fodder or for other purposes even in the 20th century. Therefore the presence of chaff and straw seems to be no sure proof of a producer site as often argued (discussion in Jacomet and Kreuz 1999, pp 146ff.). On the other hand, the "celtic fields" themselves indicate local agrarian production. Therefore we suppose local production of *Panicum miliaceum*, *Hordeum vulgare*, *Triticum aestivum* and *Setaria italica* as summer crops. The rather large size of the grains and the associated weeds—mostly sedges and Chenopodiaceae which indicate wet and fertile

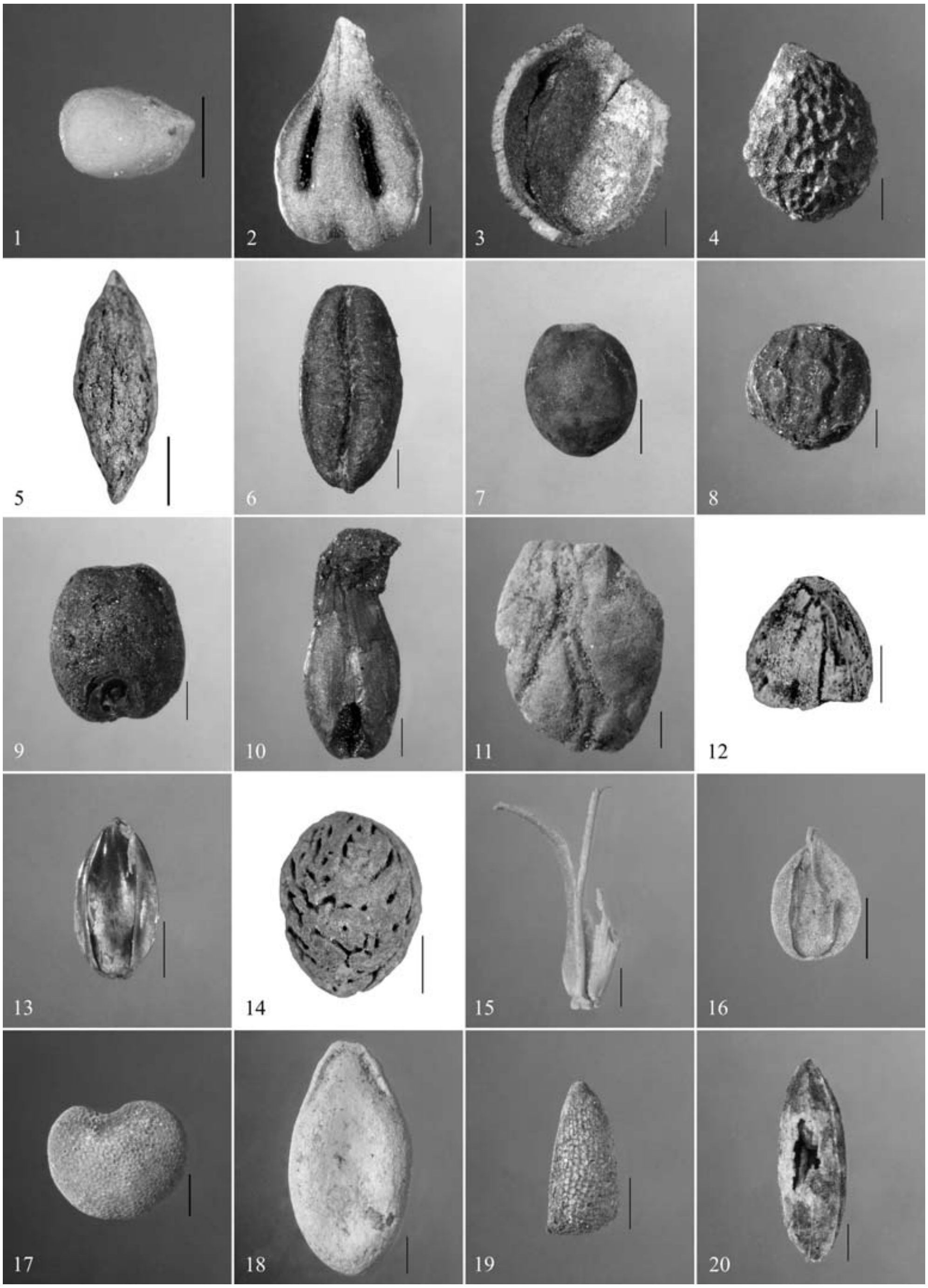

Fig. 2 Fruits and seeds of medieval Qara Qorum: 1, *Ficus carica*, nutlet; 2, *Vitis vinifera*, seed; 3, *Pinus sibirica*, nut-shell fragment; 4, unknown fruit; 5, *Ziziphus jujuba*, seed; 6, *Triticum spelta*, caryopsis; 7, *Cannabis sativa*, seed; 8, *Piper nigrum*, fruit; 9, *Triticum aestivum*, caryopsis; 10, *Hordeum vulgare*, caryopsis; 11, *Juglans regia*, nut-shell fragment; 12, *Prunus dulcis*, fruit fragment; 13, *Panicum miliaceum*, spikelet; 14, *Prunus persica*, fruit; 15, *Oryza sativa*, glume; 16, *Coriandrum sativum*, fruit; 17, *Lycium sinense*, seed; 18, *Cucumis melo*, seed; 19, unknown seed; 20, *Carum carvi*, mericarp; the scale bar is usually 1 mm, for *Ziziphus jujuba, Prunus dulcis* and *P. persica* 5 mm

soils—indicate irrigation and fertilization of the fields. Fertilization with dung of lifestock should have been no problem and water for irrigation was available in the nearby river Orchon. Due to low precipitation and especially the dry winter and spring, even the cultivation of spring and summer cereals is difficult to impossible without irrigation. Therefore it is most probable that the local cereal production was in irrigated fields. It should be possible to find old irrigation channels using archaeological prospection methods. Arable fields with irrigation require a high state of social organisation (cf. Nesbitt and O'Hara 2000).

The other, rarer cereals should have been imported, although only in small quantities, or they grew locally and scattered in wheat and barley fields as "weeds", perhaps because the seed-corn was not pure, but contaminated. *Avena* needs a rather wet climate. *Secale cereale*, *Triticum spelta* und *T. monococcum* are normally grown as winter crops. If these typical crops of medieval Europe were imported, then most probably from central or western Asia or even from Europe, as well as *T. dicoccon*. This cereal, mostly grown as a summer crop, would have been suitable for local cereal production as well. Why it was not chosen is not known. Perhaps because its yields

Table 2 Wild plants from medieval Qara Qorum (selection)

Taxon	sp	Abundance items
Weeds		
Chenopodium album	uc, c	2605
Chenopodium polyspermum	uc	328
Thlaspi arvense	uc, c	141
Portulaca oleracea	uc, c	83
Polygonum convolvulus	uc, c	74
Polygonum aviculare	uc, c	52
Chenopodium glaucum/rubrum	uc	49
Descurainia sophia	uc	26
Thymelaea passerina	uc, c	15
Galium spurium	c	11
Solanum nigrum	uc	8
Setaria verticillata/viridis	uc, c	7
Urtica urens	uc	6
Polygonum lapathifolium	uc, c	5
Polygonum hydropiper	uc	4
Capsella bursa-pastoris	uc	3
Polygonum persicaria	uc	3
Bupleurum rotundifolium	uc	2
Chenopodium hybridum	uc, c	2
Setaria pumila	uc	2
Anagallis arvensis/foemina	uc	1
Anchusa arvensis	uc	1
Lolium temulentum	c	1
Vaccaria pyramidata	uc	1
Ruderals		
Hyoscyamus niger	uc, c	139
Urtica cannabina	uc, c	36
Urtica dioica	uc	3
Galeopsis cf. bifida	uc	1
Foodpath communities		
Lolium perenne	c	4
Potentilla anserina	uc	4
Trifolium repens	c	4
Prunella vulgaris	uc	1
Ranunculus repens	c	1
Grassland, steppe		
Medicago lupulina	c	11
Arenaria serpyllifolia	uc	8
Dwarf shrubs, shrubs, forest		
Juniperus communis	uc, c	4
Pinus sibirica	uc	3
Larix	uc	2
Eurhynchium striatum	uc	1
Mires, water plants		
Eleocharis palustris	uc, c	16
Carex vulpina	uc	10
Carex curta	uc	9
Carex echinata	uc	5
Carex rostrata	uc	3
Bolboschoenus maritimus	uc	2
Carex flava	uc	2
Carex vesicaria	uc	1
Potentilla palustris	uc	1
Ranunculus aquatilis	uc	1
Scirpus lacustris	uc	1

were lower than those of *Hordeum vulgare*, *Triticum aestivum*, and *Panicum miliaceum* under the given conditions, and because its nutrient advantage of a high protein content, was not important for people who had enough meat to consume. *Oryza sativa* can be considered as a Chinese import. The rarity of rice is a little bit striking. On the other hand, rice is also very rare in medieval European towns where it is considered as an indicator of prosperity (Arndt and Wiethold 2001).

Among the oil and fibre plants, only *Cannabis sativa* is more or less common (Fig. 2). This species also occurs today rather frequently and in large amounts in Mongolia, especially on moderately moist soils in valleys where the grazing pressure is not too high. Past or recent usage, for example as a drug, is not known from written or other sources. But the number of identified seeds indicate use. If this medieval use was based on cultivated or wild gathered material and in which way the plant was used is unknown.

The other species, *Camelina sativa* and *Brassica rapa*, are rare. Keeping in mind their normally weak representation, the local cultivation of both of them must be considered as plausible. In the second case the plant was perhaps used as a vegetable (Chinese cabbage).

Also rather rare, compared with European medieval towns, are pulses, *Lens culinaris*, *Pisum sativum* and *Vicia faba*. A possible reason for the low importance of both, oil plants as well as pulses, is the ample supply of animal fat and protein.

Vegetables and spices are, due to the same taphonomic reasons as in European towns, rare (cf. Willerding 1991). Most common is *Carum carvi*, probably wild gathered, as well as *Juniperus*. The others were either grown in gardens or imported, most probably from China. To be mentioned are *Coriandrum sativum*, *Apium graveolens*, *Beta vulgaris*, *Foeniculum vulgare*, *Humulus lupulus*, *Lycium chinense*, an *Allium species*, and perhaps *Petroselinum crispum* (Fig. 2). Surely *Piper nigrum* must have been most certainly imported from southeast Asia.

Among the fruits and nuts imported material prevails, because most perennial fruit trees or shrubs cannot survive in the cold Mongolian winter. Only *Fragaria vesca*, *Prunus padus*, *Sorbus* and *Pinus sibirica* (Fig. 2) can be gathered from the wild, the latter also being imported, since the tree does not occur in Qara Qorum's vicinity but has its nearest stands in the Changei mountains at a distance of about 100 km: This was also the case in the past as *Pinus cembra* type never exceeds 10% in the pollen diagram from Ogii Noor. *P. sibirica* seed shell fragments and *Fragaria* nutlets are the most frequent fruits/nuts.

The most common imported fruits are *Vitis vinifera*, *Ficus carica* and *Ziziphus jujuba* (Fig. 2). Their nearest occurrences are in Turkestan, 3200 km away, Cashmere, 2200 km, northwest India, 2500 km and northern China, 1600 km away. *Prunus insititia* and *P. dulcis* are also not rare (Fig. 2). Their nearest occurrences are in China and central Asia. The other fruits were only found sporadically: *Cucumis melo* and *Prunus avium*, imported probably from central Asia, *P. persica*, *Malus*, *Pyrus*, *Morus*, *Hibiscus*, *Corylus* and *Physalis alkekengi* from China, and *Juglans regia* from the Himalaya region (Fig. 2).

Some common or significant wild plants are presented in Table 2. We must concede that up till now we have not been able to identify all types of wild plants to species or genus level, due to the lack of a complete modern refer-

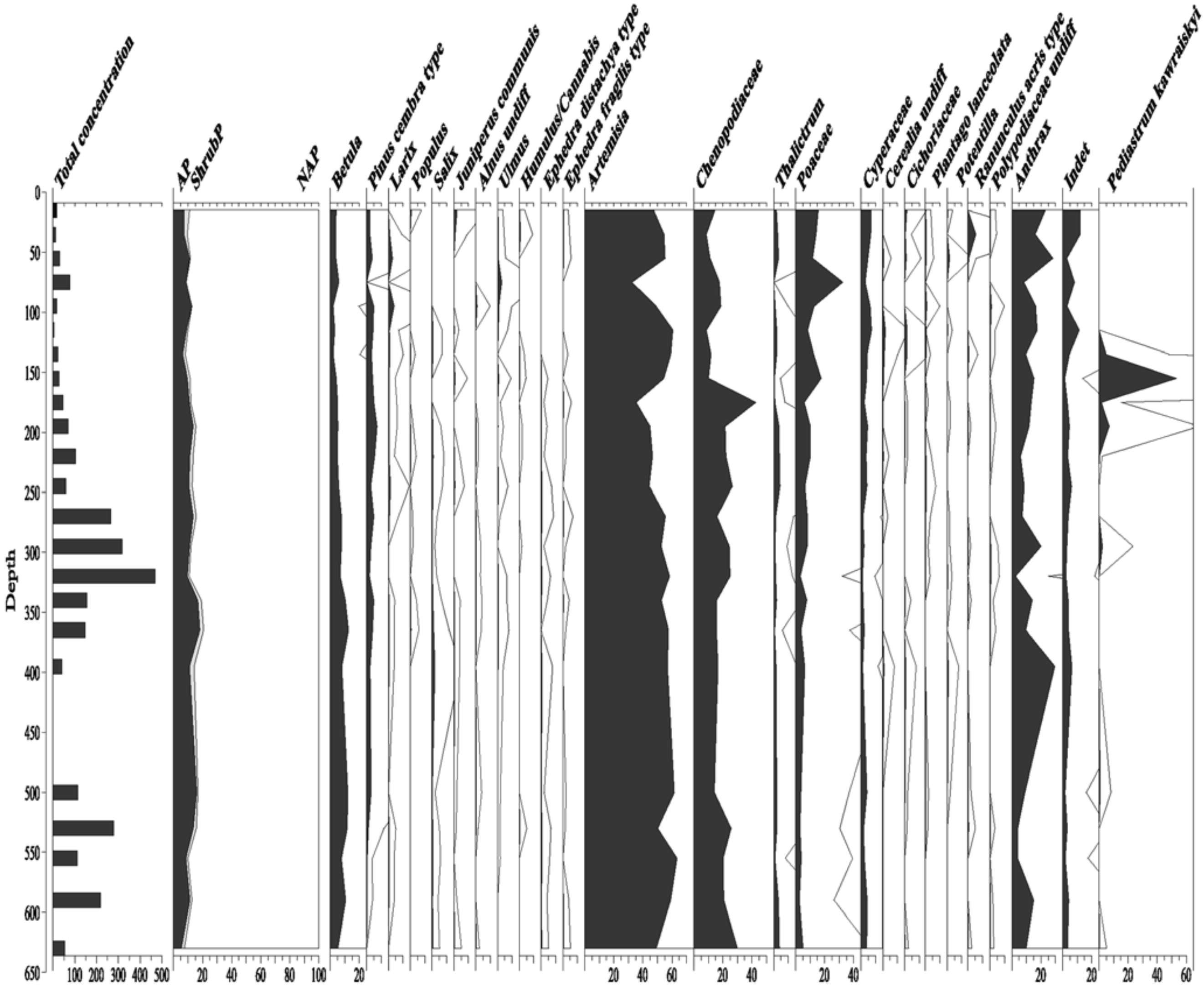

Fig. 3 Pollen percentage diagram from Ugii Nuur; selected taxa, percentage calculation sum all taxa excluding water plants and spores

ence collection. Also some probably useful plants could not be identified (Fig. 2).

The most frequent weeds are *Chenopodium* species (Table 2). Former use can not be excluded. They occur desiccated, charred, but also recent/subrecent as contamination, which is not always easy to distinguish. Well known weeds from the European context are *Bupleurum rotundifolium, Chenopodium hybridum*, *Descurainia sophia, Galium spurium*, *Polygonum aviculare, P. convolvulus*, *Solanum nigrum*, *Thlaspi arvense, Thymelaea passerina*, *Vaccaria pyramidata* and others. The both most frequent ruderals, *Hyoscyamus niger* and *Urtica cannabina*, are also very frequent in the recent vegetation. The species from footpath communities are well known from Europe. Plants from steppe/grassland and from shrubs and woods are weakly represented. More frequent are plants from wet habitats, probably to be situated in the Orchon valley in which the braided river follows several intertwining branches.

From the Ugii Nuur profile, in a distance of about 50 km north of Qara Qorum, the upper 6.5 of 8 m have been analyzed, although with wide sampling distances (Fig. 3). No precise time model exists for this profile because the radiocarbon dates are still in preparation, but we estimate that at least the middle and late Holocene is represented. The bottom of the profile probably is of Lateglacial age (Walther, personal communication). Throughout the whole profile the tree and shrub pollen proportions are only between 10 and 25%. This must not be proof of a very open landscape without or with only few woods because both most frequent herbaceous pollen types, *Artemisia* and Chenopodiaceae, which together always have records of about 75%, are very strong pollen producers, whereas *Larix* as the most frequent tree in the recent vegetation, is very poorly represented in the pollen record (Lang 1994) and has values of less than 2%. *Pinus cembra* type, a rather strong pollen producer, never exceeds 10%. Therefore, *P. sibirica* was never part of the local and regional vegetation. The changes of the AP/NAB relations indicate more woodland towards the middle Holocene, perhaps induced by more precipitation, and a—probably anthropogenic—woodland clearance afterwards. Regular occurrence of grains of the Cerealia type from this first decline of AP onwards (core depth 400 cm) let us suppose that the medieval Mongolians were not the first people to practise agriculture in this region, but that the origins of agriculture in the Mongolian Steppe must be of prehistoric age.

Conclusions

The inhabitants of the medieval Mongolian capital Qara Qorum used many cultivated and to some extent also wild gathered plants as food. Most frequent and abundant were four cereal species, *Panicum miliaceum*, *Hordeum vulgare*, *Triticum aestivum* and *Setaria italica*, probably locally produced as summer crops in fertilized and irrigated fields. Oil and fibre plants as well as pulses were less important because they were partly substituted by meat. More than ten species of vegetables and spices indicate a high gastronomic level. Some of them were probably gathered in the wild, other perhaps grown locally in gardens, but most of them must have been imported. The same holds true for the about 20 species of fruits and nuts, most of which were also found in European towns, but rather rarely and more frequently only in later periods; they are regarded as indicators for a refined lifestyle (van Zeist 1991). Whereas in Europe imported plants came from a distance of normally not more than several hundred km or less, the production sites of the imported plants consumed in Qara Qorum were in China or central Asia to mention the most important areas; that is at distances of 1500–2000 km and more, separated from the consumer site by huge deserts. To surmount such obstacles and distances using horses or camels in order to provide better food requires a similar high state of organization as needed to move huge armies over distances of more than 6000 km which was also managed successfully by the Mongolians in the same period. The ancient town covered an area of more than 2 km^2. The present excavation covers an area of about 1000 m^2, about 0.5 per thousand of the total town area. Whether the results are representative for the whole town, if for example all inhabitants had such rich food, is uncertain. Differences between palace and town and inside the town will be discussed in a more developed state of the investigations.

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