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Impressions of wild cereal chaff in pisé from the 10th millennium uncal B.P. at Jerf el Ahmar and Mureybet: northern Syria

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Abstract. Pisé (daub or building earth) from Jerf el Ahmar and Mureybet was examined and found to contain plant impressions made by the fine fraction of cereal chaff which had been added to the pisé as a tempering medium. Four wild grasses were identified from impressions, while over fifty taxa were identified from charred remains. Chaff tempering was present in all samples examined and was composed of spikelet bases and fragments of spikelets. Several aspects of these findings complement results obtained from charred remains. The sheer quantity of building material with chaff implies that cereals were widely available. De-husking and winnowing appear to have been carried out on a large scale, probably near the site. Firm evidence for wild rye confirms previous identifications for this period in the middle Euphrates, rye being difficult to distinguish from wild einkorn if only grain is available for identification. The quality of the chaff provides some evidence of crop processing.

Key words: Chaff impressions - Early Neolithic - Dehusking - *Secale* - Northern Syria

Introduction

Plant impressions from Near Eastern sites were studied by archaeobotanists before flotation techniques became widespread. Over the last 25 years, charred remains from large-scale flotation have provided a more representative range of results. However the present study presents evidence that plant impressions can provide complementary information.

Jerf el Ahmar is a tenth millennium B.P. pre-pottery Neolithic A (PPNA) village site situated on the Euphrates in northern Syria (Fig. 1, Stordeur et al. 1996). Radiocarbon dates of between 9700 and 9600 uncal B.P. have been obtained. For a preliminary report on the carbonised remains from the 1993 season see Willcox (1996); results from the 1995 season are given in Table 1. The remains from the 1996 and 1997 seasons are under study. Archaeobotanical remains of charred plants from Mureybet are reported by van Zeist and Bakker-Heeres (1984). At present there is no evidence of morphological domestication of cereals at Jerf al Ahmar or Mureybet. Wild barley, which grows in the area today, is the most frequent cereal at Jerf el Ahmar during the tenth millennium. Einkorn is the dominant cereal at Mureybet but is not found in the area today. An assemblage of plants which resemble arable weeds was identified at Jerf al Ahmar, suggesting cultivation. *Amygdalus* sp. (wild almond) and the fruits of *Pistacia atlantica* were common. Palaeo-environmental data indicate more available moisture than occurs at present in the region (Helmer et al. 1998). During the tenth millennium we have little information about crop processing activities or even whether crops were cultivated or gathered.

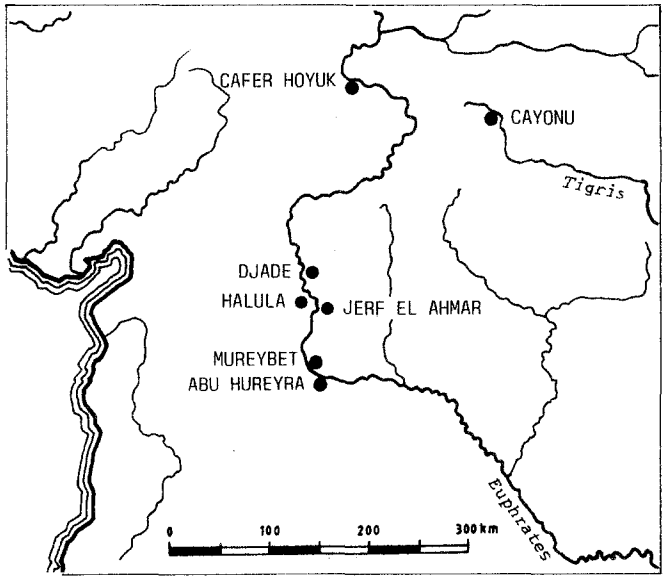

Fig. 1. Site location map showing the major early Neolithic sites in the area

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Table 1. Preliminary results giving absolute numbers of identifications based on carbonised material obtained by flotation from the 1995 season at Jerf el Ahmar, * indicates that the taxon could be part of a weed assemblage; p = presence

	trench	A15	A15	A15	A15	A15	A15	A90	A90	A90	A90	A90	A90
	layers grouped phases	Bx	By	Bz	Cx	CY	sum	BC	Cx	Cy	Ex	Ey	sum
	volume of sediment in litres	95	245	50	200	90	680	230	160	150	150	140	830
	volume of flot in ml	85	80	8	100	310	583	125	45	55	58	320	603
Gramineae	*Hordeum spontaneum* grain	26	94	3	65	48	236	58	49	69	43	25	244
	H. spontaneum rachis	5	4	-	17	40	66	1	2	8	8	5	24
	Triticum/Secale grain	5	9	-	14	18	46	9	14	13	13	9	58
	T. boeoticum/urartu spikelet	1	-	1	-	-	2	-	-	-	-	-	-
	T. boeoticum/urartu glume base	-	1	-	-	-	1	-	-	1	-	-	1
	**Hordeum* type *murinum* grain	14	65	-	13	171	263	20	25	20	332	805	1202
	**H.* type *murinum* spikelet	-	1	-	-	-	1	-	-	-	3	3	6
	H. type *bulbosum* grain	20	-	-	-	18	38	-	-	-	-	94	94
	cf. *H. bulbosum* bulb	-	-	-	1	-	1	-	-	-	-	-	-
	H. bulbosum rachis	-	-	-	1	-	1	-	-	1	-	-	1
	Hordeum sp. fragments	393	504	9	366	346	1618	56	193	343	35	241	868
	**Bromus*	1	6	-	6	4	17	-	-	1	1	2	4
	**Lolium* sp	-	1	-	2	-	3	-	-	-	-	-	-
	Stipa	2	-	-	-	-	2	-	-	-	-	-	-
	Panicoid	-	-	-	1	-	1	-	-	-	-	-	-
	not identified	27	16	3	-	5	51	-	-	-	-	-	-
	rachis not identified	-	-	-	1	-	1	1	-	-	-	-	1
Leguminosae	*Lens* cf. *orientalis*	31	32	3	23	8	97	57	27	28	17	41	170
	Vicia ervilia	-	2	-	1	-	3	3	-	-	-	1	4
	Vicia	-	21	-	-	-	21	-	-	9	-	-	9
	Vicia/Pisum	1	5	-	-	-	6	4	-	-	6	1	11
	*small legumes	33	26	3	7	3	72	1	2	1		3	7
Rosaceae	*Amygdalus* frags.	117	6	2	24	255	404	8	3	18	18	74	121
Anacardiaceae	*Pistacia* frags.	-	-	1	26	18	45	10	10	2	22	9	53
Capparidaceae	*Capparis*	-	-	-	29	16	45	-	-	-	-	13	13
Ranunculaceae	**Adonis*	1	-	-	-	2	3	-	-	-	-	-	-
Polygonaceae		-	-	-	-	-	-	-	1	1	-	1	3
Polygonaceae	**Rumex*	-	-	-	1	4	5	-	-	-	-	-	-
Caryophyllaceae	**Silene*	2	2	-	13	1	18	-	5	4	1	-	10
Rubiaceae	**Galium*	3	3	-	-	1	7	1	1	-	1	1	4
Compositae	**Centaurea* type	-	-	-	-	-	-	1	-	2	-	-	3
Chenopodiaceae	**Chenopod* type	13	1	-	-	-	14	-	-	-	-	-	-
Chenopodiaceae	**Atriplex*	16	5	-	-	-	21	-	-	-	-	-	-
Cruciferae	**Capsella*	-	-	-	2	1	3	-	1	-	-	-	1
Valerianaceae	**Valerianella*	14	1	-	-	-	15	-	-	-	-	-	-
Liliaceae	*Asphodelus*	1	-	-	-	-	1	-	-	-	-	-	-
Papaveraceae	**Glaucium*	-	9	-	-	-	9	-	1	-	-	-	1
Thymelaeaceae		-	-	-	-	-	-	-	1	-	-	-	1
Compositeae		-	-	-	1	-	1	-	-	-	-	-	-
Primulaceae	*Androsace maxima*	-	1	-	1	-	2	-	1	-	-	-	1
Labiatae		-	-	-	-	2	2	-	-	-	-	-	-
Labiatae	*Ziziophora*	1	-	-	-	-	1	-	-	-	-	-	-
Cyperaceae		-	1	-	2	-	3	3	-	1	-	-	4
Cruciferae		-	-	-	2	1	3	-	-	-	-	-	-
Liliaceae	cf. *Asparagus*	-	-	-	-	-	-	-	-	-	-	5	5
seeds	not identified	100	49	3	3	51	206	13	83	41	40	35	212
Boraginaceae	**Arnebia/Lithospernum*	p	p	p	p	p	-	p	p	-	p	-	-
	? processed food residues	-	-	p	p	p	-	-	p	-	p	-	-

Both sites are villages consisting of what have been interpreted as houses and storage structures. A variety of architectural forms were recorded. The sites represent a transition phase between round and rectangular architecture. Chalk blocks were used for the lower part of the walls and foundations. Pisé (daub, building earth) with wood reinforcement was used for the upper part of the walls and the roofs (for a reconstruction see Cauvin 1994). All pisé examined was densely tempered with chaff, presumably to stop cracking during drying and to increase its strength.

Materials and Methods

At Jerf el Ahmar several hundred fragments of pisé from a range of contexts were fractured in the field and examined using a binocular microscope (X10-X40). All pisé samples examined were found to have densely packed impressions of

chaff, but only a few were identifiable to species. The chaff had decomposed and in some cases a silica skeleton outlining cells in connection could be seen as a white film. Some of the pisé had been subjected to fire, leading to charring of the chaff with excellent preservation of normally very fragile plant parts. In general, fractures only rarely revealed well-preserved and well-oriented impressions with suitable criteria for determination. In these cases casts were made using dental silicone rubber (Silaflo) (see Fig. 2). No attempt was made to quantify the results because frequencies would relate more to the hazards of sampling and fracturing rather than the plant economy, and carbonised remains provide a more reliable record. However the ratio of einkorn to rye remains problematic (see below).

Results

At Jerf al Ahmar 38 different archaeological contexts were examined by means of several hundred fresh fractures in the pisé excavated from the site. All the material examined in this way contained chaff temper, and 44 fractures with clearly identifiable plant material were chosen to be reproduced in the form of silicone casts. These came from 19 different contexts. However we did not register frequencies because many of the impressions were not identifiable and the fragmentation of the remains and method of sampling could seriously bias the results. Nevertheless, the temper in the building material was found to consist exclusively of cereal chaff, despite the large quantities which were examined. Four taxa were identified from intact spikelets and grains: *Triticum boeoticum/urartu* (wild einkorn), *Secale* sp. (wild rye), *Hordeum spontaneum* (wild barley) and *H. murinum* type, a small-seeded wild barley. No other plants such as pulses or field weeds were identified. Most impressions were of fragmented spikelet parts which resulted in part from de-husking by pounding but also further fragmentation resulted from fracturing during examination. However it was clear that impressions were made essentially from fragments of spikelet bases, awns, grains, glumes and lemmas. Stem and leaf material was very rarely encountered. Thus it would appear that the light fraction obtained during de-husking was used rather than the chaff from the primary threshing, which would have contained high proportions of stems, culms, leaves and stem bases.

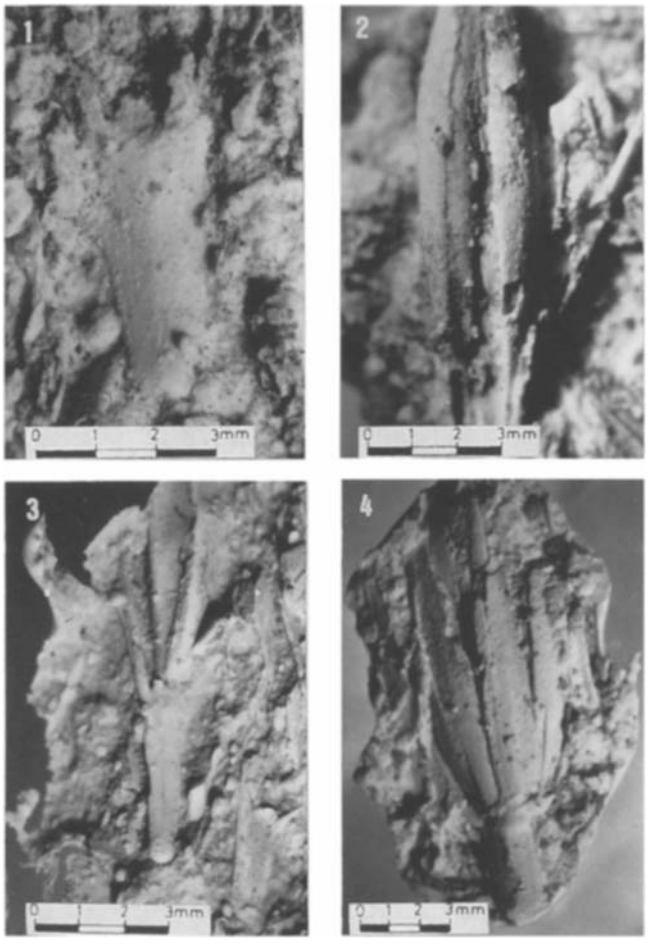

Fig. 2. Photographs of silicone casts taken from impressions found in the pisé at Jerf el Ahmar: **1** Rachis fragment of threshed wild barley *Hordeum spontaneum*; **2** Cast of *H. spontaneum* grain; **3** Spikelet of small wild barley (*H. murinum);* **4** Spikelet of *Secale* sp. (keels of lemmas not visible)

No estimation of the frequencies was attempted, however at Jerf al Ahmar spikelet bases of *Hordeum spontaneum* (Fig 2,1) appeared to be the most commonly encountered impression. In addition, whole detached grains were also found (Fig. 2,2) indicating that winnowing was not always effective. *Hordeum murinum* type spikelet bases were also present (Fig. 2,3) indicating that this taxon formed part of the harvest as did *Triticum boeoticum/urartu.* Only a single impression of a rye spikelet showed the pectinate-ciliate keel of the lemma. However another impression where the keels were not visible also appears to be rye (Fig. 2,4).

Sampling from Mureybet was more restricted and was taken from samples of pisé architecture which had been brought to France. They came from a single house (maison XVLII phase IIIA see Cauvin 1994, p 63, Fig. 15) which was dated to the tenth millennium and destroyed by fire. The sampling is therefore less representative than at Jerf al Ahmar. Some samples upon fracturing were found to contain complete carbonised spikelets which had not been de-husked and were trapped in the burnt pisé, being preserved in their entirety because they were protected by the fire hardened pisé which enclosed them. Three taxa were identified in this charred form *Secale* (Fig. 3, 1-3), *Hordeum murinum* type and *H. spontaneum.* Of particular interest was the confirmation of the presence of a wild rye already reported by Hillman for the middle Euphrates (Hillman 1989 and Hillman et al. 1993). His findings were based on grains and on biochemical markers. The results from the Mureybet and Jerf el Ahmar pisé impressions provide reliable morphological evidence of rye. The spikelets exhibit pectinate-ciliate keels characteristic of rye lemmas (Fig. 3, 1-2) and not present in other grasses. The carbonised grains obtained from within the rye spikelets (Fig. 3,3) from Mureybet compare well with Hillman's description of rye grains. Grains from Mureybet which were subject to biochemical analysis also suggested the presence of rye (Hillman et al. 1993). On the bases of our findings no species identification has been attempted at this stage, but the possible species are *Secale montanum, S. cereale* ssp. *vavilovii* and *S.*

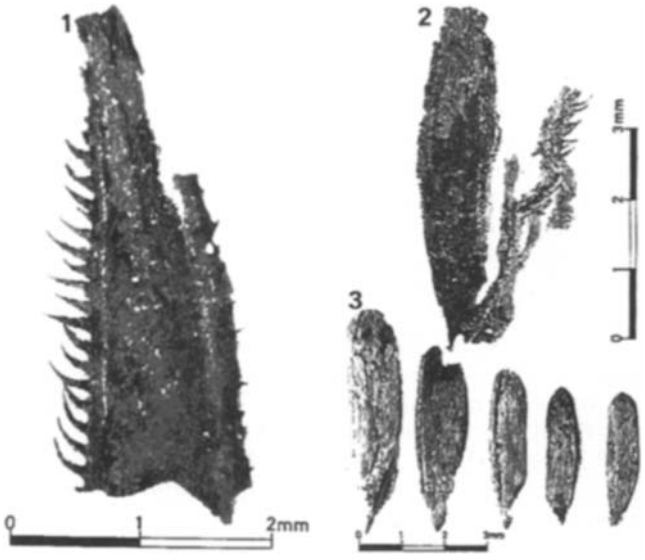

Fig. 3. Remains of rye from Mureybet. **1** fragment of carbonised lemma of rye (*Secale* sp.) with characteristic pectinate-ciliate keel from Mureybet phase IIIa. This exceptional preservation results from carbonisation of spikelets trapped in the pisé; **2** fragmented rye spikelet with grain attached from Mureybet (digital image); **3** Carbonised grains associated with rye spikelets found trapped in burnt pisé from Mureybet (digital image)

ciliatoglume (Davis 1985). The *S. montanum* is the most widespread. It is a perennial which grows at an altitude above 800m on both limestone and acid soils, while the other species are restricted to higher altitudes and acid soils. The presence of rye on Euphrates sites during the tenth and eleventh millennia B.P. would appear to indicate cooler and moister climatic conditions.

Discussion

In terms of the presence of cereals at Jerf el Ahmar and Mureybet, the study of chaff impressions has confirmed identifications made from carbonised material. This was particularly important in the case of rye. We cannot give a species identification for the rye. Indeed at present it is well outside the natural distribution of known species. Its presence in the middle Euphrates during the tenth millennium B.P. indicates that climatic conditions were cooler and/or moister than today. This would have led to a decrease in the altitude of vegetation zones compared with today's altitude limits.

On a more general level the presence of charred remains in pisé suggests that if flotation samples from sites contain fragments of burnt pisé then some charred remains could originate from the pisé. This would be more probable if samples were obtained from destruction levels. Rye was not identified from flotation samples at the two sites. At Mureybet (van Zeist and Bakker-Heeres 1984) the possible confusion between rye and einkorn had not been considered at the time the analyses were carried out and at Jerf el Ahmar we did not attempt to separate rye and einkorn from the carbonised grains. We thus used the taxon *Triticum/Secale*. Further spikelet bases were rare. However rye may be present among the carbonised grains recovered from flotation at both sites

Because of the ubiquitous use of chaff tempering in construction material at Jerf el Ahmar it appears that the chaff was available on a large scale for this purpose. We may also conclude that large quantities were stored in sheltered dry places until they were needed for building purposes, including repairs or maintenance such as fresh layers of rendering. This implies that crop processing took place near the site. It is not possible to determine at what intervals de-husking could have taken place. It could have been on a day-to-day basis or at particular seasons. The fragmentary nature of the chaff implies pounding, although some spikelets remained intact. The presence of whole grains indicates that winnowing was not always efficient. However the apparent absence of other plants (weeds?) indicates that the crop was clean prior to de-husking. Thus these findings, particularly those from Jerf el Ahmar, highlight the importance of cereals in the subsistence economy.

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