[Supplementary material]

The agroecology of an early state: new results from Hattusha

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Sub-sampling

Bulk archaeobotanical samples from the silo were initially taken from each of the five excavated chambers. Each chamber was divided up using a grid system and samples were taken from each approximately 1 × 0.5m of the grid as a means of assessing compositional heterogeneity across each chamber. Additionally, each chamber was excavated using a number of arbitrary spits (approximately 0.2m in depth), and samples were taken from all levels to explore any variation by depth within each chamber (Diffey *et al*. 2017). In total four tonnes of charred material were removed from the five chambers. From these four tonnes of material, about 50kg of the best preserved samples were eventually selected for export to the Deutsches Archäologisches Institut in Berlin. This material provided both a vertical and horizontal cross-section of all five chambers wherever possible. See Table S1 for a list of samples by chamber.

Table S1. **Number of samples by chamber.**

Chamber	**No. of samples**
12	12
28	1
29	7
30	19
32	6
Total	**45**

Crop stable isotope methodology

Crop carbon isotope ($\delta^{13}C$) values reflect plant water availability due to the fractionation of carbon during photosynthesis. During this process the heavier ^{13}C isotope is discriminated against relative to atmospheric carbon dioxide (CO_2). The extent of this discrimination is closely related to plant water stress. During periods of adequate water availability the stomata on plant leaves will be open, allowing the transpiration of water and the assimilation of carbon dioxide. During periods of water stress, stomata will close to prevent water loss and ^{13}C discrimination will not occur. Measurement of $\delta^{13}C$ values can, therefore, be used as a proxy for water availability during plant growth. The concentration of atmospheric CO_2 has, however, fluctuated throughout history and this must be taken into account during stable isotope analysis. For this reason $\delta^{13}C$ values are converted into $\Delta^{13}C$ which reflect the carbon discrimination independent of atmospheric CO_2 concentrations (Farquhar *et al*. 1982; Wallace *et al*. 2013). Similarly, crop nitrogen isotope ($\delta^{15}N$) values primarily reflect the $\delta^{15}N$ values of the soil. This value can be affected by a number of factors (e.g. waterlogging, salinity), but a major influence in arable habitats is the use of manure (Bogaard *et al*. 2007; Fraser *et al*. 2011). Manuring leads to the enrichment of the heavier nitrogen isotope (^{15}N) in the soil, as the lighter isotope (^{14}N) is volatised into the air as ammonia. The ammonium still present within the soil is then converted into nitrates which are used by crops, enriching them in $\delta^{15}N$ also (Heaton 1987).

Stable isotope analysis was conducted using a Sercon EA-GSL mass spectrometer at the Research Laboratory for Art History and Archaeology, University of Oxford. Values were measured with reference to certain international standards and were calibrated using an internal alanine standard. For the $\delta^{13}C$ determinations, isotope ratios were normalized to the Vienna Peedee Belemnite scale (VPDB) using four replicate standards of IAEA-C6 and IAEA-C7. Similarly, $\delta^{15}N$ values were calculated against the atmospheric composition of N_2, using caffeine and IAEA-N2 as the standards. All calculations, regarding crop stable isotope values, were performed using the statistical programming language R (3.2.3). In calculating $\Delta^{13}C$ values, the $\delta^{13}C$ value of atmospheric CO_2 was estimated using reference tables from the AIRCO2_LOESS system (Ferrio *et al*. 2005). The plant isotope results reported are corrected for the minor effect of charring on $\delta^{13}C$ (by subtracting 0.11‰) and $\delta^{15}N$ (by subtracting 0.31‰) (Nitsch *et al*. 2015), except where otherwise indicated.

Table S2. Number of samples from the Hattusha assemblage selected for crop stable isotope analysis, by crop species and chamber number.

Chamber	Species	No. of samples
12	Hulled barley	8
12	Emmer wheat	10
28	Hulled barley	1
28	Emmer wheat	1
29	Hulled barley	4
29	Emmer wheat	5
30	Hulled barley	9
30	Emmer wheat	18
32	Hulled barley	2
32	Emmer wheat	6
Total		**64**

Table S3. **$\delta^{13}C$ values of standards in each carbon run.**

Run no.	Alanine	CH6	CH7	Alanine (sd)	CH6 (sd)	CH7 (sd)
1	−27.15	−10.45	−32.15	0.06	0.13	0.09
2	−27.12	−10.45	−32.15	0.00	0.07	0.04
3	−27.21	−10.45	−32.15	0.07	0.06	0.05

Table S4. $\delta^{15}N$ values of standards in each nitrogen run.

Run no.	Alanine	CAFF	N2	Alanine (sd)	CAFF (sd)	N2 (sd)
1	−1.70	−3.07	20.30	0.10	0.00	0.10
2	−1.69	−2.90	20.30	0.15	0.06	0.37

Table S5. **Summary of archaeobotanical results by chamber, weed/wild taxa are ordered alphabetically by plant family.**

Chamber no.		**12**	**28**	**29**	**30**	**32**
Taxa	**Plant part**					
Crops						

Hordeum vulgare L.	Grain	7498	941	7720	43801	14205
Hordeum vulgare var. *nudum* L.	Grain	2		2	21	1
Triticum monococcum L.	Grain	14		164	4390	118
Triticum dicoccum Schübl.	Grain	2507	196	2029	12685	10514
Triticum aestivum L./*durum* Desf.	Grain	22	16	21	13	5
Cereal indet.	Grain	2	3	1	10	
Hordeum vulgare L.	Rachis	109	5	5	409	14
Triticum monococcum L.	Glume base	13	2	52	3553	6
Triticum dicoccum Schübl.	Glume base	1061	128	452	9744	2521
Triticum aestivum L./*durum* Desf.	Rachis	1		2	115	7
Culm	Node	190		23	238	3
Lathyrus sativus/cicera L.	Seed	8		1	3	1
Lens culinaris Medik.	Seed	1		10	44	
Vicia ervilia L. Willd.	Seed	29		13	59	351
Vicia faba L. var. *minuta*	Seed	2699	6	187	851	5155
Pulse indet.	Seed				4	
Fruit/nut						
Pistacia sp.	Nut shell frag.			1		
Pyrus/Malus sp.	Seed				1	
Prunus sp.	Nut shell frag.				1	
Rubus sp.	Seed				2	
Vitis vinifera L.	Seed				1	
Weed/wild						
Apiaceae	Seed			8	6	1
Bifora radians M. Bieb.	Seed	169	1	93	1973	280
cf. *Bupleurum* sp.	Seed	13		24	165	101
Caucalis platycarpos L.	Seed	12		8	297	24
Turgenia latifolia L. Hoffm.	Seed	32		19	503	81
Anchusa officinalis L.	Seed					1
Asperugo procumbens L.	Seed				1	
Buglossoides arvensis L.	Seed	139		34	94	27
Buglossoides tenuiflorum L. fil.	Seed	45		12	32	4
Buglossoides sp.	Seed	17			13	2

cf. *Heliotropium* sp.	Seed				2	
Agrostemma githago L.	Seed		3		18	
Silene sp.	Seed		1	2	20	21
Stellaria sp.	Seed		1			
Vaccaria pyramidata Medik.	Seed	137	10	23	766	767
Chenopodium album L.	Seed	24			3	
cf. *Helianthemum* sp.	Seed		4			
Compositae	Seed	54			4	15
Carthamus tinctorius L.	Seed				2	
Centaurea sp.	Seed	7	4	4	60	28
Onopordum acanthium L.	Seed				1	
cf. *Calystegia sepium* L. R. Br.	Seed			1	6	
Convolvulus sp.	Seed			4	30	
Convolvulus cf. *arvensis* L.	Seed				27	
Alyssum sp.	Seed	1	11		37	1
Brassica cf. *nigra*	Seed				4	
Boreava aptera Boiss. & Heldr.	Seed	136		14	13	2
Boreava orientalis Jaub. & Spach	Seed	5			7	
Bunias orientalis L.	Seed	40		3	15	2
cf. *Bunias/Boreava* sp.	Seed	83		7	13	44
Camelina sativa L.	Seed			4	26	5
Camelina sp.	Pod				2	
Cardaria draba L.	Seed			6	25	
Cardaria draba L.	Pod				1	
Conringia orientalis L.	Seed	1	2	2	90	13
cf. *Conringia orientalis/Camelina sativa sp.*	Seed				3	
Coronopus squamatus Forssk.	Seed				1	
Cruciferae	Pod	9		9		
Cruciferae	Seed	48		8	6	1
Lepidium cf. *latifoliatum* L.	Seed	2		3	84	
Lepidium cf. *perfoliatum* L.	Seed				2	
Lepidium sp.	Pod				4	

Lepidium sp.	Seed				24	1
Neslia paniculata L.	Seed	40		9	95	6
Thlaspi arvense L.	Seed	1			21	9
Carex sp.	Seed				7	
Scirpus sylvaticus L.	Seed			1	2	1
Cephalaria syriaca L. Schrad.	Seed			2	204	38
cf. *Geranium* sp.	Seed			2		
Avena cf. *sterilis* L.	Grain			16	358	23
Avena cf. *sterilis* L.	Spikelet				62	
Avena cf. *sterilis* L.	Spikelet base				7	
Avena cf. *sterilis* L.	Glume base				6	
Bromus cf. *sterilis* L.	Grain				2	
Bromus cf. *tectorum* L.	Grain		1	4	16	1
cf. *Bromus* sp.	Grain	2	1		10	1
cf. *Festuca* sp.	Grain				1	
Hordeum cf. *spontaneum* K. Koch	Grain	8			1	
Large grass indet.	Grain				43	1
Lolium persicum Boiss. & Hohen.	Grain	8		9	538	10
Phalaris sp.	Grain		1			3
Poa bulbosa L.	Grain				12	8
Taeniatherum caput-medusae L.	Grain				1	
Ajuga chamaepitys L. Schreb.	Seed				2	
Labiatae	Seed	6		1	29	1
Lallemantia iberica M. Bieb.	Seed			5	36	1
cf. *Lamium* sp.	Seed	16			1	
Salvia sp.	Seed			4	36	
cf. *Stachys* sp.	Seed			1	90	
Teucrium sp.	Seed			1	10	
cf. *Ziziphora* sp.	Seed	8			1	
Coronilla cf. *scorpiodes* L.	Seed				6	
Leguminosae	Pod frag.				3	
Medicago cf. *arabica/polymorpha* L.	Pod	2			1	4

Medicago cf. *truncatula* Gaertn.	Pod	12			13	2
Medicago sp.	Pod frag.	3				
Medicago sp.	Seed	1	1	1	11	21
cf. *Melilotus* sp.	Seed				3	
cf. *Melilotus* sp.	Pod frag.				12	
Onobrychis cf. *vicifolia* Scop.	Seed			1	10	
Onobrychis sp.	Seed				5	
cf. *Scorpiurus* sp.	Seed				1	
Small-seeded legumes	Seed		3			
Legume indet.	Pod	1			4	1
cf. *Vicia* sp.	Seed	122		13	25	24
cf. *Bellevalia* sp.	Seed	1			13	
Ornithogalum sp.	Seed			3	1	
Linum sp.	Seed				7	
Linum sp.	Pod				4	
Fumaria parviflora Lam.	Seed			1	2	
Glaucium corniculatum L.	Seed			1	11	
Papaver cf. *somniferum* L.	Seed				1	
Polygonaceae	Seed			10		
Polygonum aviculare L.	Seed	877	7	103	651	430
Polygonum cf. *convolvulus* L.	Seed				12	
cf. *Polygonum* sp.	Seed				1	1
Rumex cf. *acetosella* L.	Seed			1	41	
Adonis aestavalis L.	Seed	1		1	18	
Adonis cf. *annua* L.	Seed	4		3	23	1
Adonis sp.	Seed	3		2	3	
Consolida regalis S. F. Gray	Seed	1			1	2
Delphinium staphisagria L.	Seed				3	
Ranunculus arvensis L.	Seed	142	2	100	1036	620
cf. *Ranunculus* sp.	Seed			1	10	
cf. *Potentilla* sp.	Seed					1
Cruciata laevipes Opiz.	Seed	38	1	13	49	152
Galium triconutum Dandy.	Seed	1137	13	957	6012	3882

Galium spurium L.	Seed	46		39	261	352
Galium sp.	Seed				2	
Veronica sp.	Seed				3	
Veronica hederifolia L.	Seed	54		6	52	48
Thymelaea cf. *passerina* L.	Seed	2			8	1
Weed/wild indeterminate	Seed	84	3	4	41	22

Table S6. List of taxa and their respective correspondence analysis codes used in Figure 5b.

Taxa	CA Code
Adonis aestivalis	Adoaes
Adonis cf. *annua*	Adoann
Agrostemma githago	Agrogit
Alyssum sp.	Alyss
Avena cf. *sterilis*	Aveste
Bifora radians	Bifrad
Boreava aptera	Borapt
Bromus cf. *tectorum*	Brotec
Bugloissoides arvensis	Bugarv
Bugloissoides tenuiflorum	bugten
cf. *Bunias/Boreava* sp.	bun_bor
Bunias orientalis	bunori
Bupleurum sp.	buplsp
Caucalis platycarpos	caucpla
Centaurea sp.	centa
Cephalaria syriaca	cepsyr
Compositae	compsp
Convolvulus arvensis	convarv
Conringia orientalis	corori
Cruciferae	crucif
Cruciata laevipes	crulae
Galium spurium	galspu
Galium triconutum	galtri

Labiatae	labiat
Lallemantia iberica	lalibe
Lolium persicum	lolipers
Medicago sp.	medisp
Neslia paniculata	nespan
Polygonum aviculare	polavi
Ranunculus arvensis	ranuarv
Rumex cf. *acetosella*	rumace
Silene sp.	silene
cf. *Stachys* sp.	stachy
Thlaspi arvense	thlarv
Turgenia latifolia	turglat
Vaccaria pyramidata	vacpyr
Veronica hederifolia	verohed

Table S7. Results of stable isotope analysis at Hattusha.

Sample ID	Chamber no.	Species	Run C	%C	$\delta^{13}C$ raw	$\delta^{13}C$ (-0.11% charring offset)	$\Delta^{13}C$	$\delta^{13}C$ sd	Run N	% N	$\delta^{15}N$ raw	$\delta^{15}N$ (-0.31 charring offset)	$\delta^{15}N$ sd	CN
HAT01	12	Barley	Run 3	48.3	−23.7	−23.8	17.9	0.09	Run 1	3.7	7.4	7.1	0.14	15.3
HAT02	12	Emmer	Run 1	49.6	−23.0	−23.1	17.1	0.11	Run 2	3.7	6.9	6.6	0.24	15.5
HAT03	12	Barley	Run 1	49.7	−23.3	−23.4	17.4	0.11	Run 1	2.5	7.5	7.2	0.14	23.2
HAT04	12	Emmer	Run 1	50.0	−23.6	−23.7	17.7	0.11	Run 1	3.2	7.0	6.7	0.14	18.5
HAT05	12	Barley	Run 1	56.7	−23.3	−23.4	17.5	0.11	Run 2	3.4	7.0	6.7	0.24	19.7
HAT06	12	Emmer	Run 1	62.3	−22.8	−22.9	16.9	0.11	Run 2	4.6	6.8	6.5	0.24	15.7
HAT07	12	Barley	Run 1	55.9	−23.5	−23.6	17.6	0.11	Run 2	3.2	7.3	7.0	0.25	20.1
HAT08	12	Emmer	Run 1	62.2	−22.9	−23.0	17.0	0.11	Run 1	3.0	6.8	6.5	0.14	24.2
HAT09	12	Barley	Run 1	38.4	−23.4	−23.5	17.5	0.11	Run 2	3.9	7.6	7.3	0.25	11.5
HAT10	12	Emmer	Run 1	53.9	−22.4	−22.5	16.5	0.11	Run 1	3.5	7.2	6.9	0.14	17.9
HAT11	12	Barley	Run 1	49.3	−23.2	−23.3	17.3	0.11	Run 1	3.1	6.5	6.2	0.14	18.7
HAT12	12	Emmer	Run 3	51.8	−22.9	−23.1	17.1	0.09	Run 1	3.8	6.8	6.5	0.14	15.9
HAT13	12	Barley	Run 1	66.7	−22.5	−22.6	16.6	0.11	Run 2	4.4	6.6	6.2	0.24	17.7
HAT14	12	Emmer	Run 1	66.1	−22.6	−22.7	16.7	0.11	Run 1	3.6	7.0	6.7	0.14	21.2
HAT15	12	Emmer	Run 3	50.2	−22.9	−23.0	17.0	0.09	Run 2	4.0	7.4	7.1	0.25	14.7
HAT16	12	Barley	Run 1	58.7	−22.6	−22.7	16.7	0.11	Run 2	4.2	6.1	5.7	0.23	16.3

HAT17	12	Emmer	Run 1	45.2	−22.4	−22.5	16.5	0.11	Run 2	3.3	6.6	6.3	0.24	16.1
HAT18	12	Emmer	Run 1	43.2	−22.6	−22.7	16.7	0.11	Run 2	3.6	6.2	5.9	0.23	13.9
HAT19	28	Barley	Run 1	46.2	−22.4	−22.6	16.5	0.11	Run 1	2.5	6.1	5.8	0.14	21.4
HAT20	28	Emmer	Run 1	62.6	−22.2	−22.3	16.2	0.11	Run 1	3.0	7.4	7.1	0.14	24.0
HAT21	29	Barley	Run 1	66.8	−22.8	−22.9	16.9	0.11	Run 2	2.6	3.3	3.0	0.20	30.2
HAT22	29	Barley	Run 1	43.8	−22.5	−22.7	16.6	0.11	Run 1	3.1	4.5	4.2	0.15	16.5
HAT23	29	Emmer	Run 1	61.0	−23.0	−23.1	17.1	0.11	Run 1	4.1	4.2	3.9	0.15	17.2
HAT24	29	Barley	Run 1	69.4	−22.4	−22.5	16.5	0.11	Run 2	2.0	6.1	5.8	0.23	41.4
HAT25	29	Emmer	Run 1	66.2	−22.2	−22.3	16.2	0.11	Run 1	2.1	6.4	6.1	0.14	37.7
HAT26	29	Barley	Run 1	77.7	−23.0	−23.1	17.1	0.11	Run 2	2.6	6.6	6.3	0.24	34.8
HAT27	29	Emmer	Run 1	59.3	−22.3	−22.4	16.4	0.11	Run 1	2.0	6.4	6.1	0.14	35.3
HAT28	29	Emmer	Run 1	58.2	−22.1	−22.2	16.2	0.11	Run 2	2.4	5.0	4.7	0.22	28.4
HAT29	29	Emmer	Run 1	65.2	−22.2	−22.3	16.3	0.11	Run 2	2.1	7.1	6.8	0.25	36.5
HAT30	30	Barley	Run 1	58.1	−22.8	−22.9	16.9	0.11	Run 2	4.4	4.5	4.2	0.22	15.5
HAT31	30	Emmer	Run 1	70.5	−22.5	−22.6	16.6	0.11	Run 1	3.6	4.8	4.4	0.14	22.9
HAT32	30	Emmer	Run 3	45.4	−23.2	−23.3	17.3	0.09	Run 2	5.3	5.5	5.2	0.23	10.1
HAT33	30	Emmer	Run 1	48.7	−22.9	−23.0	17.0	0.11	Run 1	4.8	5.9	5.6	0.14	11.8
HAT34	30	Barley	Run 1	50.2	−22.9	−23.0	17.0	0.11	Run 1	3.7	5.3	5.0	0.14	15.8
HAT35	30	Emmer	Run 3	56.0	−22.7	−22.8	16.8	0.09	Run 1	4.3	5.4	5.1	0.14	15.1
HAT36	30	Emmer	Run 1	73.6	−21.9	−22.0	15.9	0.11	Run 2	5.5	8.7	8.4	0.27	15.7
HAT37	30	Barley	Run 1	60.4	−22.5	−22.6	16.6	0.11	Run 2	5.8	5.3	5.0	0.22	12.1

HAT38	30	Emmer	Run 1	68.3	−21.8	−21.9	15.9	0.11	Run 2	4.7	5.8	5.5	0.23	16.8
HAT39	30	Barley	Run 1	62.6	−23.1	−23.2	17.2	0.11	Run 2	4.2	4.2	3.8	0.21	17.6
HAT40	30	Emmer	Run 3	52.1	−22.5	−22.6	16.6	0.09	Run 1	4.0	3.6	3.3	0.15	15.1
HAT41	30	Emmer	Run 1	75.1	−22.0	−22.1	16.0	0.11	Run 1	5.0	3.4	3.1	0.15	17.6
HAT42	30	Barley	Run 1	60.9	−22.6	−22.7	16.7	0.11	Run 2	4.2	5.2	4.9	0.22	16.9
HAT43	30	Emmer	Run 1	59.9	−22.1	−22.2	16.2	0.11	Run 1	4.5	4.9	4.6	0.14	15.6
HAT45	30	Emmer	Run 1	75.7	−21.8	−21.9	15.9	0.11	Run 1	4.5	4.8	4.5	0.14	19.4
HAT46	30	Barley	Run 1	65.4	−21.9	−22.0	16.0	0.11	Run 2	4.1	4.0	3.7	0.21	18.7
HAT47	30	Emmer	Run 1	62.1	−22.0	−22.2	16.1	0.11	Run 1	4.4	4.2	3.9	0.15	16.3
HAT48	30	Barley	Run 1	65.5	−22.5	−22.6	16.6	0.11	Run 2	3.3	6.2	5.9	0.23	23.1
HAT49	30	Emmer	Run 3	54.3	−21.5	−21.6	15.6	0.09	Run 1	4.3	4.9	4.6	0.14	14.7
HAT50	30	Barley	Run 1	66.2	−22.9	−23.0	17.0	0.11	Run 2	5.2	3.7	3.3	0.21	14.8
HAT51	30	Emmer	Run 1	73.5	−21.9	−22.0	15.9	0.11	Run 1	5.1	4.5	4.2	0.15	16.9
HAT52	30	Emmer	Run 2	45.8	−22.0	−22.1	16.1	0.07	Run 1	2.9	3.4	3.1	0.15	18.6
HAT53	30	Barley	Run 1	62.5	−22.4	−22.6	16.5	0.11	Run 2	3.3	6.1	5.8	0.23	22.4
HAT54	30	Emmer	Run 1	58.8	−22.1	−22.2	16.2	0.11	Run 1	3.1	3.8	3.5	0.15	22.1
HAT55	30	Emmer	Run 2	59.5	−21.8	−21.9	15.9	0.07	Run 2	3.6	3.9	3.6	0.21	19.3
HAT56	30	Emmer	Run 1	64.9	−21.4	−21.5	15.4	0.11	Run 1	2.8	5.0	4.7	0.14	27.0
HAT57	30	Emmer	Run 1	67.2	−21.6	−21.7	15.7	0.11	Run 2	2.8	4.9	4.6	0.22	27.8
HAT58	32	Barley	Run 1	51.6	−23.7	−23.8	17.8	0.11	Run 2	5.5	9.4	9.1	0.28	11.0
HAT59	32	Emmer	Run 1	47.0	−22.9	−23.0	17.0	0.11	Run 2	5.6	7.4	7.1	0.25	9.8

HAT60	32	Emmer	Run 1	57.7	−22.8	−22.9	16.9	0.11	Run 2	4.0	7.1	6.7	0.25	16.7
HAT61	32	Barley	Run 1	49.0	−24.0	−24.1	18.2	0.11	Run 1	4.0	6.3	5.9	0.14	14.2
HAT62	32	Emmer	Run 1	71.8	−23.0	−23.1	17.1	0.11	Run 2	6.0	8.0	7.7	0.26	14.0
HAT63	32	Emmer	Run 1	51.0	−23.0	−23.1	17.1	0.11	Run 2	4.4	8.0	7.7	0.26	13.5
HAT64	32	Emmer	Run 1	73.7	−23.1	−23.2	17.3	0.11	Run 2	4.7	6.2	5.9	0.23	18.4
HAT65	32	Emmer	Run 1	52.8	−23.2	−23.3	17.3	0.11	Run 1	3.9	7.0	6.7	0.14	15.7

Table S8. **Results of an ANOVA test and post-hoc analysis on the $\Delta^{13}C$ values of barley and emmer wheat between chambers.**

Statistical test	Species	Chambers included	Results
ANOVA	Barley	All	F(2,18)= 5.431, p=0.0143
ANOVA	Emmer	All	F(3,35)= 11.12, p=<0.0001
Post-hoc Tukey Test	Barley	12, 30	0.0138
Post-hoc Tukey Test	Emmer	12, 30	<0.001
Post-hoc Tukey Test	Barley	29, 12	0.1033
Post-hoc Tukey Test	Emmer	29, 12	0.1821
Post-hoc Tukey Test	Barley	29, 30	0.9344
Post-hoc Tukey Test	Emmer	29, 30	0.6005
Post-hoc Tukey Test	Emmer	29, 32	0.0483
Post-hoc Tukey Test	Emmer	12, 32	0.757
Post-hoc Tukey Test	Emmer	32, 30	<0.001

Table S9. **Results of an ANOVA test and post-hoc analysis on the $\delta^{15}N$ values of barley and emmer wheat between chambers.**

Statistical test	Species	Chambers included	Results
Kruskal-Wallis	Barley	All	H(2)= 11.19, p=0.003714
ANOVA	Emmer	All	F(3,35)= 13.78, p=<0.0001
Post-hoc Dunn Test	Barley	12, 30	0.0042
Post-hoc Tukey Test	Emmer	12, 30	<0.001
Post-hoc Dunn Test	Barley	29, 12	0.0506
Post-hoc Tukey Test	Emmer	29, 12	0.2324

Post-hoc Dunn Test	Barley	29, 30	0.7600
Post-hoc Tukey Test	Emmer	29, 30	0.2194
Post-hoc Tukey Test	Emmer	29, 32	0.0928
Post-hoc Tukey Test	Emmer	12, 32	0.8614
Post-hoc Tukey Test	Emmer	32, 30	<0.001

Table S10. Results of multiple linear regression models with coefficients for discriminant function (DF), $\Delta^{13}C$ value, $\delta^{15}N$ value and chamber, by cereal taxa.

Barley	**Formula**		**R^2**	**Beta**	**SE**	**t**	**p**
	$\Delta^{13}C$ ~DF + Chamber	Constant	0.11	17.95	0.42	42.39	<0.001
		DF		0.29	0.2	1.48	0.155
		Chamber		−0.01	0.01	−1.16	0.261
	DF~$\Delta^{13}C$ + Chamber	Constant	0.1	−7.18	3.87	−1.85	0.0779
		$\Delta^{13}C$		0.33	0.22	1.48	0.1549
		Chamber		−0.01	0.01	−0.94	0.3606
	$\delta^{15}N$~DF + Chamber	Constant	0.26	9.8	1.05	8.37	<0.001
		DF		0.81	0.49	1.67	0.111
		Chamber		−0.07	0.03	−2.1	0.048
	DF~$\delta^{15}N$ + Chamber	Constant	0.12	−2.8	0.73	−3.52	0.0020
		$\delta^{15}N$		0.14	0.087	1.17	0.1114
		Chamber		−0.008	0.01	−0.52	0.6093
Emmer	$\Delta^{13}C$ ~DF + Chamber	Constant	0.15	17.47	0.32	54.11	<0.001

	DF		0.24	0.13	1.93	0.0609
	Chamber		−0.02	0.01	−1.89	0.0669
DF~$\Delta^{13}C$ + Chamber	Constant	0.08	−7.82	3.38	−2.31	0.0262
	$\Delta^{13}C$		0.38	0.2	1.93	0.0609
	Chamber		−0.008	0.01	−0.55	0.5873
$\delta^{15}N$~DF + Chamber	Constant	0.29	8.49	0.75	11.36	<0.001
	DF		0.94	0.29	3.23	0.0026
	Chamber		−0.05	0.02	−2.01	0.0522
DF~$\delta^{15}N$ + Chamber	Constant	0.21	−3.03	0.62	−4.91	<0.001
	$\delta^{15}N$		0.23	0.07	3.23	0.0026
	Chamber		−0.001	0.01	−0.11	0.9099

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