EXCAVATIONS IN TIEL-PASSEWAAIJ

Animals in Ritual and Economy in a Frontier Community

Maaike Groot

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Appendix A. Zooarchaeological data from Passewaaijse Hogeweg and Oude Tielseweg

Species	F1	F2	F3	F4	F5-6	F7
cattle	7.2	7.9	12.8	12.9	6.8	5.9
sheep	1.1	3.3	2.2	7.3	3.0	1.8
pig	4.4	5.6	2.9	-	2.1	6.5
horse	16.7	12.2	14.7	10.0	4.6	5.2

Table A1. Percentage of gnawing on animal bones from Passewaaijse Hogeweg.

Species	F1	F2	F3	F4	F7
cattle	10.3	5.0	7.4	11.4	4.0
sheep	1.9	5.0	3.8	5.4	-
pig	12.5	2.0	8.0	6.7	7.4
horse	11.8	15.2	-	21.6	13.2

Table A2. Percentage of gnawing on animal bones from Oude Tielseweg.

Species	F1	F2	F3	F4	F5-6	F7
cattle	13.7	12.5	13.3	10.4	11.1	19.3
sheep	3.3	7.2	3.8	4.7	4.5	9.0
pig	2.2	3.1	5.7	-	3.2	9.5
horse	22.2	10.6	10.1	10.7	8.0	4.7

Table A3. Percentage of butchery marks on animal bones from Passewaaijse Hogeweg.

Species	F1	F2	F3	F4	F7
cattle	13.5	11.1	6.8	13.6	3.3
sheep	5.6	3.4	1.3	1.6	3.2
pig	8.3	8.0	-	11.1	3.3
horse	23.5	16.3	14.8	8.1	3.8

Table A4. Percentage of butchery marks on animal bones from Oude Tielseweg.

Species	F1	F2	F3	F4	F5-6	F7
cattle	-	1.8	1.9	-	0.4	0.4
sheep	-	2.9	1.1	-	3.0	-
pig	2.2	2.5	5.7	-	-	0.3
horse	-	1.6	-	0.6	-	-
medium mammal	2.9	10.7	4.4	1.0	1.8	1.7
large mammal	4.5	7.3	3.8	0.8	0.5	1.1

Table A5. Percentage of burning on animal bones from Passewaaijse Hogeweg.

Species	F1	F2	F3	F4	F7
cattle	-	1.9	1.4	-	0.4
sheep	1.9	7.1	3.4	2.3	3.2
pig	-	4.0	-	-	0.4
horse	-	-	-	-	-

Table A6. Percentage of burning on animal bones from Oude Tielseweg.

Phase	Find nr	Species	Element	Withers height	Method	Withers height	Method	Context
1	233.014/2	Cattle	metatarsus R	104.6	vD/B	108.5	B/vWB	PHW
1	S826/17 [1]	Cattle	metacarpus R	98.4	vD/B	102.6	B/vWB	OTW
2	183.153/5	Cattle	metacarpus R	105.2	vD/B	106.5	B/vWB	PHW
2	122.347/12	Cattle	metatarsus R	110.1	vD/B	108.1	B/vWB	PHW
2	S1870/3	Cattle	metatarsus L	112.5	vD/B	109.8	B/vWB	OTW
3	188.093/1	Cattle	metacarpus L	103.9	vD/B	105.8	B/vWB	PHW
3	225.195/2	Cattle	metatarsus L	110.6	vD/B	108.5	B/vWB	PHW
3	123.025/36	Cattle	radius L	117.9	Matolsci	113.9	B/vWB	PHW
3	163.562/1	Cattle	metatarsus R	111.2	vD/B	108.9	B/vWB	PHW
3	168.292/1	Cattle	radius R	126.3	Matolsci	122.0	B/vWB	PHW
3	S1573/1	Cattle	metacarpus L	111.3	vD/B	110.1	B/vWB	OTW
4	146.131/5	Cattle	metatarsus R	119.9	vD/B	115.0	B/vWB	PHW
4	S309/1	Cattle	metacarpus L	106.4	vD/B	107.2	B/vWB	OTW
4-6	180.207/20	Cattle	tibia R	123.2	Matolsci	119.4	B/vWB	PHW
4-6	163.574/2	Cattle	metatarsus L	124.3	vD/B	118.0	B/vWB	PHW
4-6	163.406/1	Cattle	metacarpus L	126.7	vD/B	118.9	B/vWB	PHW
4-6	168.091/2	Cattle	metacarpus R	106.4	vD/B	107.2	B/vWB	PHW
5-6	186.040/4	Cattle	metatarsus R	111.2	vD/B	108.9	B/vWB	PHW
5-6	124.201/1	Cattle	metatarsus R	135.2	vD/B	125.6	B/vWB	PHW
5-6	124.181/1	Cattle	radius R	119.7	Matolsci	115.6	B/vWB	PHW
5-6	124.158/1	Cattle	metacarpus R	115.0	vD/B	112.2	B/vWB	PHW
5?	92.017/9	Cattle	metatarsus	133.0	vD/B	124.1	B/vWB	Cem.
7	212.073/1	Cattle	metatarsus R	123.2	vD/B	117.2	B/vWB	PHW
7	177.150/90	Cattle	metacarpus L	124.8	vD/B	117.8	B/vWB	PHW
7	177.150/74	Cattle	metatarsus R	131.3	vD/B	122.9	B/vWB	PHW
7	177.150/69	Cattle	metacarpus L	123.0	vD/B	116.8	B/vWB	PHW
7	177.150/47	Cattle	radius L	129.4	Matolsci	125.0	B/vWB	PHW
7	147.211/2	Cattle	metatarsus R	107.9	vD/B	106.6	B/vWB	PHW
7	147.166/19	Cattle	radius L	129.8	Matolsci	125.4	B/vWB	PHW
7	164.299/9	Cattle	tibia L	130.3	Matolsci	126.3	B/vWB	PHW
7	164.288/5	Cattle	metacarpus R	118.7	vD/B	114.3	B/vWB	PHW
7	170.126/11	Cattle	metatarsus	127.5	vD/B	120.2	B/vWB	PHW

Table A7. Withers height for cattle in cm. PHW=Passewaaijse Hogeweg, Cem.=Cemetery, OTW=Oude Tielseweg. Methods: vD/B=Von den Driesch/Boessneck, B/vWB=Bergström/Van Wijngaarden-Bakker.

[1] This withers height is not mentioned in chapter 2 or represented in the diagrams because it was not included in the zooarchaeological report for Oude Tielseweg.

Phase	Find nr	Species	Element	Withers height	Method	Withers height	Method	Context
7	164.072/1	Cattle	metacarpus L	131.0	vD/B	121.4	B/vWB	PHW
7	S618	Cattle	metacarpus	112.5	vD/B	110.7	B/vWB	OTW
7	S618	Cattle	metacarpus	130.5	vD/B	121.1	B/vWB	OTW
7	S618	Cattle	radius	104.7	Matolsci	101.2	B/vWB	OTW
7	S618	Cattle	radius	111.3	Matolsci	107.5	B/vWB	OTW
7	S618	Cattle	radius	118.8	Matolsci	114.8	B/vWB	OTW
7	S618	Cattle	tibia	115.7	Matolsci	112.1	B/vWB	OTW
7	S618	Cattle	tibia	116.1	Matolsci	112.5	B/vWB	OTW

Table A7 continued. Withers height for cattle in cm. PHW=Passewaaijse Hogeweg, Cem.=Cemetery, OTW=Oude Tielseweg. Methods: vD/B=Von den Driesch/Boessneck, B/vWB=Bergström/Van Wijngaarden-Bakker.

Phase	Find nr	Species	Element	Withers height	Context
1	212.064/2	sheep	radius R	63.9	PHW
1	215.044/9	sheep	radius L	54.3	PHW
1	138.039/1	sheep	metatarsus R	57.7	PHW
1	S225/71	sheep/goat	tibia L	59.9	OTW
2	168.207/18	sheep/goat	radius L	54.7	PHW
2	168.211/8	sheep/goat	tibia L	56.9	PHW
2	176.238/7	sheep	humerus L	62.1[1]	PHW, SD 36
2	176.238/6	sheep	humerus R	61.6[1]	PHW, SD 36
2	176.238/8	sheep	radius L	61.1[1]	PHW, SD 36
2	176.238/10	sheep	radius R	60.7[1]	PHW, SD 36
2	176.238/12	sheep	metacarpus L	61.6[1]	PHW, SD 36
2	176.238/17	sheep	metacarpus R	61.6[1]	PHW, SD 36
2	176.238/2	sheep	femur L	61.8[1]	PHW, SD 36
2	176.238/83	sheep	metacarpus L	49.9[2]	PHW, SD 36
2	176.238/84	sheep	metatarsus R	51.1[2]	PHW, SD 36
2	176.238/28	sheep	metacarpus L	54.8[3]	PHW, SD 36
2	176.238/29	sheep	metatarsus L	54.5[3]	PHW, SD 36
2	211.204/15	sheep	metacarpus L	59.2[4]	PHW, SD 50
2	211.204/17	sheep	metatarsus L	59.5[4]	PHW, SD 50
2	211.204/18	sheep	metatarsus R	59.5[4]	PHW, SD 50
3	122.170/14	sheep	metacarpus R	63.4	PHW
3	123.237/10	sheep	metacarpus R	64.1	PHW, SD 42
3	123.237/13	sheep	metacarpus L	57.2	PHW, SD 42
3	123.237/17	sheep	metatarsus R	57.5	PHW, SD 42
3	123.253/22	sheep	metacarpus L	62.6[5]	PHW, SD 42
3	123.253/23	sheep	metacarpus R	62.3[5]	PHW, SD 42
3	123.253/25	sheep	metacarpus R	63.2	PHW, SD 42
3	123.253/24	sheep	metacarpus R	57.7	PHW, SD 42
3	176.059/10	sheep	metatarsus R	62.8	PHW
3	176.247/8	sheep	metatarsus L	50.8	PHW

Table A8. Withers height for sheep/goat in cm. PHW=Passewaaijse Hogeweg, Cem.=Cemetery, OTW=Oude Tielseweg, SD=Special Deposit.

Phase	Find nr	Species	Element	Withers height	Context
3	178.089/3	sheep	metatarsus R	54.3	PHW
3	212.089/1	sheep	radius R	63.9	PHW
4	S814/4	sheep	metacarpus R	62.3	OTW
4	S1734/62	sheep	metacarpus L	58.4	OTW
5-6	197.054/1	sheep/goat	metacarpus R	62.3	PHW

Table A8 continued. Withers height for sheep/goat. PHW=Passewaaijse Hogeweg, Cem.=Cemetery, OTW=Oude Tielseweg, SD=Special Deposit.

Phase	Find nr	Species	Element	Withers height	Context
4-6	177.168/6	pig	tibia R	83.1	PHW
7	124.264/2	pig	tibia L	78.8	PHW
7	164.072/10	pig	tibia R	94.1	PHW
7	147.149/27	pig	radius L	75.5	PHW
7	147.158/20	pig	tibia L	71.3	PHW
7	147.158/87	pig	humerus L	72.1	PHW
7	147.158/89	pig	tibia R	76.0	PHW
7	147.159/6	pig	tibia L	74.1	PHW

Table A9. Withers height for pig. PHW=Passewaaijse Hogeweg.

Phase	Find nr	Species	Element	Withers height	Context
1	211.084/1	Horse	metacarpus L	125.6	PHW
1	168.212/4	Horse	metacarpus L	135.3	PHW
1	S36.236/35	Horse	metacarpus	134.0	OTW
1	S36.236/56	Horse	metacarpus	144.2	OTW
2	216.346/1	Horse	femur R	125.7	PHW
2	122.316/1	Horse	radius R	127.2	PHW
2	164.262/1	Horse	metacarpus R	132.0	PHW
2	184.275/1	Horse	tibia R	141.3	PHW
2	S719	Horse	metacarpus	134.5	OTW
3.1	176.122/22	Horse	femur L	143.9	PHW, SD 35
3.1	176.122/27	Horse	femur R	143.6	PHW, SD 35
3.1	176.122/10	Horse	humerus L	146.6	PHW, SD 35
3.2	228.140/1	Horse	metacarpus R	132.5	PHW
3.2	228.211/1	Horse	metacarpus R	145.3	PHW
3	163.712/4	Horse	metacarpus R	137.2	PHW
3	163.829/1	Horse	metacarpus L	128.2	PHW
3	S226/11[2]	Horse	metatarsus R	133.3	OTW
3	S265/5	Horse	metatarsus L	127.9	OTW
4	146.141/9	Horse	femur R	120.0	PHW

Table A10. Withers height for horse in cm, according to May. PHW=Passewaaijse Hogeweg, Cem.=Cemetery, OTW=Oude Tielseweg, SD=Special Deposit.

[2] This withers height is not mentioned in chapter 2 or represented in the diagrams because it was not included in the zooarchaeological report for Oude Tielseweg.

Phase	Find nr	Species	Element	Withers height	Context
4	146.141/4	Horse	metatarsus R	131.1	PHW
4	135.103/2	Horse	metatarsus L	135.4	PHW
4	162.163/3	Horse	radius R	136.7	PHW
4	188.238/1	Horse	metacarpus R	138.5	PHW
4	163.665/6	Horse	humerus R	141.2	PHW
4	162.162/6	Horse	metacarpus R	141.7	PHW
4	229.095/2	Horse	metatarsus R	147.7	PHW
4	75.163/14	Horse	radius L	149.3	PHW
4	128.076/1	Horse	metacarpus R	142.3	PHW
4	128.184/1	Horse	metacarpus L	141.7	PHW
4	S1404/3	Horse	metatarsus L	133.3	OTW
4	S1479/5	Horse	tibia L	138.6	OTW
4	S1734/189	Horse	radius L	152.3	OTW
4	73.113/1	Horse	tibia R	138.6	Cem.
4?	82.104/1	Horse	tibia L	143.0	Cem.
5-6	165.128/2	Horse	metatarsus L	144.4	PHW
5-6	122.375/4	Horse	metacarpus L	148.1	PHW
5-6	171.068/18	Horse	metacarpus L	159.0	PHW, SD 41
5-6	171.068/24	Horse	metacarpus R	158.3	PHW, SD 41
5-6	171.068/8	Horse	metatarsus R	155.1	PHW, SD 41
5-6	176.130/8	Horse	radius L	143.2	PHW, SD 43
5-6	176.130/15	Horse	tibia R	146.9	PHW, SD 43
4-6	179.151/1	Horse	metatarsus R	122.6	PHW
4-6	122.266/1	Horse	tibia R	136.5	PHW
4-6	168.150/59	Horse	metatarsus R	141.2	PHW
4-6	168.150/44	Horse	radius R	142.8	PHW
4-6	163.659/9	Horse	metatarsus L	146.6	PHW
4-6	180.207/21	Horse	femur R	151.3	PHW
4-6	168.150/15	Horse	tibia R	154.3	PHW
3-6	163.052/1	Horse	radius R	141.5	PHW
3-6	163.052/2	Horse	metatarsus R	151.9	PHW
7	177.150/117	Horse	metatarsus R	137.0	PHW
7	177.150/99	Horse	metatarsus L	139.1	PHW
7	177.150/59	Horse	metatarsus R	139.1	PHW
7	177.150/61	Horse	metacarpus L	140.4	PHW
7	177.150/2	Horse	metatarsus L	140.7	PHW
7	166.055/4	Horse	metacarpus L	141.0	PHW
7	177.150/106	Horse	metatarsus R	142.8	PHW
7	177.150/87	Horse	metatarsus L	143.4	PHW
7	164.082/5	Horse	metacarpus L	146.8	PHW
7	166.061/6	Horse	tibia L	147.4	PHW
7	177.150/48	Horse	metacarpus R	148.1	PHW
7	177.150/96	Horse	metacarpus L	148.1	PHW
7	165.162/7	Horse	metatarsus L	151.9	PHW

Table A10 continued. Withers height for horse in cm, according to May. PHW=Passewaaijse Hogeweg, Cem.=Cemetery, OTW=Oude Tielseweg, SD=Special Deposit.

Phase	Find nr	Species	Element	Withers height	Context
7	177.150/65	Horse	metacarpus L	155.1	PHW
7	S618	Horse	metacarpus	136	OTW
7	S618	Horse	metatarsus	137.5	OTW
7	S618	Horse	tibia	140	OTW

Table A10 continued. Withers height for horse in cm, according to May. PHW=Passewaaijse Hogeweg, Cem.=Cemetery, OTW=Oude Tielseweg, SD=Special Deposit.

Phase	Find nr	Species	Element	Withers height	Context
2	122.308/1	dog	tibia R	56.7	PHW
3	S839/133	dog	femur	61.7[1]	OTW
3	S839/132	dog	tibia	62.3[1]	OTW
4	188.181/1	dog	humerus R	33.5	PHW, SD 37
4	188.181/2	dog	femur L	34.7	PHW, SD 37
4	188.094/1	dog	radius R	28.0	PHW, SD 37
4	188.164/3	dog	humerus L	45.7	PHW, SD 38
4	188.164/4	dog	humerus R	45.4	PHW, SD 38
4	188.164/8	dog	femur R	47.1	PHW, SD 38
4	188.164/10	dog	tibia	45.6	PHW, SD 38
4	36.252	dog	humerus L	54.6[2]	OTW
4	36.252	dog	radius R	57.0[2]	OTW
4	36.252	dog	femur R	57.1[2]	OTW
5-6	122.454/1	dog	femur L	57.7	PHW
3-4	122.418/2	dog	humerus R	73.5[3]	PHW, SD 29
3-4	122.418/1	dog	humerus L	72.8[3]	PHW, SD 29
3-4	122.418/3	dog	radius L	72.5[3]	PHW, SD 29
3-4	122.418/4	dog	ulna L	72.1[3]	PHW, SD 29
3-4	122.418/5	dog	femur L	76.6[3]	PHW, SD 29
3-4	122.418/6	dog	tibia L	73.4[3]	PHW, SD 29
4-5	122.305/1	dog	humerus L	66.3[4]	PHW, SD 30
4-5	122.305/2	dog	humerus R	66.6[4]	PHW, SD 30
4-5	122.305/3	dog	radius L	62.4[4]	PHW, SD 30
4-5	122.305/4	dog	radius R	62.7[4]	PHW, SD 30
4-5	122.305/5	dog	ulna L	62.1[4]	PHW, SD 30
4-5	122.305/6	dog	ulna R	62.9[4]	PHW, SD 30
4-5	122.305/7	dog	femur L	64.0[4]	PHW, SD 30
4-5	122.305/8	dog	femur R	64.3[4]	PHW, SD 30
4-5	122.305/9	dog	tibia L	62.3[4]	PHW, SD 30
4-5	122.305/10	dog	tibia R	62.0[4]	PHW, SD 30
5-6	125.002/6	dog	humerus L	29.9[5]	PHW, SD 33
5-6	125.002/11	dog	femur R	32.0[5]	PHW, SD 33
5-6	125.002/14	dog	tibia L	27.4[5]	PHW, SD 33
5-6	196.078/6	dog	humerus L	54.6[6]	PHW, SD 51
5-6	196.078/9	dog	humerus R	56.0[6]	PHW, SD 51
7	165.150/32	dog	humerus L	60.1[7]	PHW, SD 19

Table A11. Withers height for dog in cm. PHW=Passewaaijse Hogeweg, OTW=Oude Tielseweg, SD=Special Deposit.

Phase	Find nr	Species	Element	Withers height	Context
7	165.150/33	dog	radius L	60.5[7]	PHW, SD 19
7	165.150/34	dog	ulna L	60.1[7]	PHW, SD 19
7	165.150/25	dog	femur L	60.2[7]	PHW, SD 19
7	165.150/27	dog	tibia L	60.8[7]	PHW, SD 19

Table A11 continued. Withers height for dog in cm. PHW=Passewaaijse Hogeweg, OTW=Oude Tielseweg, SD=Special Deposit.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age[3]
1	211.084/2		g	l	k	j	45	old adult
1	212.180/6		b	g	g	d	32-36	30-36 m
1	233.012/1	a					1-3	0-1 m
1	233.026/8				g	c	32-35	30-36 m
1	233.038/5	l					<29	<30 m
1	234.017/2		E	h	g	d	34	30-36 m
1	138.062/1	k		g	c		20	18-30 m
1	138.069/1			k	g	b	35	30-36 m
1	172.115/2					b	30-34	18-36 m
1	172.117/8	a					1-3	0-1 m
2	184.172/7	j		f			14-19	8-30 m
2	184.220/3		g	l	k		43-46	adult or older
2	184.245/1					m	51-54	senile
2	185.048/1					l	49-52	senile
2	136.205/1	f					4	1-8 m
2	183.101/3	c					3-4	0-8 m
2	183.148/6		d	k	j	j	41-44	adult/old adult
2	189.065/4	j					8-30	8-30 m
2	189.071/2			g	b		20-21	18-30 m
2	189.071/3				f	U	25-26	18-30 m
2	190.051/2					k	46-50	senile
2	190.056/3	k		g	d		23-26	18-30 m
2	211.260/1			l	k		42-46	adult or older
2	122.386	k		g	g	e	34	30-36 m
2	120.074					d	34-38	30-36 m/young adult
2	122.208	b					3	0-1 m
2	122.302/8	a					1-3	0-1 m
2	122.340/2		f	l	k	j	45	old adult
2	122.349/17		f	l	k		42-46	adult or older
2	136.206/1	f		U			5	1-8 m
2	161.075/2	f					4-7	1-18 m
2	163.602/1		b	j	g		33-38	30-36 m/young adult

Table A12. Tooth wear of mandibular teeth of cattle from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

3 Age estimated according to Hambleton's comparison of Grant's and Halstead's methods.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age
2	163.746/1			k	g		34-39	30-36 m/young adult
2	163.746/4		e	k	j	g	42	adult
2	122.302	U					2-3	0-1 m
2	122.347	k					<29	<30 m
2	120.047				f	U	29	18-30 m
2	120.074/1					c	32-35	30-36 m
2	120.086/1	k		h			27-30	18-30 m
2	164.231/5	j	g	b			20-21	18-30 m
2	165.006/1				g	g	37-49	young adult or older
2	165.145/4	j		f	E		14	8-18 m
2	167.132/1			l	l	g	42	adult
2	171.119/1					g	37-49	young adult or older
2	171.128/1	j		e	E		13	8-18 m
2	176.051/1	f		½			4-5	1-8 m
2	177.158/1		f	k	j	g	42	adult
2	184.126/1		g	l			41-47	adult or older
2	184.377/2	j		f			14-19	8-30 m
2	191.026/1	k		j			29	18-30 m
3	184.345/4	k					23-26	18-30 m
3	188.078/2					a	30	18-30 m
3	193.053/1	k					23-26	18-30 m
3	210.178/7	n					24	18-30 m
3	212.100/2		c	j			38-39	young adult
3	122.170/20		g	l	k	g	43	adult
3	225.196/2	k					23-26	18-30 m
3	225.198/1					j	44-47	old adult or older
3	216.238/2	j					<29	<30 m
3	122.168/24	h		g	½		16	8-18 m
3	123.024/34		g	j			29-41	18 m - adult
3	163.274/1		c	j	g	f	37	young adult
3	163.419/7					b	30-34	18-36 m
3	122.170		g	k	k	h	45	old adult
3	163.419					b	30-34	18-36 m
3	177.084/3			j	d	U	29	18-30 m
3	211.149/1		c	k	j	f	41	adult
3.1	147.113/1				j	g	41-42	adult
3.1	163.736/4			j	g	b	33	30-36 m
3.1	163.736/1	j		e			10	8-18 m
3.1	163.742/1				l	l	49-51	senile
3.1	163.743/1		f	k	j		38-41	young adult/adult
3.1	147.113			l	k	g	43	adult
3.1	163.315			f	U		16	8-18 m
3.1	168.251/4	j		g	U		17	18-30 m
3.1	168.330	j		f			14-19	8-30 m

Table A12 continued. Tooth wear of mandibular teeth of cattle from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age
3.2	229.167/1		c	k	g	d	37	young adult
3.2	228.205/1	f		E			3-4	0-8 m
3.2	163.629/2			k	k	g	44	old adult
3.2	163.629/3			b			8-10	8-18 m
3.2	163.727/4	k		f			14-19	8-30 m
3.2	135.112					k	46-50	senile
3.2	136.166/5					g	38-46	young adult or older
3.2	168.291/11					k	46-50	senile
3.2	168.292/5		h	m	k		46-47	senile
3.2	168.315/5	j		g	E		15	8-18 m
3.2	168.315/1	j		f			14-19	8-30 m
3.2	168.324/2				d	V	23	18-30 m
4	182.075/2	j		e			13-14	8-18 m
4	182.098/1			j	h	d	36	30-36 m
4	182.074/4		f	k	j	g	41	adult
4	192.088/1					j	44-46	old adult or older
4	229.097/1		f	k	k	k	48	senile
4	216.237/1	k		g	U		17	18-30 m
4	128.458/1		c	j	e	g	36	30-36 m
4	146.141/3				k	k	46-47	senile
4	162.123/2			k	k		42-44	adult/old adult
4	163.651/3		h	l	k		42-46	adult or older
4	163.699/5		E	j	g	c	34	30-36 m
4	75.162/3		g	k	k	g	44	old adult
4	75/163/9			j			29-41	18 m - adult
4	162.124/1					l	49-52	senile
4	162.153/1		f	k	j	g	42	adult
5-6	194.104/3	f					4-7	1-8 m
5-6	122.375			l			41-47	adult or older
5-6	124.051/2		h	m	k	k	49	senile
5-6	124.139/2		e	k	h	f	40	young adult
5-6	124.155		f	k	k		42-44	adult/old adult
5-6	124.160					b	30-34	18-36 m
5-6	124.199		f	k	j	g	42	adult
5-6	164.273/1			j	f	½	29	18-30 m
5-6	170.090/2					j	44-47	old adult/senile
4-6	136.227/3			m	k	k	47	senile
4-6	163.094/1					g	37-49	young adult or older
4-6	163.249/1	j			b	C	19-21	18-30 m
4-6	163.659/2		d	k	k	g	44	old adult
4-6	168.150	j		f	U		16	8-18 m
4-6	168.150		g	k	k	h	45	old adult
4-6	168.150		e	k	g	f	39	young adult
4-6	168.150			k	g	b	35	30-36 m

Table A12 continued. Tooth wear of mandibular teeth of cattle from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age
4-6	168.245/4	j		e	b		13	8-18 m
4-6	171.057/5	j		d			12-17	8-30 m
7	147.149/52					k	46-50	senile
7	147.149/64		e	j			39-41	young adult/adult
7	147.149/90					m	51-54	senile
7	147.158/85				k	k	46-47	senile
7	147.165/31					g	38-46	young adult or older
7	147.220/13					f	38-42	young adult/adult
7	164.299/7			m	l	l	47	senile
7	164.303/2		f	k	k	j	46	senile
7	164.325/1	j		e	½		14	8-18 m
7	165.012/3		g	k	k	j	46	senile
7	165.115/2	j		d			12-17	8-30 m
7	165.119/2			j	f	b	32	30-36 m
7	165.140/5	j		d	V		10-12	8-18 m
7	166.038				k	k	46-47	senile
7	170.066/1		f	k	j		38-41	young adult/adult
7	170.104/1	h		e	V		12	8-18 m
7	177.150/14	g					10-27	8-30 m
7	177.150/15	f		a			6-7	1-8 m
7	177.150/30			k	f	b	34	30-36 m
7	177.150/33	k		g	c	a	23	18-30 m
7	177.150/35		c	k	j	j	41	adult
7	177.150/37	j		f			14-23	8-30 m
7	177.150/60		f	k	j	f	41-42	30-36 m
7	177.150/62			j	f	b	32	18-30 m
7	177.150/72	k		h	d	a	28	18-30 m
7	177.150/73	j		d			13	8-18 m
7	177.150/148			f	b		19	18-30 m
7	177.150/203		f	j	h	g	41	adult
7	177.150/368	k		g	c		23	18-30 m
7	177.150/57	f		a			6-7	1-8 m
7	177.150/369	j		g	c		23	18-30 m
7	177.173/2			m	l	l	47	senile

Table A12 continued. Tooth wear of mandibular teeth of cattle from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age[4]
1	137.133/1		e	g	e	½	30	2-3 yr
1	215.044/6	g		e	E		13-14	6-12 m
1	233.014/1	g		e	C		11	6-12 m
1	233.023/8	g		e	C		11	6-12 m
1	233.029/1		g	k	g	g	40	4-6 yr
1	215.076/1	g		e	V		12	6-12 m
1	123.379/1	h		e	V		25	1-2 yr
1	137.063/1	f		d			9	6-12 m
1	138.049	g		e			10	6-12 m
1	138.064/1		k	g	f	d	32	2-3 yr
1	172.116/1	g		f			13-24	6 m – 2 yr
2	184.120/7		e	g	g	e	34	3-4 yr
2	184.132/6	g					5-22	2 m – 2 yr
2	184.136/1	g					5-22	2 m – 2 yr
2	184.136/4	g		d			10-17	6-12 m
2	184.136/5	g		d			10-17	6-12 m
2	184.137/1	g		d			10-17	6-12 m
2	184.136/9	g		e			11-18	6-12 m
2	184.141/3	f		b			8-10	6-12 m
2	184.147/2		f	g	g	c	32	2-3 yr
2	184.160/1			g	e		23-28	1-2 yr
2	184.166/1	f		c			9-11	6-12 m
2	184.166/2	f		c			9-11	6-12 m
2	184.166/3			g	e		23-30	1-3 yr
2	184.200/1	g					5-22	2 m – 2 yr
2	184.212/10	f					4-12	2-12 m
2	184.219/3	g					5-22	2 m – 2 yr
2	184.225/3		g	g	g	f	35	3-4 yr
2	184.225/4	g		d			10-17	6-12 m
2	184.225/5	j		g	d		22-25	1-2 yr
2	184.255/4	f		c			9-11	6-12 m
2	184.255/5	g		f			13-18	6-12 m
2	184.256/6		g	g	g	f	35	3-4 yr
2	184.257/1	g		d			10-17	6-12 m
2	184.273/1	g		d			10-17	6-12 m
2	184.304/5		h	k	g	g	40	4-6 yr
2	184.305/8	g		d			10-17	6-12 m
2	184.305/9	g		f	b		19	1-2 yr
2	184.305/10	g		e			11-21	6 m – 2 yr
2	185.060/1		h	g	g	f	35	3-4 yr
2	187.030/3	f					4-12	2-12 m

Table A13. Tooth wear of mandibular teeth of sheep/goat from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

4 Age estimated according to Hambleton's comparison of Grant's and Payne's methods.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age
2	187.126/1		k	m	k	h	46	> 8 yr
2	183.127/1	h		g			14-18	6-12 m
2	184.063/1	h		g	f		24	1-2 yr
2	189.061/8		f	g	g	d	33	2-3 yr
2	189.061/12	g		d	V		11	6-12 m
2	189.068/20	g		d	E		12	6-12 m
2	189.068/21	g		d	V		11	6-12 m
2	189.068/22	g		d	E		12	6-12 m
2	189.071/4	g		d			10-17	6-12 m
2	189.076/9	g		d	E		12	6-12 m
2	190.047/6			h	g	g	37	3-4 yr
2	190.052/2		j	k			37-41	3-6 yr
2	191.084/2	h		g	d		22-24	1-2 yr
2	191.090/2					g	36-46	> 3 yr
2	211.099/1	h		d			10-17	6-12 m
2	211.260/2		f	g	g		28-35	2-4 yr
2	211.100/3	h		c			9-11	6-12 m
2	211.151/13		g	k	g	g	40	4-6 yr
2	211.173/1		g	j	h	g	39	4-6 yr
2	122.200/5	g		d			10-17	6-12 m
2	122.223	g		d	½		13	6-12 m
2	122.167		h	j	g		34-38	3-6 yr
2	233.022/2					g	36-46	> 3 yr
2	233.022/3					b	28-31	1-3 yr
2	233.061/1		e	g	e		23	1-2 yr
2	177.158/3	f		b			8-10	6-12 m
2	209.027/2	f					4-12	2-12 m
2	123.147/4	j		g	½		16-17	6-12 m
2	123.161/8		g	m	g		41	4-6 yr
2	122.302/10	g		d			10-17	6-12 m
2	122.347/5	g		d			10-17	6-12 m
2	123.134/1			g	c		20	1-2 yr
2	123.141/1					c	29-34	2-4 yr
2	123.193/2		h	h	g		28-37	1-4 yr
2	162.040/1	g		b	C		8	6-12 m
2	120.065/1		g	g	g	g	36	3-4 yr
2	120.079/1			g	d		22-29	1-3 yr
2	165.145/1			g	c		21-24	1-2 yr
2	168.207/9		g	h	g	g	37	3-4 yr
2	177.156/3		h	k	g	g	40	4-6 yr
2	177.156/4		f	g		c	29-32	2-3 yr
2	177.156/5	g		f	d	E	23-24	1-2 yr
2	209.020/2	f		b			8-10	6-12 m
2	179.114/2	g		d			10-12	6-12 m

Table A13 continued. Tooth wear of mandibular teeth of sheep/goat from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age
2	184.205/1		g	g	g	e	34	3-4 yr
2	209.019/1	h		g			14-28	6 m – 2 yr
2-3	210.216/1	g					5-22	2 m – 2 yr
3	122.168/1			g	f	½	27	1-2 yr
3	122.168/3		f	h	g	d	34	3-4 yr
3	122.168/2		h	l	g	g	39	4-6 yr
3	122.170/8		g	g	g	d	33	2-3 yr
3	122.177/4		h		g	g	36-40	3-6 yr
3	123.025					g	36-46	> 3 yr
3	136.124			g	g	f	35	3-4 yr
3	136.124/3	g					5-22	2 m – 2 yr
3	136.164/6	h		f			13-24	6 m – 2 yr
3	163.265/3	h		g	d		21	1-2 yr
3	163.419/11		g	h	g	g	37	3-4 yr
3	177.178	g		e			11-21	6 m – 2 yr
3	177.183/1			k	g		37-39	3-6 yr
3	184.081/2				g	e	34-38	3-6 yr
3	184.297/1	f		c			9-11	6-12 m
3	184.386/2					g	36-46	>3 yr
3	188.106/1					e	33-38	3-6 yr
3	210.178/10		f	g	e	c	30	2-3 yr
3	210.178/9		g	g	g	c	32	2-3 yr
3	210.178/8	h		g	d		22-24	1-2 yr
3	216.286/2			k			37-41	3-6 yr
3	216.268/3		h	j	g	g	37	3-4 yr
3	216.299/1	h		g			18-24?	6 m – 2 yr
3	225.196/1	g		d	E		12	6-12 m
3.1	123.237/2		j	l	g	g	39	4-6 yr
3.1	123.237/1	g					5-22	2 m – 2 yr
3.1	123.253/18			g	g	g	36	3-4 yr
3.1	123.253/14	h		g	d		21	1-2 yr
3.1	161.095/2		h	k	g	g	40	4-6 yr
3.1	161.095/4					g	36-46	> 3 yr
3.1	161.109/1		g	g	g	d	33	2-3 yr
3.1	161.114/4		g	g	g		27-36	1-4 yr
3.1	161.114/2	g		d			9	6-12 m
3.1	163.315/1			g	f	c	31	2-3 yr
3.1	163.511/1			m	j	g	43	6-8 yr
3.2	123.270/1	f		c			8	6-12 m
3.2	135.112/1		g	h	g		28-37	1-4 yr
3.2	137.169/4	g		e			11-21	6 m – 2 yr
3.2	216.186/1			g	e		23-30	1-3 yr
3.2	216.314/1					c	29-34	2-4 yr
3.2	228.208/1	g		d	V		11	6-12 m

Table A13 continued. Tooth wear of mandibular teeth of sheep/goat from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age
3.2	228.210/1	g		d	V		11	6-12 m
3.2	228.211/2					g	36-46	> 3 yr
3-4	135.167/3	f		d			10-12	6-12 m
4	182.072/7	g					5-22	2 m – 2 yr
4	182.085/1			h			21-37	1-4 yr
4	210.105/6	g					5-22	2 m – 2 yr
4	210.118/6					b	28-31	1-3 yr
4	210.146/3					c	29-34	2-4 yr
4	211.183/1	h		c			9-11	6-12 m
4	163.699/3			m	k	g	45	8-10 yr
4	164.186/2	g		d			22-29	1-3 yr
5-6	173.116/1		h	j	g	g	38	4-6 yr
5-6	123.373/7		j	k	g	g	40	4-6 yr
4-6	180.207/8		e	g	e	c	30	2-3 yr
4-6	178.083/2		g	k	g	g	40	4-6 yr
4-6	180.092/11	h		e			11-21	6 m – 2 yr
7	177.150/71		g	g	g	g	36	3-4 yr
7	177.150/359					g	36-46	> 3 yr
7	147.158/33	g					5-22	2 m – 2 yr
7	147.158/35	g		f			13-17	6-12 m
7	180.181/3			m	k		44-47	> 6 yr
7	165.163/1			g	e		23-30	1-3 yr
7	166.058/4			g	e	U	27	1-2 yr
7	170.113/2		j	l	g	g	39	4-6 yr
7	170.126/2					d	32-34	2-4 yr
7	170.133/2	h		g	d		22-29	1-3 yr

Table A13 continued. Tooth wear of mandibular teeth of sheep/goat from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age
1	233.026/7					c	34-38	21-27 m
1	233.038/2		a	d			18-19	14-21 m
1	123.379/5				d	U	25-30	14-21 m
1	172.069/1	e		c			9-12	7-14 m
1	172.115/1		b	e	b		18-23	14-21 m
1	172.116/5			e	a		17-18	7-21 m
1	172.119/4		b	h	e	a	29	14-21 m
2	184.308/1		d	m	e	b	34	21-27 m
2	184.321/3	d					3-6	2-7 m
2	185.046/7				d		24-29	14-21 m
2	187.117/2					a	23-35	14-27 m
2	190.051/5		d	g	d	a	27	14-21 m
2	190.051/6				d	a	27-31	14-21 m

Table A14. Tooth wear of mandibular teeth of pig from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age
2	233.022/1		b	h	e	a	29	14-21 m
2	234.012/1				b	1/2	20-25	14-21 m
2	234.018/3		a	d	a	C	16	7-14 m
2	122.344/14	g		d	½		12-15	7-14 m
2	123.161/1		b	e			18-23	14-21 m
2	123.285/1		e	k	f	c	35	21-27 m
2	146.178/1	d		e			10	7-14 m
2	163.757/1		b	g	d	U	26	14-21 m
2	165.015/4		½	e	a		17	7-14 m
2	165.113/8		a	f	a		18-20	14-21 m
2	168.207/31	d		b			7	2-7 m
2	179.114/4		c	j	e	a	30	14-21 m
2	179.181/1	e					30-38	14-27 m
2	184.309/1		c	l	f	b	33	21-27 m
3	163.419/9		b		d	U	25-30	14-21 m
3.1	163.738/1			c			8	2-7 m
3.1	168.325/4	h		c			9-15	7-14 m
3.1	163.241		b	f	d		20	14-21 m
4	146.130/10				a	C	15-18	7-21 m
4	164.205/2				f	c	35-36	21-27 m
5-6	186.049/1				a		15-17	7-14 m
5-6	123.373/6			g	c		22-27	14-21 m
5-6	124.048/2			g	d	a	27	14-21 m
5-6	124.049/3		f			e	42	21-27 m
5-6	124.111/2			e	a		17-18	7-21 m
5-6	124.146/2		d	j	e	b	31	14-21 m
5-6	170.036/4	e		a	C		16	7-14 m
5-6	170.130/5			e	c		19-23	14-21 m
4-6	168.100		b	f	e	a	27	14-21 m
4-6	168.344/3			f	c		23-25	14-21 m
4-6	122.213	b					1-8	0-7 m
3-6	163.157/5		b	h	d		22	14-21 m
3-6	163.270/4		c	e	d		19	14-21 m
3-6	163.416/4			h	f	b	31	14-21 m
3-6	163.417/2					c	34-38	21-27 m
7	147.158/97	d					3-6	2-7 m
7	147.165/43		b	h	e	b	29-30	14-21 m
7	147.203/2		d	h	f		31-33	14-27 m
7	147.206/6		f	l			32-38	14-27 m
7	147.209/12		d	l	h	d	38	21-27 m
7	147.210/2					d	33-43	21-36 m
7	147.220/10					e	42-43	21-36 m
7	180.190/1			h	e	a	29	14-21 m
7	180.190/4					c	34-38	21-27 m

Table A14 continued. Tooth wear of mandibular teeth of pig from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

Phase	Find nr	dp4	P4	M1	M2	M3	MWS	Age
7	124.212/1		b	f			20	14-21 m
7	124.248/1				e	a	29-32	14-21 m
7	124.261/3				d	a	27-31	14-21 m
7	147.067/1		b	e			10	7-14 m
7	164.244/9				c		19-29	14-21 m
7	165.089/1				e	a	29-32	14-21 m
7	165.140/2				d	a	27-31	14-21 m
7	165.154/6				m	j	47	old adult
7	167.194		e	h	f		33	21-27 m
7	170.072/2			e	a		17-18	7-21 m
7	170.075/5				j	d	40-42	21-27 m
7	170.080			k	h	c	37	21-27 m
7	170.082/3		e	j			30-36	14-27 m
7	170.095/8			e	d	E	22	14-21 m
7	170.126/23				d	a	27-31	14-21 m
7	171.098				e	c	32-36	14-27 m

Table A14. Tooth wear of mandibular teeth of pig from Passewaaijse Hogeweg. Tooth Wear Stages and Mandible Wear Stages according to Grant 1982.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	0	0		
	humerus distal	2	1	3		
	radius proximal	0	5	5		
	acetabulum	0	0	0		
	total	***2***	***6***	***8***	***25***	***#***
1 - 2 years	phalanx 1	0	1	1		
	phalanx 2	0	0	0		
	metacarpus distal	3	0	3		
	tibia distal	1	1	2		
	metatarsus distal[5]	1	1	2		
	metapodials distal	0	0	0		
Category	**Element**	**Unfused**	**Fused**	**Total**	**% unfused**	**% killed**
	total	***5***	***3***	***8***	***62.5***	***#***
2 – 3 years	ulna proximal	0	1	1		
	femur proximal	0	0	0		
	calcaneum	0	0	0		
	total	***0***	***1***	***1***	***0***	***#***

Table A15. Epiphyseal fusion data for sheep, Passewaaijse Hogeweg phase 1. # means the numbers were too low to calculate percentages.

5 Silver states that the distal metatarsus fuses between 20 and 28 months. I have included the distal metatarsus in the category 1-2 years for two reasons. First, Habermehl estimates the fusion to take place between 20 and 24 months, and second, this will avoid overlapping categories and allow for unspecified metapodial epiphyses to be included in the age analysis.

Category	Element	Unfused	Fused	Total	% unfused	% killed
3 – 3.5 years	humerus proximal	0	0	0		
	radius distal	1	2	3		
	femur distal	1	0	1		
	tibia proximal	1	2	3		
	total	***3***	***4***	***7***	***42.9***	***#***
> 3.5 years						#

Table A15 continued. Epiphyseal fusion data for sheep, Passewaaijse Hogeweg phase 1. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	0	0		
	acetabulum	2	4	6		
	total	***2***	***4***	***6***	***33.3***	***#***
1 – 2 years	humerus distal	0	3	3		
	radius proximal	0	2	2		
	phalanx 1	3	2	5		
	phalanx 2	1	4	5		
	total	***4***	***11***	***15***	***26.7***	***0-2 yr: 26.7***
2 – 3 years	metacarpus distal	4	1	5		
	metatarsus distal	1	2	3		
	metapodials distal	1	3	4		
	tibia distal	2	1	3		
	total	***8***	***7***	***15***	***53.3***	***26.6***
3 – 4 years	humerus proximal	0	0	0		
	radius distal	0	0	0		
	ulna proximal	1	0	1		
	femur proximal	0	0	0		
	femur distal	0	0	0		
	tibia proximal	0	0	0		
	calcaneum	1	2	3		
	total	***2***	***2***	***4***	***50***	***#***
> 4 years						> 3 yr: 46.7

Table A16. Epiphyseal fusion data for cattle, Passewaaijse Hogeweg phase 1. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	0	0		
	phalanx 2	0	2	2		
	total	***0***	***2***	***2***	***0***	***#***
1 – 2 years	humerus distal	0	0	0		
	radius proximal	0	0	0		
	metacarpus distal	0	2	2		
	metatarsus distal	0	0	0		
	metapodials distal	0	0	0		
	acetabulum	0	1	1		
	tibia distal	0	0	0		
	phalanx 1	1	1	2		
	total	***1***	***4***	***5***	***20***	***#***
2 – 3.5 years	humerus proximal	0	0	0		
	radius distal	0	0	0		
	ulna proximal	0	0	0		
	femur proximal	0	0	0		
	femur distal	0	0	0		
	tibia proximal	0	0	0		
	calcaneum	0	0	0		
	total	***0***	***0***	***0***	***0***	***#***
> 3.5 years						#

Table A17. Epiphyseal fusion data for horse, Passewaaijse Hogeweg phase 1. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	1	1		
	humerus distal	2	0	2		
	radius proximal	0	0	0		
	acetabulum	0	1	1		
	total	***2***	***2***	***4***	***50***	***#***
1 – 2.5 years	metacarpus distal	0	0	0		
	tibia distal	0	1	1		
	calcaneum	1	0	1		
	metatarsus distal	0	0	0		
	metapodials distal	3	0	3		
	total	***4***	***1***	***5***	***80***	***#***
2.5 – 3.5 years	humerus proximal	2	0	2		
	radius distal	0	0	0		
	ulna proximal	0	0	0		
	femur proximal	0	0	0		
	femur distal	0	0	0		
	tibia proximal	0	0	0		
	total	***2***	***0***	***2***	***100***	***#***
> 3.5 years						#

Table A18. Epiphyseal fusion data for pig, Passewaaijse Hogeweg phase 1. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	6	6		
	humerus distal	4	10	14		
	radius proximal	2	9	11		
	acetabulum	2	6	8		
	total	***8***	***31***	***39***	***20.5***	***20.5***
1 - 2 years	phalanx 1	4	7	11		
	phalanx 2	1	0	1		
	metacarpus distal	8	2	10		
	tibia distal	7	9	16		
	metatarsus distal	4	0	4		
	metapodials distal	3	0	3		
	total	***27***	***18***	***45***	***60.0***	***39.5***
2 – 3 years	ulna proximal	4	1	5		
	femur proximal	4	4	8		
	calcaneum	1	0	1		
	total	9	5	14	64.3	4.3
3 – 3.5 years	humerus proximal	2	0	2		
	radius distal	7	3	10		
	femur distal	2	2	4		
	tibia proximal	3	1	4		
	total	***14***	***6***	***20***	***70***	***5.7***
> 3.5 years						30.0

Table A19. Epiphyseal fusion data for sheep, Passewaaijse Hogeweg phase 2.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	8	8		
	acetabulum	1	3	4		
	total	***1***	***11***	***12***	***8.3***	***8.3***
1 – 2 years	humerus distal	2	9	11		
	radius proximal	0	7	7		
	phalanx 1	7	17	24		
	phalanx 2	5	15	20		
	total	***14***	***48***	***62***	***22.6***	***14.3***
2 – 3 years	metacarpus distal	5	4	9		
	metatarsus distal	1	3	4		
	metapodials distal	4	7	11		
	tibia distal	3	13	16		
	total	***13***	***27***	***40***	***32.5***	***9.9***
3 – 4 years	humerus proximal	2	0	2		
	radius distal	2	1	3		
	ulna proximal	2	0	2		
	femur proximal	3	1	4		
	femur distal	1	1	2		
	tibia proximal	0	1	1		
	calcaneum	3	1	4		
	total	***13***	***5***	***18***	***72.2***	***39.7***
> 4 years						27.8

Table A20. Epiphyseal fusion data for cattle, Passewaaijse Hogeweg phase 2.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	2	2		
	phalanx 2	1	1	2		
	total	***1***	***3***	***4***	***25***	***#***
1 – 2 years	humerus distal	0	2	2		
	radius proximal	1	3	4		
	metacarpus distal	0	3	3		
	metatarsus distal	0	0	0		
	metapodials distal	0	3	3		
	acetabulum	1	5	6		
	tibia distal	1	3	4		
	phalanx 1	0	3	3		
	total	***3***	***22***	***25***	***12***	***0-2 yr: 12.0***
2 – 3.5 years	humerus proximal	0	1	1		
	radius distal	0	1	1		
	ulna proximal	0	0	0		
	femur proximal	0	2	2		
	femur distal	0	3	3		
	tibia proximal	0	1	1		
	calcaneum	0	0	0		
	total	***0***	***8***	***8***	***0***	***#***
> 3.5 years						#

Table A21. Epiphyseal fusion data for horse, Passewaaijse Hogeweg phase 2. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	0	0		
	humerus distal	0	3	3		
	radius proximal	0	0	0		
	acetabulum	0	0	0		
	total	***0***	***3***	***3***	***0***	***#***
1 – 2.5 years	metacarpus distal	1	2	3		
	tibia distal	1	0	1		
	calcaneum	0	0	0		
	metatarsus distal	0	1	1		
	metapodials distal	3	0	3		
	total	***5***	***3***	***8***	***62.5***	***#***
2.5 – 3.5 years	humerus proximal	0	0	0		
	radius distal	0	0	0		
	ulna proximal	0	0	0		
	femur proximal	1	0	1		
	femur distal	0	0	0		
	tibia proximal	1	0	1		
	total	***2***	***0***	***2***	***100***	***#***
> 3.5 years						#

Table A22. Epiphyseal fusion data for pig, Passewaaijse Hogeweg phase 2. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 years	scapula	0	2	2		
	humerus distal	2	3	5		
	radius proximal	0	2	2		
	acetabulum	0	0	0		
	total	***2***	***7***	***9***	***22.2***	***#***
1 - 2 years	phalanx 1	0	20	20		
	phalanx 2	0	20	20		
	metacarpus distal	2	7	9		
	tibia distal	1	2	3		
	metatarsus distal	2	5	7		
	metapodials distal	4	1	5		
	total	***9***	***55***	***64***	***14.1***	***0-2 yr: 15.1***
2 – 3 years	ulna proximal	0	0	0		
	femur proximal	0	0	0		
	calcaneum	3	0	3		
	total	3	0	3	100	#
3 – 3.5 years	humerus proximal	2	0	2		
	radius proximal	3	1	4		
	femur distal	1	1	2		
	tibia proximal	0	2	2		
	total	***6***	***4***	***10***	***60***	***2-3.5 yr: 69.2***
> 3.5 years						30.8

Table A23. Epiphyseal fusion data for sheep, Passewaaijse Hogeweg phase 3. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 years	scapula	1	4	5		
	acetabulum	1	2	3		
	total	***2***	***6***	***8***	***25***	***#***
1 – 2 years	humerus distal	0	4	4		
	radius proximal	0	9	9		
	phalanx 1	1	8	9		
	phalanx 2	2	4	6		
	total	***3***	***25***	***28***	***10.7***	***0-2 yr: 16.1***
2 – 3 years	metacarpus distal	1	3	4		
	metatarsus distal	1	2	3		
	metapodials distal	0	2	2		
	tibia distal	1	4	5		
	total	***3***	***11***	***14***	***21.4***	***5.3***
3 – 4 years	humerus proximal	0	1	1		
	radius distal	1	2	3		
	ulna proximal	0	0	0		
	femur proximal	5	2	7		
	femur distal	0	2	2		
	tibia proximal	0	0	0		
	calcaneum	3	0	3		
	total	***9***	***7***	***16***	***56.3***	***31.3***
> 4 years						43.7

Table A24. Epiphyseal fusion data for cattle, Passewaaijse Hogeweg phase 3. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	3	3		
	phalanx 2	0	3	3		
	total	***0***	***6***	***6***	***0***	***#***
1 – 2 years	humerus distal	0	1	1		
	radius proximal	0	1	1		
	metacarpus distal	0	4	4		
	metatarsus distal	1	2	3		
	metapodials distal	0	4	4		
	acetabulum	0	3	3		
	tibia distal	0	1	1		
	phalanx 1	2	5	7		
	total	***3***	***21***	***24***	***12.5***	***12.5***
2 – 3.5 years	humerus proximal	0	0	0		
	radius distal	0	1	1		
	ulna proximal	0	0	0		
	femur proximal	1	1	2		
	femur distal	1	1	2		
	tibia proximal	1	0	1		
	calcaneum	0	0	0		
	total	***3***	***3***	***6***	***50***	***#***
> 3.5 years						#

Table A25. Epiphyseal fusion data for horse, Passewaaijse Hogeweg phase 3. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	0	0		
	humerus distal	0	1	1		
	radius proximal	1	0	1		
	acetabulum	0	1	1		
	total	***1***	***2***	***3***	***33.3***	***#***
1 – 2.5 years	metacarpus distal	2	1	3		
	tibia distal	0	0	0		
	calcaneum	1	0	1		
	metatarsus distal	0	0	0		
	metapodials distal	0	0	0		
	total	***3***	***1***	***4***	***75***	***#***
2.5 – 3.5 years	humerus proximal	0	0	0		
	radius distal	0	0	0		
	ulna proximal	0	0	0		
	femur proximal	0	0	0		
	femur distal	0	0	0		
	tibia proximal	1	0	1		
	total	***1***	***0***	***1***	***100***	***#***
> 3.5 years						#

Table A26. Epiphyseal fusion data for pig, Passewaaijse Hogeweg phase 3. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	0	0		
	humerus distal	1	2	3		
	radius proximal	1	1	2		
	acetabulum	1	1	2		
	total	***3***	***4***	***7***	***42.9***	***#***
1 - 2 years	phalanx 1	1	0	1		
	phalanx 2	0	0	0		
	metacarpus distal	2	2	4		
	tibia distal	1	5	6		
	metatarsus distal	0	1	1		
	metapodials distal	4	1	5		
	total	***8***	***9***	***17***	***47.1***	***0-2 yr: 45.8***
2 – 3 years	ulna proximal	0	0	0		
	femur proximal	0	0	0		
	calcaneum	2	1	3		
	total	2	1	3	66.7	#
3 – 3.5 years	humerus proximal	1	0	1		
	radius distal	0	0	0		
	femur distal	1	0	1		
	tibia proximal	0	0	0		
	total	***2***	***0***	***2***	***100***	***#***
> 3.5 years						#

Table A27. Epiphyseal fusion data for sheep, Passewaaijse Hogeweg phase 4. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	6	6		
	acetabulum	0	3	3		
	total	***0***	***9***	***9***	***0***	***0***
1 – 2 years	humerus distal	2	3	5		
	radius proximal	0	10	10		
	phalanx 1	0	5	5		
	phalanx 2	0	6	6		
	total	***2***	***24***	***26***	***7.7***	***7.7***
2 – 3 years	metacarpus distal	3	1	5		
	metatarsus distal	1	2	3		
	metapodials distal	1	4	5		
	tibia distal	1	2	3		
	total	***6***	***9***	***15***	***40***	***32.3***
3 – 4 years	humerus proximal	0	0	0		
	radius distal	1	1	2		
	ulna proximal	0	0	0		
	femur proximal	4	2	6		
	femur distal	2	1	3		
	tibia proximal	0	0	0		
	calcaneum	2	0	2		
	total	***9***	***4***	***13***	***69.2***	***29.2***
> 4 years						30.8

Table A28. Epiphyseal fusion data for cattle, Passewaaijse Hogeweg phase 4.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	3	3		
	phalanx 2	0	1	1		
	total	***0***	***4***	***4***	***0***	***0***
1 – 2 years	humerus distal	0	2	2		
	radius proximal	1	6	7		
	metacarpus distal	2	4	6		
	metatarsus distal	2	3	5		
	metapodials distal	1	2	3		
	acetabulum	3	2	5		
	tibia distal	4	4	8		
	phalanx 1	1	6	7		
	total	***14***	***29***	***43***	***32.6***	***32.6***
2 – 3.5 years	humerus proximal	0	1	1		
	radius distal	3	3	6		
	ulna proximal	1	1	2		
	femur proximal	1	2	3		
	femur distal	0	3	3		
	tibia proximal	1	1	2		
	calcaneum	1	1	2		
	total	***7***	***12***	***19***	***36.8***	***4.2***
> 3.5 years						63.2

Table A29. Epiphyseal fusion data for horse, Passewaaijse Hogeweg phase 4.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	1	1		
	humerus distal	0	2	2		
	radius proximal	0	0	0		
	acetabulum	0	0	0		
	total	***0***	***3***	***3***	***0***	***#***
1 – 2.5 years	metacarpus distal	0	0	0		
	tibia distal	1	0	1		
	calcaneum	0	0	0		
	metatarsus distal	0	0	0		
	metapodials distal	0	0	0		
	total	***1***	***0***	***1***	***100***	***#***
2.5 – 3.5 years	humerus proximal	1	0	1		
	radius distal	0	0	0		
	ulna proximal	0	0	0		
	femur proximal	0	0	0		
	femur distal	1	0	1		
	tibia proximal	0	0	0		
	total	***2***	***0***	***2***	***100***	***#***
> 3.5 years						#

Table A30. Epiphyseal fusion data for pig, Passewaaijse Hogeweg phase 4. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	0	0		
	humerus distal	0	0	0		
	radius proximal	1	0	1		
	acetabulum	0	1	1		
	total	***1***	***1***	***2***	***50***	***#***
1 - 2 years	phalanx 1	0	2	2		
	phalanx 2	0	1	1		
	metacarpus distal	0	1	1		
	tibia distal	2	1	3		
	metatarsus distal	0	0	0		
	metapodials distal	1	0	1		
	total	***3***	***5***	***8***	***37.5***	***#***
2 – 3 years	ulna proximal	0	0	0		
	femur proximal	0	0	0		
	calcaneum	1	0	1		
	total	***1***	***0***	***1***	***100***	***#***
3 – 3.5 years	humerus proximal	0	0	0		
	radius distal	0	0	0		
	femur distal	0	0	0		
	tibia proximal	1	0	1		
	total	***1***	***0***	***1***	***100***	***#***
> 3.5 years						50

Table A31. Epiphyseal fusion data for sheep, Passewaaijse Hogeweg phase 5-6. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	4	4		
	acetabulum	1	5	6		
	total	***1***	***9***	***10***	***10***	***10***
1 – 2 years	humerus distal	0	4	4		
	radius proximal	0	7	7		
	phalanx 1	1	6	7		
	phalanx 2	0	3	3		
	total	***1***	***20***	***21***	***4.8***	***0***
2 – 3 years	metacarpus distal	2	1	3		
	metatarsus distal	0	2	2		
	metapodials distal	1	5	6		
	tibia distal	2	3	5		
	total	***5***	***11***	***16***	***31.2***	***21.2***
3 – 4 years	humerus proximal	0	0	0		
	radius distal	1	2	3		
	ulna proximal	1	0	1		
	femur proximal	2	3	5		
	femur distal	1	1	2		
	tibia proximal	0	5	5		
	calcaneum	1	2	3		
	total	***6***	***13***	***19***	***31.6***	***0.4***
> 4 years						68.4

Table A32. Epiphyseal fusion data for cattle, Passewaaijse Hogeweg phase 5-6.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	2	1	3		
	phalanx 2	0	2	2		
	total	***2***	***3***	***5***	***40***	***#***
1 – 2 years	humerus distal	3	4	7		
	radius proximal	4	1	5		
	metacarpus distal	1	2	3		
	metatarsus distal	0	2	2		
	metapodials distal	1	1	2		
	acetabulum	0	2	2		
	tibia distal	1	6	7		
	phalanx 1	2	4	6		
	total	***12***	***22***	***34***	***35.3***	***0-2 yr: 36.6***
2 – 3.5 years	humerus proximal	0	2	2		
	radius distal	4	2	6		
	ulna proximal	0	1	1		
	femur proximal	1	3	4		
	femur distal	2	2	4		
	tibia proximal	1	2	3		
	calcaneum	1	2	3		
	total	***9***	***14***	***23***	***39.1***	***2.5***
> 3.5 years						60.9

Table A33. Epiphyseal fusion data for horse, Passewaaijse Hogeweg phase 5-6. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	4	4		
	humerus distal	1	1	2		
	radius proximal	0	5	5		
	acetabulum	0	4	4		
	total	***1***	***14***	***15***	***6.7***	***6.7***
1 – 2.5 years	metacarpus distal	2	2	4		
	tibia distal	1	2	3		
	calcaneum	1	0	1		
	metatarsus distal	0	1	1		
	metapodials distal	0	0	0		
	total	***4***	***5***	***9***	***44.4***	***#***
2.5 – 3.5 years	humerus proximal	0	0	0		
	radius distal	2	0	2		
	ulna proximal	0	0	0		
	femur proximal	0	0	0		
	femur distal	1	0	1		
	tibia proximal	0	0	0		
	total	***3***	***0***	***3***	***100***	***#***
> 3.5 years						#

Table A34. Epiphyseal fusion data for pig, Passewaaijse Hogeweg phase 5-6. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	1	0	1		
	humerus distal	1	2	3		
	radius proximal	2	2	4		
	acetabulum	1	2	3		
	total	***5***	***6***	***11***	***45.5***	***45.5***
1 - 2 years	phalanx 1	2	4	6		
	phalanx 2	0	1	1		
	metacarpus distal	2	4	6		
	tibia distal	3	6	9		
	metatarsus distal	0	1	1		
	metapodials distal	4	2	6		
	total	***11***	***18***	***29***	***37.9***	***0***
2 – 3 years	ulna proximal					
	femur proximal	1	1	2		
	calcaneum	5	2	7		
	total	***6***	***3***	***9***	***67.7***	***#***
3 – 3.5 years	humerus proximal	1	0	1		
	radius distal					
	femur distal	1	0	1		
	tibia proximal	2	0	2		
	total	***4***	***0***	***4***	***100***	***#***
> 3.5 years						#

Table A35. Epiphyseal fusion data for sheep, Passewaaijse Hogeweg phase 4-6. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	5	5		
	humerus distal	1	6	7		
	radius proximal	0	5	5		
	acetabulum	0	4	4		
	total	***1***	***20***	***21***	***4.8***	***4.8***
1 – 2.5 years	metacarpus distal	3	2	5		
	tibia distal	2	3	5		
	calcaneum	1	0	1		
	metatarsus distal	0	1	1		
	metapodials distal	0	0	0		
	total	***6***	***6***	***12***	***50.0***	***45.2***
2.5 – 3.5 years	humerus proximal	1	0	1		
	radius distal	2	0	2		
	ulna proximal	0	0	0		
	femur proximal	0	0	0		
	femur distal	3	0	3		
	tibia proximal	0	1	1		
	total	***6***	***1***	***7***	***85.7***	***#***
> 3.5 years						#

Table A36. Epiphyseal fusion data for pig, Passewaaijse Hogeweg phase 4-6. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	1	1		
	humerus distal	1	0	1		
	radius proximal	0	0	0		
	acetabulum	0	1	1		
	total	***1***	***2***	***3***	***33.3***	***#***
1 - 2 years	phalanx 1	0	1	1		
	phalanx 2	0	0	0		
	metacarpus distal	1	1	2		
	tibia distal	1	2	3		
	metatarsus distal	1	1	2		
	metapodials distal	0	0	0		
	total	***3***	***5***	***8***	***37.5***	***#***
2 – 3 years	ulna proximal	0	0	0		
	femur proximal	1	2	3		
	calcaneum	0	0	0		
	total	***1***	***2***	***3***	***33.3***	***#***
3 – 3.5 years	humerus proximal	1	0	1		
	radius distal	0	0	0		
	femur distal	1	0	1		
	tibia proximal	1	0	1		
	total	***3***	***0***	***3***	***100***	***#***
> 3.5 years						

Table A37. Epiphyseal fusion data for sheep, Passewaaijse Hogeweg phase 7. # means the numbers were too low to calculate percentages.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	5	16	21		
	acetabulum	7	10	17		
	total	***12***	***26***	***38***	***31.6***	***31.6***
1 – 2 years	humerus distal	5	19	24		
	radius proximal	2	15	17		
	phalanx 1	1	15	16		
	phalanx 2	0	9	9		
	total	***8***	***58***	***66***	***12.1***	***0***
2 – 3 years	metacarpus distal	2	6	8		
	metatarsus distal	3	5	8		
	metapodials distal	3	1	4		
	tibia distal	7	9	16		
	total	***15***	***21***	***36***	***41.7***	***10.1***
3 – 4 years	humerus proximal	2	1	3		
	radius distal	6	10	16		
	ulna proximal	8	2	10		
	femur proximal	12	7	19		
	femur distal	8	5	13		
	tibia proximal	14	10	24		
	calcaneum	7	5	12		
	total	***57***	***40***	***97***	***58.8***	***17.1***
> 4 years						41.2

Table A38. Epiphyseal fusion data for cattle, Passewaaijse Hogeweg phase 7.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	4	11	15		
	phalanx 2	0	9	9		
	total	***4***	***20***	***24***	***16.7***	***16.7***
1 – 2 years	humerus distal	6	4	10		
	radius proximal	7	3	10		
	metacarpus distal	3	3	6		
	metatarsus distal	5	8	13		
	metapodials distal	1	0	1		
	acetabulum	3	11	14		
	tibia distal	8	6	14		
	phalanx 1	2	7	9		
	total	***35***	***42***	***77***	***45.5***	***28.8***
2 – 3.5 years	humerus proximal	1	0	1		
	radius distal	11	3	14		
	ulna proximal	1	0	1		
	femur proximal	7	2	9		
	femur distal	7	2	9		
	tibia proximal	4	4	8		
	calcaneum	4	1	5		
	total	***35***	***12***	***47***	***74.5***	***29***
> 3.5 years						25.5

Table A39. Epiphyseal fusion data for horse, Passewaaijse Hogeweg phase 7.

Category	Element	Unfused	Fused	Total	% unfused	% killed
< 1 year	scapula	0	10	10		
	humerus distal	2	15	17		
	radius proximal	0	13	13		
	acetabulum	1	12	13		
	total	***3***	***50***	***53***	***5.7***	***5.7***
1 – 2.5 years	metacarpus distal	5	5	10		
	tibia distal	4	9	13		
	calcaneum	1	0	1		
	metatarsus distal	1	6	7		
	metapodials distal	2	4	6		
	total	***13***	***24***	***37***	***35.1***	***29.4***
2.5 – 3.5 years	humerus proximal	2	2	4		
	radius distal	3	1	4		
	ulna proximal	3	1	4		
	femur proximal	3	1	4		
	femur distal	6	1	7		
	tibia proximal	5	6	11		
	total	***22***	***12***	***34***	***64.7***	***29.6***
> 3.5 years						35.3

Table A40. Epiphyseal fusion data for pig, Passewaaijse Hogeweg phase 7.

Phase	Find nr	Tooth	Association	Crown height	Age (years)	Average age
2	75.165	P/Mi	-	39.0	9-11	
2	164.267/1	P2i	-	36.1	7.5 - 9.75	
2	178.98	P3i	H	18.0	17+	17.5
2	178.98	P4i	H	25.8	14+	17.5
2	178.98	M1i	H	21.0	11.75 - 18	17.5
2	178.98	M2i	H	23.2	14-20	17.5
2	178.98	M3i	H	15.9	20+	17.5
2	165.109	P/Ms	-	75.7	3 - 6.5	
2	164.173/2	M3i	-	17.8	20+	
2	120.066	P/Ms	-	56.0	7 - 9.75	
2	122.206/1	P/Ms	-	53.6	7 - 9.75	
2	123.183/2	P/Mi	-	62.0	5.25 - 7.5	
2	123.183/3	P/Mi	-	60.8	5.25 - 7.5	
3	142.169/2	P/Mi	-	37.9	9.75 - 14	
3.1	163.408/1	P/Ms	-	71.8	3 - 6.5	
3.1	163.736/6	M1s	-	69.6	5.5 - 7	
3.1	168.325/16	P/Ms	-	38.6	11 - 15.5	
3.2	163.380/2	P/Ms	-	62.5	5.5 - 8	
3.2	168.291/9	P/Mi	-	41.6	8-11	
3.2	168.291/10	P/Mi	-	37.9	9.75 - 14	
4	75.133	P/Ms	-	35.2	12-13	
4	146.052/1	P2s	B	26.8	11.5 - 14	12.6
4	146.052/2	P3s	B	35.6	11-14	12.6
4	146.052/3	M1s	B	34.9	11-14	12.6
4	146.052/4	M2s	B	37.3	11.5 - 15.5	12.6
4	146.052/5	M3s	B	39.1	10.25 - 13.5	12.6
4	163.667/2	P/Ms	-	61.0	5.5 - 8	
4	138.057/1	P/Ms	-	48.8	8.5 - 11.5	
4	148.078/1	P/Mi	-	66.9	5.25 - 7.5	
4	162.096/1	P/Mi	-	46.4	8-11	
3-4	163.515	P/Ms	-	49.3	8.5 - 11.5	
3-4	163.692/1	P/Mi	A	59.9	6.5 - 9	6.1
3-4	163.692/2	P/Mi	A	78.7	4 - 6.5	6.1
3-4	163.692/3	P/Mi	A	78.9	4 - 6.5	6.1
3-4	122.092	P/Ms	-	48.7	8.5 - 11.5	
3-4	122.093/7	P/Ms	-	68.8	5.5 - 8	
3-4	122.093/8	P/Ms	-	63.9	5.5 - 8	
3-4	122.094/3	P/Ms	-	68.3	5.5 - 8	
3-4	122.094/6	P/Mi	-	81.7	2 - 4.5	
3-4	122.157/14	P/Ms	-	55.3	7 - 9.75	
3-4	122.157/15	P/Ms	-	41.2	8.5 - 11.5	
3-4	122.197/1	P/Mi	-	59.3	6.5 - 9	
5-6	122.376/6	P/Mi	-	69.0	5.25 - 7.5	
5-6	122.409/2	P/Ms	-	63.6	5.5 - 8	
5-6	123.382/4	P/Ms	-	44.4	8.5 - 11.5	

Table A41. Crown height measurements of horse teeth from Passewaaijse Hogeweg. Ages according to Levine 1982.

Phase	Find nr	Tooth	Association	Crown height	Age (years)	Average age
5-6	123.382/5	P/Ms	-	38.2	11 - 15.5	
4-6	163.694/1	P2i	-	23.7	9.75 - 12.25	
4-6	163.695/1	P/Mi	-	46.7	8-11	
4-6	163.647/1	M3i	-	71.8	3 - 6.25	
4-6	136.110/1	P2i	-	18.9	12.25 - 16	
4-6	136.098	P2i	C	23.3	9.75 - 12.25	
4-6	136.098	P3i	C	26.1	12-17	
4-6	136.098	P4i	C	28.2	14+	
4-6	136.098	M1i	C	29.7	11.75 - 18	
4-6	136.098	M2i	C	19.1	20+	
4-6	179.151/2	P/Mi	-	41.1	8 - 11.5	
4-6	168.150/1	P2s L	K	38.1	9.5 - 11.5	8.3
4-6	168.150/1	P3s L	K	52.2	7.5 - 9	8.3
4-6	168.150/1	P2s R	K	41.6	7.5 - 9.5	8.3
4-6	168.150/1	P3s R	K	54.5	7.5 - 9	8.3
4-6	168.150/1	P4s R	K	57.7	7.75 - 9.25	8.3
4-6	168.150/1	M2s R	K	53.3	8 - 9.5	8.3
4-6	168.150/1	M3s R	K	55.3	7.5 - 8.75	8.3
4-6	168.150/8	P2i	K	36.9	7.5 - 9.75	8.3
4-6	168.150/8	P3i	K	55.5	7 - 8.25	8.3
4-6	168.150/8	P4i	K	65.4	6.5 - 7.5	8.3
4-6	168.150/8	M1i	K	56.2	6.5 - 8	8.3
4-6	168.150/8	M2i	K	59.4	7.5 - 9	8.3
4-6	168.150/8	M3i	K	53.3	7.75 - 9.25	8.3
4-6	168.150/49	P2s	L	15.2	14-20	17.8
4-6	168.150/49	P3s	L	11.4	18+	17.8
4-6	168.150/49	P4s	L	12.1	15+	17.8
4-6	168.150/91	M1i	-	64.0	5.25 - 6.5	
4-6	168.150/92	M1i	M	57.7	6.5 - 8	7.5
4-6	168.150/92	M2i	M	60.5	6 - 7.5	7.5
4-6	168.150/92	M3i	M	55.7	7.75 - 9.25	7.5
4-6	136.098	P2i	O	22.5	9.75 - 12.25	15.1
4-6	136.098	P3i	O	26.0	12-17	15.1
4-6	136.098	P4i	O	28.4	14+	15.1
4-6	136.098	M1i	O	29.7	13.75 - 18	15.1
4-6	136.098	M2i	O	23.9	14-20	15.1
7	164.070/1	P/Mi	-	58.3	6.5 - 9	
7	164.270/4	P2i	-	45.6	6 - 7.5	
7	164.303/7	M1i L	E	73.0	4 - 5.25	
7	164.303/8	M1i R	E	70.6	4 - 5.25	
7	170.065/3	P2s L	F	40.3	7.5 - 9.5	8.7
7	170.065/3	P3s L	F	44.9	9-11	8.7
7	170.065/3	P4s L	F	51.1	7.75 - 9.25	8.7
7	170.065/4	P2s R	F	40.3	7.5 - 9.5	8.7
7	170.065/4	M3s R	F	52.7	7.5 - 8.75	8.7

Table A41 continued. Crown height measurements of horse teeth from Passewaaijse Hogeweg. Ages according to Levine 1982.

Phase	Find nr	Tooth	Association	Crown height	Age (years)	Average age
7	124.305	P2s R	G	53.6	6 - 7.5	5.7
7	124.305	P3s R	G	74.6	3-6	5.7
7	124.305	P4s R	G	82.0	3-5	5.7
7	124.305	M1s R	G	64.6	5.5 - 7	5.7
7	124.305	M2s R	G	75.9	5 - 6.5	5.7
7	124.305	M3s R	G	77.5	5.5 - 6.5	5.7
7	124.305	P2s L	G	58.3	6 - 7.5	5.7
7	124.305	P3s L	G	75.0	3-6	5.7
7	124.305	P4s L	G	82.0	3-5	5.7
7	124.305	M1s L	G	63.2	5.5 - 7	5.7
7	124.305	M1i R	G	67.1	5.25 - 6.5	5.7
7	124.305	M2i R	G	64.4	6 - 7.5	5.7
7	124.305	M3i R	G	69.5	6.25 - 7.75	5.7
7	124.305	P2i L	G	67.1	3-4	5.7
7	124.305	M2i L	G	64.8	6 - 7.5	5.7
7	124.305	M3i L	G	67.6	6.25 - 7.75	5.7
7	170.137/3	P/Ms	-	65.4	5.5 - 8	
7	165.077/1	P/Mi	-	73.9	4 - 6.5	
7	165.124/2	P/Ms	-	76.1	3 - 6.5	
7	165.124/3	P/Ms	-	62.8	5.5 - 8	
7	166.051/1	M3s R	I	43.1	8.75 - 10.25	14.2
7	166.051/2	M2s R	I	38.6	11.5 - 15.5	14.2
7	166.051/3	M1s R	I	30.8	11-14	14.2
7	166.051/4	P4s R	I	33.6	11.25 - 15	14.2
7	166.051/5	P3s R	I	42.8	9-11	14.2
7	166.051/6	P2s R	I	32.5	9.5 - 11.5	14.2
7	166.051/6	P3s L	I	21.7	14-18	14.2
7	166.051/7	M1s L	I	20.0	14+	14.2
7	166.051/9	M2s L	I	21.3	15.5+	14.2
7	166.062/3	M3i	-	38.3	11.5 - 13.75	
7	166.062/4	M2i	J	31.5	11-14	12.8
7	166.062/4	M3i	J	34.2	12.5 - 13.75	12.8
7	169.042/5	M1i	-	68.8	5.25 - 6.5	
7	170.065/1	P3i L	N	47.3	8.25 - 10	8.6
7	170.065/1	P4i L	N	57.7	7.5 - 8.75	8.6
7	170.065/1	M1i L	N	48.3	8 - 9.75	8.6
7	170.065/1	M2i L	N	54.5	7.5 - 9	8.6
7	170.065/1	M3i L	N	58.8	7.75 - 9.25	8.6
7	170.065/2	P2i R	N	31.0	7.5 - 9.75	8.6
7	170.065/2	P3i R	N	45.6	8.25 - 10	8.6
7	170.065/2	P4i R	N	56.0	7.5 - 8.75	8.6
7	170.065/2	M1i R	N	48.4	8 - 9.75	8.6
7	170.065/2	M3i R	N	57.3	7.75 - 9.25	8.6
7	142.114/1	P/Ms	-	54.8	7 - 9.75	
7	163.391/1	P/Ms	-	65.4	5.5 - 8	

Table A41 continued. Crown height measurements of horse teeth from Passewaaijse Hogeweg. Ages according to Levine 1982.

Phase	Find nr	Tooth	Association	Crown height	Age (years)	Average age
7	163.572	P/Ms	-	35.8	11 - 15.5	
7	164.071/1	P2i	D	30.7	7.5 - 9.75	9.2
7	164.071/1	P3i	D	47.6	8.25 - 10	9.2
7	164.071/1	P4i	D	56.2	7.5 - 8.75	9.2
7	164.071/1	M1i	D	42.0	8 - 9.75	9.2
7	164.071/1	M2i	D	48.8	9-11	9.2
7	164.071/1	M3i	D	48.9	9.25 - 11.5	9.2
7	178.087/1	P/Ms	-	50.4	7 - 9.75	
7	179.152/2	P2i	-	26.4	9.75 - 12.25	
7	162.062/1	P/Mi	-	47.1	8-11	

Table A41 continued. Crown height measurements of horse teeth from Passewaaijse Hogeweg. Ages according to Levine 1982.

Phase	Male	Female	Total	% male	% female
1	0	2	2		
2	0	4	4		
3	0	1	1		
4	0	1	1		
5-6	0	2	2		
3-6	0	1	1		
7	6	3	9		
Total	***6***	***14***	***20***	***30***	***70***

Table A42. Sex determinations for cattle for Passewaaijse Hogeweg, based on the shape of the pubic bone.

Phase	Male	Female	Total	% male	% female
1					
2		4	4		
3					
4					
5-6	1		1		
7					
Total	***1***	***4***	***5***	***20***	***80***

Table A43. Sex determinations for sheep/goat for Passewaaijse Hogeweg, based on the shape of the pubic bone.

Phase	Male	Female	Total	% male	% female
1	1	3	4	25	75
2	7	8	15	46.7	53.3
3	3	1	4	75	25
2-3	0	1	1	-	-
4	0	0	0	-	-
5-6	4	4	8	50	50
4-6	3	3	6	50	50
7	23	6	29	79.3	20.7
Total	***41***	***26***	***67***	***61.2***	***38.8***
1-6	18	20	38	47	53

Table A44. Sex determinations for pigs for Passewaaijse Hogeweg, based on the shape and size of the canine teeth.

Phase	Male	Female	Total	% male	% female
1		1	1		
2		1	1		
3	1	1	2		
3-4		1	1		
4		1	1		
5-6	1	2	3		
4-6	3	1	4		
7	6	1	7		
Total	***11***	***9***	***20***	***55***	***45***

Table A45. Sex determinations for horse for Passewaaijse Hogeweg, based on the presence and size of the canine teeth.

Phase	Find nr	Bd	GL	Bd/GL	Sex
2	183.153/5	46.0	171	0.269	F
3	188.093/1	48.3	169	0.286	F
4-6	163.406/1	59.4	206	0.288	F
4-6	168.091/2	58.0	173	0.335	M
7	164.072/1	72.5	213	0.340	M
7	164.288/5	55.0	193	0.285	F
7	177.150/69	59.2	200	0.296	F
7	177.150/90	63.1	203	0.311	M
7	177.150/132	64.1	213	0.301	M
-	128.493/1	75.4	219	0.344	M

Table A46. Sex determinations for cattle for Passewaaijse Hogeweg, based on the distal breadth/greatest length ratio for the metacarpus.

5. Conclusion and suggestions for further research

Animal bone studies for rural settlements in the Eastern Dutch River Area have been published before, but most are of small samples, often from settlements with just one or two phases (or even worse, from sites that could not be dated accurately), or from sites where only a small section of the settlement was excavated.[1] Tiel-Passewaaij is one of the very few sites where most of a rural settlement was excavated. Furthermore, habitation in Tiel-Passewaaij covered the entire Roman period, and could be divided into a chronology that makes it possible to study changes in animal husbandry during the Roman period. The relatively large number of animal bones and the excellent preservation has allowed an analysis in which species ratios and age profiles for the most prominent species could be presented for each phase. This gives us a detailed view of the economy of a rural settlement throughout the Roman period. This by itself would make the animal bone assemblage special enough, but the combination of settlement and cemetery is what makes Tiel-Passewaaij truly unique. For the first time, the roles of animals in different contexts could be compared for the same community. This has led to new insights, especially into the use of horses in funerary ritual, something that was unknown previously. The analysis of the animal remains found in special deposits in the settlement Passewaaijse Hogeweg has led to new information on the use of animals in rituals performed within the settlement.

5.1 The roles of animals in a rural community

5.1.1 Economy: changes in animal husbandry and the production of a surplus for a market

This study has attempted to explore some of the roles of animals in a rural community in the Eastern Dutch River Area, in the frontier zone of the Roman Empire. In a rural community such as Tiel-Passewaaij, where agriculture dominated daily life, the importance of livestock cannot be overestimated. The staple food in the Roman period consisted of cereals; meat was probably not eaten every day. However, arable agriculture and animal husbandry were mutually beneficial. Livestock grazed the stubble that was left after the crops had been harvested. Not only did the animals feed on those parts of the crops that were inedible to humans, but at the same time they fertilised the fields. Cattle provided the necessary traction to work the land. Meat may not have been daily food, but when it was eaten it was a valuable source of protein as well as a valued part of the diet. Dairy products also contributed to the diet. Animal skins and bones were made into clothing and useful objects. Surplus animal products could be exchanged or sold to acquire items that were not produced in the settlement.

To obtain a more detailed view of the economy as far as animal husbandry is concerned, in chapter 2 changes in species ratios and mortality profiles were used to infer changes in the exploitation of animals. Changes in species ratios can be summed up as follows. In phases 1 to 3, sheep and cattle together accounted for about 80 % of all animal bones. In phase 4, the proportion of sheep bones started to decline. This decline continued in the next phases. At the same time, the proportion of horse bones increased in phase 4 and 5-6. The proportion of pig bones was stable until phase 5-6, when it increased.

[1] Lauwerier 1988, 90, 92; Zeiler 2001.

Mortality profiles provide information on what the animals were actually exploited for. While the age at which pigs were killed remains stable throughout the Roman period (not surprising, since meat is the only pig product of any importance), average slaughter ages for sheep and cattle varied between phases. In phases 1 and 2, sheep were killed at an early age: between 6 and 12 months. Milk and meat were the most important products of sheep in these phases. In phase 3, sheep were no longer mainly killed when they were young, but some were killed in each age category until the age of about six years. Wool was now the most important product next to meat, while the absence of young lambs shows that milk was not a primary product any more. No significant changes in mortality were observed in the next phases, but the steady decline of sheep numbers indicates that sheep and their products had lost their importance.

For cattle, slaughter peaks for meat varied per phase between two age categories: 18 to 30 months and 30 to 36 months. From phase 4 onwards the proportion of older cattle increased. Two explanations are possible for this increase. First, young cattle may have been taken to market, resulting in an overrepresentation of older breeding stock. However, a comparison between age data for cattle from Passewaaijse Hogeweg with military and urban sites in Nijmegen shows that hardly any young cattle reached these sites. Second, it may reflect a change to keeping cattle alive for longer. The most obvious reason to do so is when the products of the living animal are more important than those of the dead animal. There is no evidence that milk was utilised to any extent in these later phases, which means that the products that were now so important were traction and manure.

Since the Augustan period, Tiel-Passewaaij was not located on the border. This may explain the delay of any noticeable effect of the Roman occupation on animal husbandry. It is not until the second half of the 1st century that changes in species composition and age are observed. Changes in species ratios and mortality profiles in the second half of the 1st century AD are interpreted as a sign that Tiel-Passewaaij started to produce an agricultural surplus for the Roman markets. The type of agricultural surplus that was produced changed during the Roman period. While there was an emphasis on wool production in the 1st century, this changed to horse breeding early in the 2nd century. Both these specialisations are found in several other rural settlements in the regions, but not in all. Some settlements already had relatively large flocks of sheep in the Late Iron Age and Early Roman period. These flocks were not managed for wool, but for milk and meat. However, the change to an increased emphasis on wool was easily made. The settlements that did not already have large flocks of sheep in the early Roman period did not have the means to take advantage of the demand for wool in the second half of the 1st century.

In the early 2nd century, the decline in the proportion of sheep indicates that wool had lost its importance. The infrastructure in the Eastern Dutch River Area may have been completed by this time, enabling textile of a superior quality or with a lower price to be transported to our region over a much larger distance. *Gallia*, for instance, was well-known for its textile production.[2]

Animal bone assemblages from Passewaaijse Hogeweg and other settlements in the area are characterised by high proportions of horse bones. Horse breeding formed an important part of the animal husbandry in the 2nd and 3rd centuries AD, and in some settlements, such as Wijk bij Duurstede-De Horden, already in the 1st century AD. The fertile flood basins offered rich grazing. Parts of the flood basins flooded during winter, but the animals could have retreated to higher grounds. Horses can survive on reeds and bark and when nothing is left to eat, on their fat reserves. Optimal use was made of the dynamic river landscape. The horses stayed outdoors year round. This way of raising horses required very little in the way of labour. Children may have herded the horses to make sure they did not wander too far. The increase in the average withers height of horses reflects a desire to breed larger horses. Whether this aim for large horses was guided by the authorities, or whether the rural inhabitants pursued this by their own initiative is unknown. Larger breeding stock must have been imported into rural settlements to increase the size of the animals they were breeding.

[2] Drinkwater 1978, 109, 112.

With part of the population of the Eastern Dutch River Area living in the town of Nijmegen and the military forts along the *limes*, there must have been a demand for food. This food must have consisted to a large extent of cereals, the main component of the Roman diet, and beef.[3] However, comparison of mortality profiles for Tiel-Passewaaij and Nijmegen indicate that there was no specialised production of cattle for meat in rural settlements. The rural settlements managed their cattle herds for traction and manure in the first place and only sent their surplus animals to market after they had been useful for several years. The cattle were butchered for meat, but only at the end of a life providing other products. Apparently, no specialised production of beef was needed to answer the demand for meat. Considering that cattle supported the growing of cereals by providing labour and manure, it may have paid off to keep cattle alive for longer, and thus be able to grow larger crops of cereals. Although limited by the available land for arable agriculture, cereals were the preferred crop. The increase in withers height of cattle could reflect not only a desire for more meat per animal, but also for more power for pulling a plough. Although no evidence was found for specialised production of beef, this does not deny the importance of cattle for meat. The proportion of cattle in Tiel-Passewaaij remains stable throughout the Roman period, with only minor fluctuations. Considering their size, most of the meat consumed in Tiel-Passewaaij was beef. In the towns and military camps, beef was also the most important type of meat.

5.1.2 Animals in rituals in the settlement Passewaaijse Hogeweg

Besides the role of animals as contributors to the local economy, they also served a symbolic function. Animals were used in various ritual activities, both in the settlement and the cemetery. While chapter 3 discussed rituals involving the deposition of animal remains in the settlement Passewaaijse Hogeweg, chapter 4 focused on the role of animals in funerary ritual.

In the settlement Passewaaijse Hogeweg, a number of deposits of animal remains were very different from the animal bone refuse. These special deposits include complete animal burials, articulated limbs, skulls and concentrations of unarticulated or partially articulated bones. Not just the completeness but in some cases the animal species and in others the location or the manner in which the bones were buried set them apart as 'special'.[4] The manipulation of body parts was observed in several deposits that for that reason are considered to have had a special function. Others were associated with special finds such as large pottery sherds, an iron knife or bronze brooches. Although it was easy enough to categorise the deposits as special, the challenge was to draw any conclusions on whether they originated during ritual activities. In other words, are the special animal deposits from Passewaaijse Hogeweg ritual deposits?

Several criteria were used to distinguish between the disposal of rubbish and ritual deposits. First, if complete skeletons represent the clearing away of carcasses of animals that died from natural causes and disease, to prevent bad smells, flies and the spread of disease, then the species composition of burials of diseased animals should reflect the species ratios for the animal bone assemblage in total. This is not the case: there is clearly a preference for some species over others for burial. Furthermore, the inclusion of wild animals in special deposits strengthens the argumentation for a ritual interpretation considerably. A second argument is the occurrence of more than one individual in special deposits. Where the death of one animal can be considered accidental, the death of two or more animals at the same time seems deliberate, especially when they represent different species. The manner in which the animal remains were buried forms the next criterion. In some of the special deposits, the animal remains have clearly

3 Lauwerier 1988, 56, table 11, 58, table 14, 87, table 27, 89, table 29.

4 "Special" can either refer to the exceptional preservation of the animal remains in some of the deposits or to the ritual function of the deposit. Only after careful consideration of all special deposits and various arguments used to identify a ritual function were deposits interpreted as "ritual" or "non-ritual".

been arranged. Also, in some cases, a pit was dug especially for the burial of the remains and filled up immediately. The manipulation of some of the remains can be seen as part of this criterion. In one special deposit, the head of a sheep was replaced by a calf's head. In several others, one limb was removed. The association with special non-bone finds and the location in relation to boundaries and houses are additional criteria. In two special deposits, dogs were buried with large pottery sherds, of a size that was rarely found amongst the settlement refuse. Many of the special deposits were found in house ditches or farmyard boundary ditches. Finally, the lack of fragmentation and the good preservation were used initially to recognise special deposits. Although these factors are taphonomical, they do reflect rapid burial, whether deliberate or not.

By applying these criteria to the 62 special animal deposits from Passewaaijse Hogeweg, many were confidently assigned a ritual origin, whereas others were interpreted as rubbish that was simply less fragmented than the other animal bone refuse. Unsurprisingly, for a number of special deposits, the choice between ritual and rubbish could not be made. The meaning of the rituals resulting in special animal deposits is uncertain, but the location of some in house ditches suggests a similarity with rituals relating to the building or abandoning of farmhouses. The special deposits in farmyard boundary ditches could both emphasise and confirm the boundaries and offer protection to the inhabitants and their livestock. Considering the importance of livestock and crops to the inhabitants of Passewaaijse Hogeweg and the ubiquity of fertility rituals around the world, it would be surprising if some of the rituals were not related to the promotion of fertility of animals and fields.

Feasting was another occasion where animals were indispensable. On special gatherings of regional importance, a number of animals were killed to provide a feast for the gathered people. In this way, animals played a role in political and social life as well. The remains from the feast were buried soon after, separate from everyday household rubbish, which suggests that some meaning may have been attributed to these remains.

It was not just animals that were of little value that were selected for use in rituals. Animals that were important to the economy, such as cattle, horse and sheep, were selected for burial in ritual deposits, feasting and display on burial mounds. This selection could be related to a public display of wealth.

5.1.3 ANIMALS IN FUNERARY RITUAL

Animals also played an important role in funerary ritual. The complexity of funerary ritual requires the separate analysis of animal bones from different contexts within the cemetery: cremation graves, grave ditches, ceremonial pits, animal burials and animal bones that were found on the original ground surface. This analysis has demonstrated that different animals were used for different parts of the funerary ritual. Remains of pig and chicken were placed on the funeral pyre, cremated with the dead and buried with the rest of the cremated remains. These two species accounted for most of the animal bones found in grave pits; sheep was found as well, but in much smaller numbers. The scarcity of chicken bones among settlement refuse suggests that the use of this species may have been restricted to funerary ritual. Cremated bones of pig and chicken were also found in ceremonial pits, an enigmatic context that shares many similarities with grave pits but contained no human cremation. While pig, chicken and sheep bones were mostly burnt and found in grave pits, horse and cattle bones were found unburnt, not in grave pits, but in grave ditches and on the original ground surface. Horse and cattle were used in post-burial rituals, when body parts of these species, especially skulls, were probably displayed on the burial mound. The large proportion of horse bones compared to cattle bones shows that this is not just settlement rubbish that ended up in the cemetery. Only two animal burials were found in the cemetery, but the fact that they consisted of one horse and one cattle burial suggests that they are part of the same ritual that resulted in the horse and cattle bones in grave ditches and on the original ground surface.

5.2 ANIMAL BONES AS A SOURCE OF EVIDENCE FOR THE STUDY OF INTEGRATION INTO THE ROMAN EMPIRE

Apart from reconstructing the roles of animals in the rural community of Tiel-Passewaaij, the aim of this study was to determine how this community was integrated into the Roman Empire. Although situated in a frontier region, imported material culture shows that Tiel-Passewaaij was part of a network of trade. This automatically implies that it must have produced goods as well as imported them. A surplus of cattle was sold for meat. In the second half of the 1st century AD, wool was an important export product. Around the beginning of the 2nd century, the production of wool started to decline. Instead, horses were now bred and sold, presumably to the Roman army. Tiel-Passewaaij operated within the local networks that covered the military and urban markets.

While the rural economy was integrated to a considerable extent in the Roman economic system, rituals taking place within the settlement seem to have been much more a continuation of Late Iron Age traditions. Deposits of parts of animals or complete animals made in pits, wells and ditches are found not just in Roman Tiel-Passewaaij but in various settlements in northwestern Europe, both in the Iron Age and Roman period.[5] This shows the widespread existence of rituals involving deposits of animals in the ground. The existence of Roman-style temples in Empel, Elst and Kessel show that the rural communities of the Eastern Dutch River Area also participated in new forms of worship, or rather, a new way of worshipping old gods with new names. An important aspect of worship in these temples is the offering of young cattle. Finds of bronze statuettes and terracotta images of gods in Passewaaijse Hogeweg show that the Roman-style worship spread to the settlements as well (fig. 3.3). These new elements were incorporated into the rural way of practising religion. The old rituals, involving deposits of animals, continued to exist side by side with the new form of religion.

The analysis of the animal bones from the cemetery shows a similar scenario. Although some new elements were incorporated into the rituals related to the disposal of the dead, the cremation graves were essentially a continuation of Iron Age traditions. In Tiel-Passewaaij itself, very few Iron Age graves were found, but Late Iron Age cremation cemeteries in the southern Netherlands show many similarities with the Roman cemetery in Tiel-Passewaaij.[6] One new element is the use of chicken in funerary ritual.

To conclude, the settlements in Tiel-Passewaaij maintain many local characteristics that deviated from general Roman practice, while at the same time the influence of the Roman Empire is unmistakable. The inhabitants may have served in the army, participated in trade networks, worshipped in Roman-style temples, paid Roman taxes, used Roman products and Roman money, used Roman livestock to breed larger animals, and written in Latin, but at the same time they hung on to aspects of their traditional way of life. They continued to live in byre houses and performed rituals that originated in the Iron Age. This mix of old and new characteristics is found throughout the Roman Empire.[7]

5.3 RECOMMENDATIONS FOR FIELD ARCHAEOLOGY

The analysis of the animal bones from Tiel-Passewaaij has resulted in some surprising new information. This is to a large degree a consequence of the way in which the site was excavated. This has important implications for future excavations of similar rural settlements and cemeteries.

First, it shows that modern rescue archaeology can be a valuable contributor to academic archaeology. Second, it has consequences for future excavation strategies for similar sites. Finally, one of the greatest advantages of the animal bone assemblage from Tiel-Passewaaij was its size.

5 Hill 1995; Meniel 1992; Therkorn 2004.

6 Hiddink 2003, 45.

7 Hingley 2005, 99, 107-108, 118; Hingley 1989, 157, 161; Roymans 2004, 253; Woolf 1998, 238-239.

5.3.1 The relation between rescue archaeology and academic research

One of the consequences of the way in which modern archaeology is organised is that most excavations in the Netherlands are rescue excavations. This means that the location of an excavation is determined by its suitability as a building location and not its academic potential. Nevertheless, rescue excavations can contribute to academic research. The excavations in Tiel-Passewaaij are proof that data gathered in rescue excavations can provide new insights. Although most excavation projects do not have the time available to publish anything more than basic data, these data can and should be used for research. More money should be made available for those excavation projects that fit into academic research programmes, or that fit into the research themes described in the Dutch National Research Agenda.[8]

5.3.2 Excavation strategy

I am convinced that the special deposits in Passewaaijse Hogeweg are not unique to this settlement, but that their apparent abundance is a result of excavation strategy and alertness of the field archaeologists. Complete skeletons will be recognised by anyone, and are still recognisable during the animal bone analysis, but for other types of special deposit it is essential that they are recognised and recorded during excavation. Without good recording and photographs, it is impossible to determine, for instance, whether associated bones were buried as an articulated limb. The fact that animal bone refuse is sometimes found in the same features makes this even more difficult.

The analysis of the animal bones from the cemetery in Tiel-Passewaaij has shown how important it is to include material from all features in a study. Only then can all aspects of the funerary process be understood. Focusing just on central cremation graves may tell us about the way of burial, but ignores other parts of the funerary process. Although every archaeologist realises that all features, including grave ditches, should be fully excavated, this does not always happen in reality. The data from Tiel-Passewaaij prove that the complete excavation of grave ditches can lead to important new insights.

5.3.3 Sample size

The analysis of the animal bones from Tiel-Passewaaij has led to new insights partly because of their number. Although the number of bones was too small for some phases, for others it was large enough to lead to conclusions on animal husbandry. The importance of large samples for zooarchaeological studies cannot be emphasised enough. Zooarchaeological studies are only as good as the data set they are based on. Animal bone assemblages consisting of over a 1000 identified fragments are rare for our period and region. It is vital that, when promising sites with good preservation conditions are excavated, animal bones are collected systematically. Also, enough of the excavation budget needs to be reserved for complete analysis and publication of the animal bones. It is unacceptable that well-preserved animal bones from dated contexts are not analysed or even collected due to restraints of time and money. Inevitably, the nature of rescue archaeology means that uncollected bones will be destroyed or disturbed.

Much improvement has been made in the last decades, and zooarchaeology is now a standard feature of many site reports. However, all too often only part of any animal bone assemblage is selected for analysis, the underlying idea being that a certain number of bones should be 'enough'. Zooarchaeologists are still expected by some archaeologists to answer questions on subsistence and diet based on small total

[8] www.noaa.nl. See 5.4.3.

numbers of fragments. The truth, of course, is that zooarchaeologists are not easily satisfied, realising the problems associated with small samples.

The larger the animal bone assemblage, the more information it will provide. A sample consisting of 300 identified fragments can say something about animal ratios, but not about the age at which the animals were slaughtered, while a 1000 fragments sample can say something about age, but perhaps not about sex ratios or prevalence of common diseases.

While accepting that a lack of money and the need for selective analysis is a fact of modern rescue archaeology, at the same time we must strive for a creative solution. At the moment, priorities are often misplaced. Small assemblages that are almost worthless from a statistical point of view are often analysed in full, while in the rare case of a large, well-preserved and well-dated assemblage, it all too often happens that only part is selected for analysis, resulting in more small samples. The money spent on all those small samples and yet another report whose main conclusion is that the sample is too small to draw any conclusions from, would be better spent on the few large assemblages, ensuring that all that money spent on archaeology will actually lead to a better understanding of the past.

The broad potential of zooarchaeology is still not fully comprehended. Most excavations aim to answer questions on the means of subsistence. In a world where agriculture was the dominant means of subsistence, the study of animal and plant remains is the best way to answer those questions. Besides answering questions on subsistence, zooarchaeology can also contribute to a range of research topics, varying from ritual and religion to food and land use.

5.4 FURTHER RESEARCH

5.4.1 ASPECTS RELATING TO ANIMALS IN THE EASTERN DUTCH RIVER AREA IN NEED OF FURTHER RESEARCH

Every study answers some questions but inevitably leads to many new ones. In the present study, several aspects are discussed that are of great importance to research in the Eastern Dutch River Area during the Roman period. These aspects should be studied in greater detail and for more sites.

The first is the production of wool in the second half of the 1st century AD. More information is needed about which sites specialised in wool production, and which did not. It would also be interesting to investigate how the production and transportation of wool was organised. I assume that the wool was transported to towns, where it was processed into cloth by specialised craftsmen.

Second, more research is needed into the breeding of horses in rural settlements. More solid evidence is needed. This may be hard to find, considering that horses must have lived in the flood basins for most of the year. Passewaaijse Hogeweg is one of many rural settlements breeding horses, and we must ask ourselves whether the army stationed in the region needed such a large number of horses. If not, horses bred in the Eastern Dutch River Area may have been traded over large distances. Chemical analysis or DNA studies may enable us to trace the origin of horses used in military sites throughout the Roman Empire.

Both these aspects are parts of a larger theme, the production of a surplus for a market and the participation of rural communities in trade networks. The comparative analysis of rural, urban and military assemblages can lead to better insights into production of and trade in animal products. The production-consumption model for cattle presented in chapter 2 is only a first tentative step in this direction. More data from a large number of sites should be included. Apart from age, other types of data can be used as well. Metrical data can tell us more about the origin of the animals found in consumption sites.[9] Economic models such as the one used in chapter 2 can clarify our data.

9 Maltby 1994, 94-96, 100.

A third aspect is the systematic study of special deposits in rural settlements, which deserves much more attention. As mentioned in 5.3, a first condition is that field archaeologists are aware of the existence of special deposits. These deposits can contain other materials besides animal remains. In this study, other categories of material have not been included.[10] Hill demonstrated how useful a study that includes different find categories can be.[11] When selecting material for deposition within a ritual context, the inhabitants of Tiel-Passewaaij were not limited to animals, but could include pottery, metal objects and organic materials such as wood and crops. While archaeologists usually separate special deposits according to the find categories they contain, it is important to realise that one type of ritual activity may have used different kinds of material. Rituals involving animals are part of a ritual repertoire, including amongst others building offerings that usually consist of pottery. The study of rituals should not be strictly separated from that of economic aspects. Almost certainly, the inhabitants of Tiel-Passewaaij did not make the strict distinction between economic and ritual that we now do. Feasting, for instance, ties together economic, ritual and socio-political spheres.

An aspect that has barely received any attention in this study is the cultural aspect of animals. Domestic animals were as much symbolic animals, attributed with meaning, as economic animals of flesh and blood. The choice to kill an animal or to keep it alive was not always guided by economic, practical or ritual concerns, but could also be determined by other reasons. One example is the use of cattle in exchange systems, where they function as a primitive kind of money.[12]

Another aspect that has only been mentioned briefly is the differentiation in animal husbandry between settlements and households. Species ratios for Passewaaijse Hogeweg and Oude Tielseweg indicate that one settlement specialised in horse breeding while the other did not. Such a differential specialisation could have occurred not just between settlements but also between individual households. Where possible, analysing assemblages on household level could provide important new insights.

The aspects mentioned so far are themes that in most cases can either be studied on site level or on a regional level. It is almost twenty years since the publication of Lauwerier's regional survey of animals in the Roman period. In that time, a huge amount of new data has come to light. Perhaps it is time for a new regional survey. Although the present study focused on a rural settlement, recent research has focused more on towns and military sites.[13]

5.4.2 INTEGRATION OF ZOOARCHAEOLOGICAL DATA

Although zooarchaeological studies are valuable in their own right, it is by combining their results with other archaeological and even non-archaeological data that new insights can be reached. Many specialist analyses suffer from a lack of integration with the other archaeological data. The National Research Agenda mentions this lack of integration of specialised reports, and suggests publication of the synthesis by all involved, instead of just the one archaeologist coordinating the sub-projects.[14] A promising development is the inclusion of guidelines for specialist research in the latest version of the Quality Norm Dutch Archaeology (Kwaliteitsnorm Nederlandse Archeologie 3.1). The excavation protocol requires the participation of specialists in the writing of the synthesis of a site report when their contribution is substantial.[15]

10 Although I realise the inclusion of other material categories could have led to a better understanding, practical reasons made this impossible within the time constraints of the present research. Only a fraction of the pottery from Tiel-Passewaaij has been analysed so far.

11 Hill 1995.

12 Hiddink 1999, 81, 174-175; Roymans 1996, 194-295; Piot 1992.

13 Filean 2006; Robeerst in prep.; Sub-project D in the NWO project *A sustainable frontier? The establishment of the Roman frontier in the Rhine delta.*

14 Cavallo *et al.* 2006, 3, 14.

15 KNA 3.1, II, Protocol Opgraven, 27.

An alternative solution is for the archaeologist in charge to get a brief overview of all finds per feature, before they are separated into categories and sent off to the various specialists.[16] However, the sheer numbers of finds in the Eastern Dutch River Area make this strategy unfeasible. A more feasible option would be to have more discussion between the various people working on a project. Results should be shared before final reports are written. When specialists are informed about other find categories, they will have a better idea of the site as a whole, and their reports will be more valuable. To achieve this, regular meetings should be part of the analysing process, with plenty of time for discussion. The synthesis can still be published by all the people involved, but this strategy has the added advantage that the quality of the separate specialist reports will be much better. A recent cooperation between a botanical archaeologist and the authors of the three studies of the research programme *Rural communities in the* civitas Batavorum *and their integration into the Roman Empire* (of which the present study is part), shows the fruitfulness of an approach where different types of archaeological data are combined. Evidence from botanical and zooarchaeological analyses is combined with data on settlement structures, in an attempt to determine the existence, type and degree of surplus production in rural settlements in the Eastern Dutch River Area.[17]

5.4.3 THE NATIONAL RESEARCH AGENDA

The recent publication of the National Research Agenda for Dutch archaeology has highlighted several zooarchaeological themes that need more attention. The first theme relates to cultural aspects of the use of animals and includes the use of animals in a ritual context, diet, cultural patterns in butchery and the manufacturing of objects out of bone and antler.[18] Although interest in a non-economic use of animals has increased in the past years, there is a need for more synthesising studies that give a balanced review of both economic and non-economic aspects. Both diet and butchery are dictated by culture as well as functionality. Detailed studies of butchery patterns and differences between different types of settlement can lead to new insights into the degree of integration of rural settlements into the Roman Empire.

A second theme that is relevant to the Eastern Dutch River Area in the Roman period is the introduction of new species.[19] Chicken was probably introduced in the Late Iron Age, but little is known about its introduction and distribution. Donkeys and mules are known to have been used by the Roman army, but they are rarely reported archaeologically.[20] This is a consequence of the difficulty of assigning equid remains to species. A systematic survey of horse bones from the Roman period could lead to the identification of donkeys and mules.

A final theme concerns technology and animal husbandry.[21] Of necessity, the interpretation of mortality profiles is based on research in a very different region and environment. Models for different production strategies, based on breeds of species that are comparable to those from the Roman period and live in an environment similar to that of the Eastern Dutch River Area could lead to better interpretations of our data. The Roman period is a period in which new types of domestic species were evolved. Research on this process is based on morphological and metrical studies, but DNA studies could provide a valuable contribution to the origin of these new types.

Zooarchaeological research can also contribute to other, more general themes for the Roman period. For the Eastern Dutch River Area, the main themes discussed in the National Research Agenda to which zooarchaeology can contribute are ritual deposition, romanisation and the production and distribution of food. Ritual depositions outside cult places are mentioned as an important research theme, which

16 Pers. comm. Henk Hiddink.

17 Groot/Heeren/Kooistra/Vos in prep.

18 Cavallo *et al*. 2006, 7-8.

19 Cavallo *et al*. 2006, 11-12.

20 Baxter 1998, 5-6.

21 Cavallo *et al*. 2006, 13.

includes building offerings, horse graves, coin hoards and deposits in wet contexts.[22] Unfortunately, the existence of ritual deposits of parts of animals, which are much harder to recognise than complete skeletons, is not mentioned. The study of changes in withers height is mentioned as a method of grasping the effect of romanisation on rural settlements. For research into the production of food, the differentiation between different areas, chronological changes and the exchange of food and cattle are of importance.[23] Although not explicitly mentioned, zooarchaeology can also contribute to the study of landscape use in the Roman period.

A widely held opinion seems to be that we already know everything there is to know about animals in the Eastern Dutch River Area during the Roman period. However, there is no room for complacency. There are still many uncertainties, and many research questions that zooarchaeology can answer. Although a relatively large number of animal bone assemblages have been analysed and published for the Eastern Dutch River Area, many of these are small. The analysis of the large animal bone assemblage from Tiel-Passewaaij has shown the value of zooarchaeology for this period and region.

22 Van Enckevort *et al*. 2006, 25.

23 Van Enckevort *et al*. 2006, 28.

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4. Animals in funerary ritual

4.1 Funerary ritual and the cremation cemetery of Tiel-Passewaaij

4.1.1 The cremation cemetery in Tiel-Passewaaij

The cremation cemetery in Tiel-Passewaaij originally consisted of about 490 graves (although many graves have been lost) and covered 5 hectares. A total of 343 graves has actually been excavated.[1] This makes it one of the largest Roman cemeteries in the Netherlands. The earliest graves date to around AD 60, and the latest to around AD 270.

There are several factors that ensure that this cemetery site has unique research opportunities. First, there is the excellent preservation. Preservation was generally very good but varied within the cemetery. There was a difference in height of up to one metre between the higher northern half and the lower southern half of the cemetery. The lower half was flooded several times, leaving a protective layer of sediment on top of the Roman structures. However, floods also damaged or destroyed some features.[2] In the northern half it was not natural processes but processes caused by humans that have affected preservation. After the cemetery went out of use, the ground was leveled. The northern half has suffered from ploughing but despite that, the grave pits have been preserved. The ditches around the graves were shallow and badly preserved because ploughing has cut away the upper part.

The preservation of the southern half was generally much better. The original ground surface and parts of the burial mounds were found in this area. Nevertheless, grave pits have not been found in the southern half. The reason for this is that in this part of the cemetery, because of a higher ground water level, the graves were dug in the top of the burial mound instead of on ground level, as was the case in the northern half. The higher position of the graves left them more vulnerable to ploughing in later periods. Not only have the different grave structures been preserved, but the clay soil ensured that it is not only cremated human and animal bone, but unburnt animal bone as well that was found. Most of the cemeteries from the Roman period in the Netherlands that were excavated and published are located on sandy soils, where only cremated bone is preserved. This severely limits our chances to reconstruct the use of animals in funerary ritual.

Second, there is the large number of graves, combined with the fact that most of the cemetery has been excavated. Excavations of many Roman cemeteries are small-scale and incomplete, which means that the information is fragmentary at best. Of the cemeteries that have been excavated more fully, the analysis of some remains unpublished.[3] Next, the strategy with which the cemetery was excavated made maximum use of the available information and research opportunities. From the outset, one of the research aims for the cemetery was to study the whole process of the funerary ritual, and not just the aspect of the cremation graves. In the case of the animal bones, one important factor is that animal bones from all features as well as the original ground surface have been collected and analysed. Almost

1 Only one inhumation was recovered; all other graves are cremation graves.

2 Tops 2001, 8.

3 Hiddink 2003, 19-20. One unpublished cemetery with huge potential is Valkenburg, Zuid-Holland (pers. comm. Henk Hiddink).

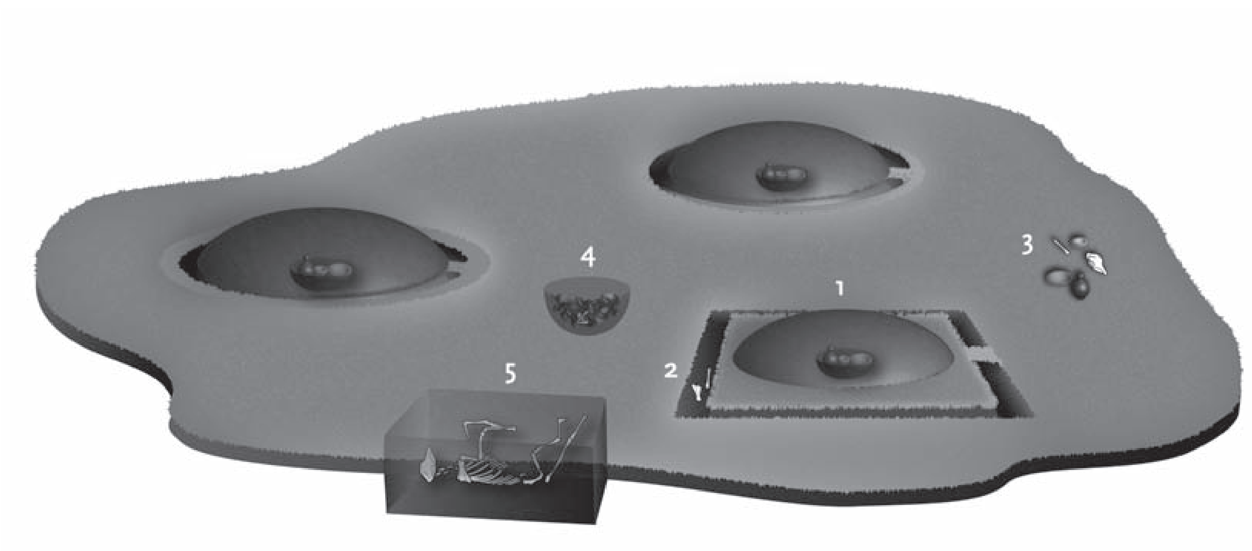

Fig. 4.1. Different contexts found in the cemetery. 1: cremation grave; 2: grave ditch; 3: original surface; 4: ceremonial pit; 5: animal burial.

certainly, animal bones were present in grave ditches in other cemeteries as well, but have either not been collected or not been selected for analysis. Finally, it is not just this cemetery, but also the two adjoining settlements for which we have information. This enables us to make a comparison between the animal bone samples from a cemetery and the settlements that used this cemetery.

The above factors mean that we have available for this study a large, well-preserved and well-excavated cemetery, together with the settlements whose inhabitants were buried in the cemetery after death. Because bones were collected from all the different grave structures, we can look at the way animal bones were deposited in the various contexts. Not only can we look at burnt bones found among the human cremation, but we can also analyse unburnt bones found in graves or other grave structures. Little or nothing is known about the deposition of animal bones in grave structures apart from the cremation grave.[4]

The different contexts in the cemetery in which animal bones were found consisted of cremation graves, grave ditches, burial mounds, ceremonial pits, and the original ground surface (fig. 4.1). These different contexts were created or relevant at different moments in the funerary ritual. Cremation graves have been classified into different types, the exact details of which need not concern us here.[5] However, what we do need to realise is that the amount of animal bones in a grave depends on one basic distinction: whether the cremated remains were selected from the pyre remains or not. In roughly two thirds of the graves in Tiel-Passewaaij, part of the human cremated bones (as well as part of the burnt animal bones) was collected and buried, either with or without burnt remains from the pyre (charcoal, burnt pottery).[6] These graves are distinguished by a clear concentration of cremated bones, a result of wrapping the remains in a piece of cloth or leather. So-called *Brandgrubengräber* are graves where some of the remains of the pyre were deposited in a pit, without first selecting the cremated bones. These graves typically contain fewer cremation remains than graves with a cremation concentration. The main implication is that there is a direct relation between the amount of human and animal cremated bones: the higher the number and weight of human remains, the higher the number and weight of animal remains.[7] In order to make the grave visible, a low burial mound surrounded by a grave ditch was thrown up on top of the grave. The ditches can be either round or rectangular or, in a few cases, of an irregular shape.[8] The diameter of the grave ditches varies from several metres to up to 20 metres.

4 An exception is the cemetery Lamadelaine in Luxemburg. Metzler *et al.* 1999.

5 Bechert 1980; Bridger 1996.

6 Tops 2001, 11-12.

7 Pers. comm. Henk Hiddink.

8 Tops 2001, 11.

Ceremonial pits are pits that contained large amounts of burnt pottery and burnt animal bones. In contrast to graves, it was not just a few fragments of each individual pot that were found, but complete vessels broken into pieces. The number of plates, pots and glass items was large. The pits contained charcoal but no human cremated remains. Ceremonial pits were located either outside the grave ditches or within a grave ditch but not in a central position. It is not yet clear how these pits should be interpreted. The absence of human cremated bones is an argument against an interpretation as graves or pyre remains. The combination of large amounts of pottery and animal bones suggests that this could be the remains of a funerary feast. However, hobnails were also found in two of the pits.[9] Sedimentation has preserved parts of the original Roman ground surface in the southern half of the cemetery, as well as animal bones deposited there. Apart from the human graves, several animal burials were also found in the cemetery.

All soil from grave pits was sieved. Bones from other features were hand-collected. In theory this could cause discrepancies between the species distribution in graves and other features. However, hand-collecting was done with great care, making it unlikely that much was missed. Burnt animal bones from graves were found among the human cremated bones, and separated from the human fragments by the physical anthropologist studying the human cremated remains.

In this chapter, I will discuss the various ways in which animal bones were incorporated in the native-Roman funerary ritual. This will be done by analysing the animal bones found in different contexts within the cemetery. First, funerary ritual will be discussed in a broader, anthropological context. Ethnographic studies can contribute to our understanding of funerary ritual. Second, I will summarise what we know of Roman funerary ritual in western Europe. Next, the results of the analysis of the animal bones from the different contexts in the cemetery in Tiel-Passewaaij will be presented. An attempt will be made to reconstruct funerary ritual in Tiel-Passewaaij, as far as the use of animals is concerned. Finally, a comparison with results from other cemeteries will allow us to conclude whether the Tiel-Passewaaij cemetery fits in a regional picture.

4.1.2 THE ANTHROPOLOGY OF FUNERARY RITUAL

A good place to start when studying funerary ritual in archaeology are ethnographic and historical accounts of funerary practices in non-western or historical societies. These will help to widen our view on death and the surrounding rituals, as well as focus our attention on some important concepts. Funerary rituals are valuable study objects in order to understand a society. During the time around death, cultural values become more clear than they normally would be.[10]

A first question to ask is why funerary rituals exist in almost every society around the world. Although the primary aim of a funeral could be understood as the very practical need to dispose of a dead body, this process is usually surrounded by various rituals. At first, it seems logical to assume that funerary rituals help to overcome grief over the loss of a loved one. However, ritual is just as likely to be useless in this aspect, or to be an extra burden during a difficult time.[11] Van Gennep's concept of *rites de passage* helps us to understand the role of funerary rites.[12] Rites of passage can be observed around the world, occurring at moments of transition in a person's life, such as puberty, marriage and death. They ensure that a person can pass from one position (life stage, age group, profane world, life) to another position (life stage, age group, sacred world, death) with as little harm or disturbance as possible. Rites of passage can be subdivided into rites of separation or preliminal rites, transition or liminal rites, and rites of incorporation or postliminal rites. Although all three rites are usually present, often the emphasis is on one of them,

9 Tops 2001, 14-15.

10 Metcalf/Huntington 1991, 25.

11 Metcalf/Huntington 1991, 4-5.

12 Van Gennep 1960.

depending on the type of transition. Preliminal rites ensure that the person is separated from the previous position; during the liminal phase the person is in a transitional stage, and postliminal rites result in the incorporation in the next position.[13]

When this concept is applied to funerals, the following stages can be observed. The dead first have to be separated from the world of the living. During the liminal phase, the deceased is still close to the world of the living. In many cultures, this is perceived as a dangerous period, where the dead can affect the living in a negative way. Postliminal rites are needed so that the dead will be incorporated into the afterlife.[14] In many societies, a certain period has to pass before everyone can return to normal. One aspect of this return to normality can be the freedom of a widow or widower to remarry, or the division of the dead's possessions.[15] People in many societies believe that the dead will affect the life of the living. The living have to look after their dead by observing rituals or remembering the deceased, and in return the dead will look after the living. There is an ongoing relationship between the living and the dead. Because the ancestors continue to affect daily life, descent and kinship are important factors.[16]

Thus, funerary rituals serve to reformulate the structure of a community and the roles of the members in this community after a member (and with that person, the roles he or she fulfilled) has been lost. Both the deceased and the mourners go through a phase where they are situated between the world of the living and the dead. Deceased who are not fully incorporated in the world of the dead present a danger to the living; therefore it is important that the rites are performed correctly.[17] When a valued member of the community dies, a void is left that needs to be filled.[18] The survivors have lost part of their identity with the death of a relative: a wife, for instance, is no longer a wife, but will be a widow from now on.[19] The state of marriage is an important part of a person's identity, and with the death of husband or wife the survivor loses this part of their identity. Rituals are often needed to help people in this transformation of their identity. In the same way, the deceased has to be transformed from corpse to ancestor or from a member of this world to a member of the next world. Apart from the loss of identity, death often results in new responsibilities for the survivors.[20] The change in social status, position or circumstances is accompanied by rites of passage. Funerals can also be political events, where status is not just passively reflected but actively created.[21]

As in other rituals, many aspects that were important in funerary ritual are lost to the archaeologist. Some examples of these are music and other sounds such as wailing, colour symbolism, and the cutting or growing of hair. Hair style can be particularly important to signify a life stage or group membership of an individual. Widows often cut their hair to separate themselves from their previous status of being a married person; the cutting of hair can thus be interpreted as a rite of separation.[22]

4.1.3 ANIMALS AND FOOD IN FUNERARY RITUAL

Of special interest to the zooarchaeologist is the role of living animals in funerary rituals as described in ethnographic accounts, for instance the cattle stampede that takes place in Bara funerals in Madagascar.[23] Unfortunately, references to living animals in ritual are few. Apart from playing an active role in ritual

13 Van Gennep 1960, 3, 10-13, 21.

14 Parker Pearson 1999, 22; Davies 1997, 9, 13.

15 Metcalf/Huntington 1991, 95.

16 Davies 1997, 95, 99.

17 Van Gennep 1960, 147, 160.

18 Metcalf/Huntington 1991, 80.

19 Davies 1997, 53.

20 Davies 1997, 4.

21 Parker Pearson 1999, 23.

22 Van Gennep 1960, 166-167.

23 Metcalf/Huntington 1991, 117-8. The importance of cattle in this society is also visible in the placing of bucrania (frontal part of cattle skull with horncores) on tombs.

during their life, animals can also be killed and buried whole. Horses and dogs, for instance, were regularly sacrificed in the past to accompany the dead.[24] Favourite animals of the deceased can be put to death as part of the separation rites.[25] Others, especially where a number of animals are concerned, are often included as a status symbol. The third way in which animals take part in funerary ritual is as food.

From ethnography, we learn that food plays an important part in any funeral. From food given to the dead to consume in the afterlife to a feast provided for the survivors, there are different ways in which food contributes to the funeral. The survivors make sure that the deceased has everything he or she needs for the afterlife, or the journey towards the "next world": clothing, arms, equipment, and also food.[26] Food placed in graves should be seen as "complex symbols which express the various values, aims and attitudes of the mourners in the face of death".[27] Food can emphasise identity, social status, or the difference between the living and the dead. However, food can also emphasise similarities between the living and the dead (social or kinship bonds) in the sense that the dead need food, just as the living do. Offering food to the dead suggests that communication is possible. Placing food in graves is only one way in which food contributes to funerary ritual. The absence of food, in the sense of fasting, can also be meaningful.[28] Another aspect in which food is used is feasting.

In many funeral rites, the participants share food and drink with each other and the deceased, emphasising relationships with the dead but also among the living. Shared meals should be seen as part of the rites of incorporation, uniting the survivors, and sometimes the deceased as well.[29] There is often a shift in mood on these occasions. Sharing food emphasises the positive side of life; alcohol adds to a more positive mood.[30] These aspects of food in funerary ritual are found in many societies around the world and in the past. Feasts can occur at different occasions; funerals are just one typical context. Large funerals can be accompanied by the slaughter of a large number of animals.[31] Indeed, in some cultures, certain animals are eaten only at funerals. A funeral presents an opportunity for a display of wealth by providing an abundant, high-quality feast. One feature of funeral feasts is that guests often bring a gift in the form of livestock as a contribution to the feast. This creates a debt relationship that will have to be repaid in the future.[32]

4.1.4 Roman funerary ritual in Western Europe

Funerary ritual in Rome

Within Roman funerary ritual, we can distinguish three different moments: rites performed immediately after death but before the funeral itself, the funeral procession and disposal of the corpse, and rites performed after the funeral.[33] Two beliefs are behind Roman funerary ritual. First, death was considered to be polluting, requiring purification rites. Second, the corpse needed to be buried in order to keep the soul from harm. Just before death, friends and family gathered around the dying. Immediately after death, the deceased's eyes were closed, his name was called out, and he was lamented. The body was washed, anointed and dressed as a preparation for the lying-in-state.

The next stage was the funeral procession, when the corpse was carried on a bier to the place of disposal. Roman law demanded that burial took place outside the city walls. The corpse was placed on the pyre, together with gifts and personal possessions of the deceased. Pets could be killed next to the

24 Parker Pearson 1999, 2, 11.
25 Van Gennep 1960, 164.
26 Van Gennep 1960, 153-154.
27 Parker Pearson 1999, 10.
28 Parker Pearson 1999, 10.
29 Van Gennep 1960, 164.
30 Davies 1997, 44.
31 Adams 2004, 56-57; Metcalf/Huntington 1999, 119.
32 Adams 2004, 60, 65.
33 This paragraph is based on Toynbee 1971, 43-64, 73, 100, 143-163.

pyre to accompany the dead. Grave goods could consist of jewellery, military equipment, toilet articles, cooking vessels, eating and drinking vessels, lamps, dice or other gaming pieces and children's toys. These items would help the dead feel at home in the afterlife. Before lighting the pyre, the name of the deceased would be called out for the last time. After the corpse had burnt, the burning pyre was extinguished with wine. Relatives collected the remaining bones of the deceased and placed them in a container.

The rites that were performed after the actual disposal of the corpse were considered to be very important, for they would ensure that the deceased would be remembered. These rites consisted mainly of ceremonial meals. Meals were eaten at the grave both on the day of the funeral, on the ninth day after the funeral, and periodically afterwards. Birthdays and the *dies Parentales*, the official commemorative festival for the dead, were days when food was brought to the grave and shared by the living and the dead. Some graves had holes or pipes so that food and drink could be given directly to the dead. The type of grave marker was extremely variable and depended on the wealth of the deceased, varying from a simple amphora or plain standing stone to a large mausoleum.

One important change in Roman funerary ritual which can easily be observed by archaeologists is the change from cremation to inhumation. Cremation was the normal way of disposal from around 400 BC to the end of the 1st century AD. In the 2nd and 3rd century AD, cremation was replaced by inhumation, first in Rome and later in the provinces.

Late Iron Age funerary ritual in western Europe

Inhumation was widespread in western Europe from the 5th to the 3rd centuries BC. Very few graves are known from the 2nd century BC, but cremation graves appear in the 1st century BC. In this period, human bones frequently ended up in settlements.[34]

Little is known about funerary practice in the Eastern Dutch River Area in the Late Iron Age. The few graves that are known are cremation graves.[35] In Tiel-Passewaaij, small clusters of graves occurred within the settlement during the Late Iron Age and Early Roman period. Apart from several cremation graves (without surrounding ditch and with no or few grave goods), inhumations of two infants have been found.

There is more information about the region directly south of the Eastern Dutch River Area, the Maas-Demer-Scheldt region, where burial traditions can be followed over a long period. The Early Iron Age and the beginning of the Middle Iron Age are characterised by large urnfields, consisting of cremation graves under round barrows.[36] Somewhere during the Early Iron Age, an opening in the circular ditch surrounding the barrow appeared. In the Middle Iron Age, we find square ditches for the first time in urnfields. Burial practice during the later Middle Iron Age and the Late Iron Age is not well known. The large urnfields were replaced by small clusters of unremarkable and poorly visible cremation graves. People were still cremated, and some of the cremated remains were buried in a small pit, but burial in urns was rare, as were barrows, ditches and grave goods. In the Middle Iron Age, inhumation sometimes occurred. At the end of the Late Iron Age, communal cemeteries reappeared, although small clusters of graves and isolated graves were also common. The cremated remains were buried without an urn. Ditches surrounding the grave are found at some sites but not at others.[37]

Funerary ritual in the northwestern provinces

Much less is known about funerary ritual in the Roman provinces. When the deceased was born or raised in Rome, we can assume that the funerary rites at his death would be very similar to those performed in Rome. For local people, funerary rites would have had a distinctly local flavour. Funerary ritual

[34] Morris 1992, 47.

[35] Gerritsen 2003, 133, table 4.3.

[36] Hiddink 2003, 6-7; Gerritsen 2003, 128.

[37] Gerritsen 2003, 128-129, 131-132, 135-137.

in the Eastern Dutch River Area during the Roman period was probably a mixture of local traditions and aspects of Roman funerary ritual. Some elements of cemeteries can already be found in the Iron Age, such as barrows and round and square ditches (see next paragraph).

4.2 ANIMAL REMAINS FROM THE CEMETERY IN TIEL-PASSEWAAIJ

4.2.1 ANIMAL REMAINS IN CREMATION GRAVES

Both burnt and unburnt animal bones have been found in graves. The burnt animal bones from graves are mostly completely calcified and mixed up with the human cremated remains. The colour of the fragments is the same as that of the human remains, suggesting that the animal remains were subjected to the same heat as the corpse. In most cases, several identified burnt animal bone fragments were recovered, usually in combination with some unidentified burnt animal bones. In some cases, only one or two small fragments of animal bone, either burnt or unburnt, were present in a grave. It is not always clear whether these belong to the original grave contents or whether they are 'intrusions', brought to the grave by burrowing mammals or included in the soil used to fill the grave. Isolated small fragments of bone should be considered as possible intrusions. Since most of the animal bones in grave pits are burnt, small unburnt fragments are almost certainly intrusions.

Instead of the total numbers of animal bones per grave, numbers of graves containing animal bones are more useful in this analysis. The reason for this is that only part of the cremated remains was collected for burial.[38] Furthermore, it is not relevant how many fragments a grave contains (although we will try to reconstruct meat portions), but rather whether a species is present or not. Although animal bones were found in many of the graves, in most cases only small, unidentifiable fragments were found. 44 graves contain animal bones that could be identified, and in 30 of these graves the animal bones are burnt (table 4.1).

The burnt animal bones in graves consist almost entirely of pig, chicken and sheep bones, with some goose and cattle bones (table 4.2). Many graves that contained identified animal bones contained remains of more than one species. Therefore, the percentages in table 4.2 do not add up to 100 %. Most of the unburnt animal bones in graves are from sheep or goat and cattle (table 4.2).

Table 4.3 shows the absolute numbers and percentages of animal bones in graves. The highest percentage, both for burnt and unburnt bones, is that for chicken, followed by that for pig for burnt bones. Although burnt remains of pig are found in more graves, the number of bones per grave is higher for chicken than for pig. The high percentage of unburnt chicken bones can be explained by the find of a complete skeleton in one grave.

More than half of the unidentified animal bones are from medium-sized mammals (table 4.3). More than a third of the unidentified fragments are bird bones. Among the burnt animal bones, again more than half are medium-sized mammal bones, whereas slightly less are bird bones. Only 3 % are bones from large mammals. This emphasises the fact that it is medium-sized mammals, such as pig and sheep or goat, and birds that dominate animal remains in graves. In the next paragraphs, each species found in grave pits will be discussed in more detail.

[38] 40-60 % according to Parker Pearson 1999, 7; 35-40 % according to Hiddink 2003, 121. The authors do not mention whether the percentage applies to the total weight of the cremated remains or the number of fragments.

	Number	Percentage of total number of grave pits
Graves with animal bones	111	57.5
Graves with burnt animal bones	86	44.6
Graves with unburnt animal bones	53	27.5
Graves with identified (burnt or unburnt) animal bones	44	22.8
Graves with burnt, identified animal bones	30	15.5
Graves with unburnt, identified animal bones	17	8.8

Table 4.1. Graves with animal bones in Tiel-Passewaaij (the total number of grave pits that were excavated is 193). Three graves contained both burnt and unburnt animal bones.

Species	Number of graves (n=44)	%	Burnt (n=30)	%	Unburnt (n=17)	%
Pig	16	36.4	13	43.3	3	17.6
Chicken	13	28.3	12	38.7	1	5.6
Sheep/goat	14	30.4	8	25.8	7	38.9
Cattle	8	17.4	1	3.2	7	38.9
Goose	3	6.5	3	9.7	-	-
Horse	2	4.3	-	-	2	11.1

Table 4.2. Animal bone species found in graves in Tiel-Passewaaij (% of total numbers of graves with identified bone). More than one species can be present in one grave. Three graves contained both burnt and unburnt identified animal bones.

Pig

Pig bones were found in 16 graves, or 36 % of the graves that contained identified animal bones. Burnt pig fragments were found in 13 graves, or 43 % of the graves that contained identified burnt animal bones (table 4.2; fig. 4.2). Pig was found in the highest number of graves, but is surpassed by chicken when the total number of fragments is taken into account (fig. 4.3). Three quarters of the graves containing pig bones contained only burnt pig bones. Sex could be established only once: a maxilla is from a female pig. Because not all the cremated bones were collected for burial, it is hard to say anything definitive about the amount of meat originally placed on the pyre. However, an attempt has been made to reconstruct body parts out of the pig bones found. The occurrence of these body parts in graves is represented in table 4.5.

The hind legs included the lower leg parts, whereas these were absent in the front legs. The two hind legs are both from pigs younger than two years. One front leg is from an animal of around one year old, whereas another leg is from a pig older than three years. Age could not be estimated for the third front leg. Legs from the left side of the body were found four times, compared to one right leg. If we assume that the loose teeth were originally part of a skull, skulls are the most frequent find. The unassociated humerus and femur are both calcified. They could originally have been part of a whole leg. In that case, we would have found four front legs, three hind legs, and seven skulls.

Fragments of ribs and one vertebra were found in graves, but these fragments have only been identified as *medium mammal*. Rib fragments were found in eight graves: burnt rib fragments in seven graves, and unburnt fragments in one grave. The rib fragments can be from either pig or sheep. The fact that most of them are burnt, as is the case for the pig bones, makes it more likely that the ribs are from pig, and not from sheep or goat. Pig bones were found in seven male, six female and three non-adult graves (table 4.4).

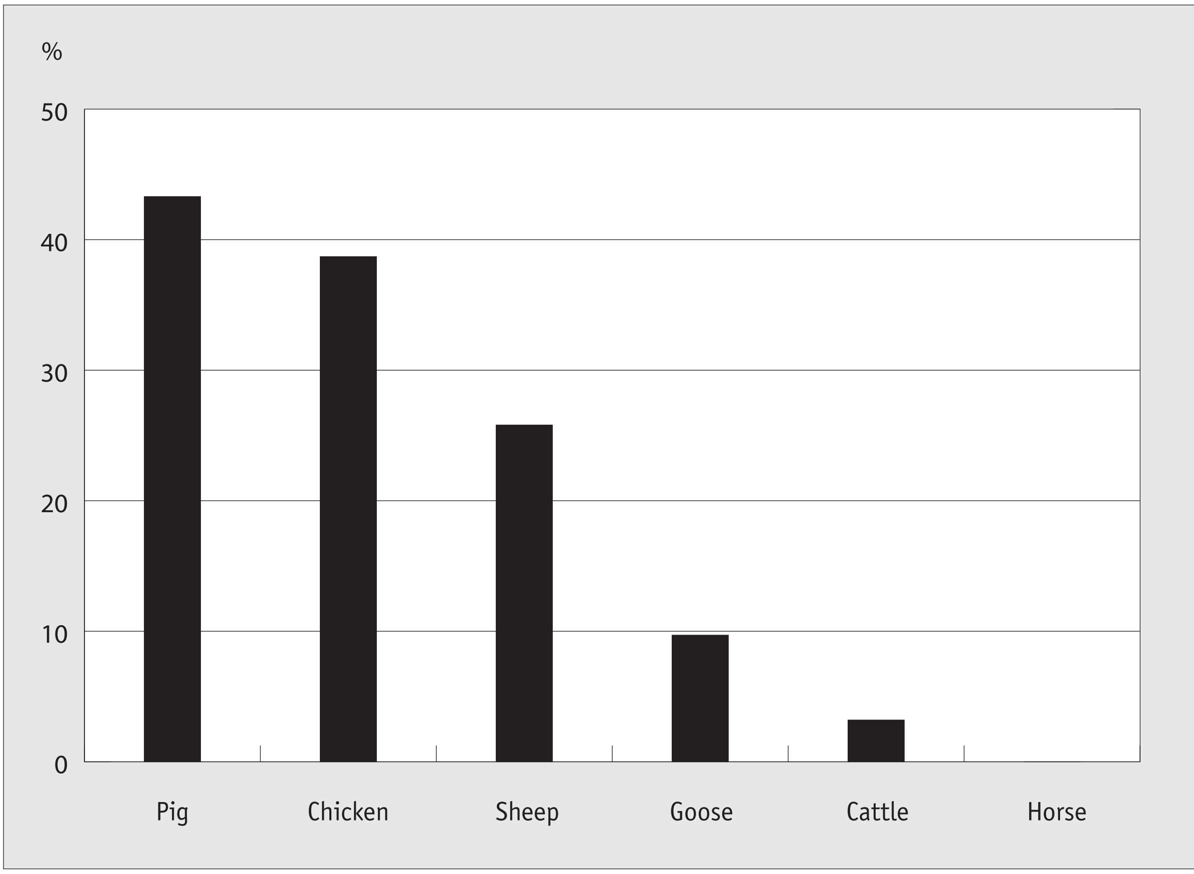

Fig. 4.2. Species distribution of burnt animal bones in cremation graves, percentages out of the total number of graves with burnt and identified animal bones. Since some graves contained fragments of more than one species, the percentages do not add up to 100 %.

Species	**Number of bones**	**%**	**Burnt**	**%**	**Unburnt**	**%**
Identified bones						
Pig	54	34.0	48	39.3	6	16.2
Chicken	68	42.8	54	44.3	14	37.8
Sheep/goat	20	12.6	12	9.8	8	21.6
Cattle	8	5.0	1	0.8	7	18.9
Goose	7	4.4	7	5.7	0	-
Horse	2	1.2	0	-	2	5.4
Total	**159**	**100.0**	**122**	**99.9**	**37**	**99.9**
Unidentified bones						
Bird	160	34.1	159	43.2	1	1.0
medium mammal	270	57.6	199	54.1	71	70.3
large mammal	39	8.3	10	2.7	29	28.7
Total	**469**	**100.0**	**368**	**100.0**	**101**	**100.0**

Table 4.3. Animal bone numbers in graves.

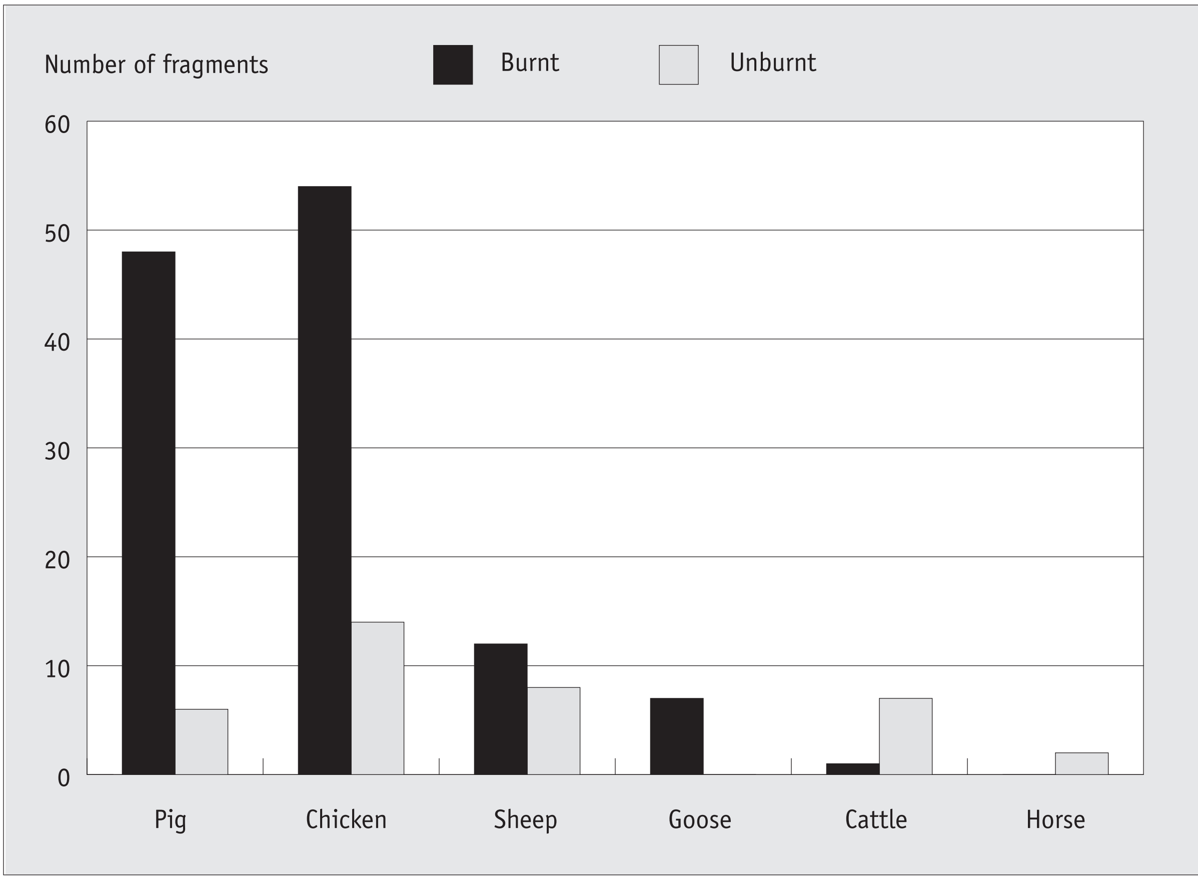

Fig. 4.3. Total numbers of animal bones (burnt and unburnt) found in cremation graves per species.

Species	Male	Male?	Male??	Female	Female?	Unsexed adult	Child	???
Pig	5	1	1	5	1	-	3	-
Chicken	4	-	1	3	-	-	3	2
Sheep/goat	3	-	-	6	-	2	4	-
Goose	-	-	-	-	-	2	1	-

Table 4.4. The number of times fragments of a species were found in graves of males, females, unsexed adults and children. Question marks indicate the level of reliability of the sex attributions.

Chicken

Chicken bones were found in 13 graves. Twelve of these graves contained burnt chicken fragments. In almost forty percent of the graves containing burnt animal bones, chicken fragments were found (fig. 4.2). In numbers, chicken is the most numerous species: 44 % of the total number of identified burnt animal bones in graves are chicken bones (table 4.3; figure 4.3). Most of the unidentified bird bones will probably be chicken bones, so the real number of chicken bones in graves will have been even higher. In nine graves, bones from both wings and legs were present. One grave contained bones from the shoulder and wing. In another grave, three phalanges were found, and in the final grave, only a caudal vertebra was present. Sex could be established once: a spur was seen on a tarsometatarsus, which means that this

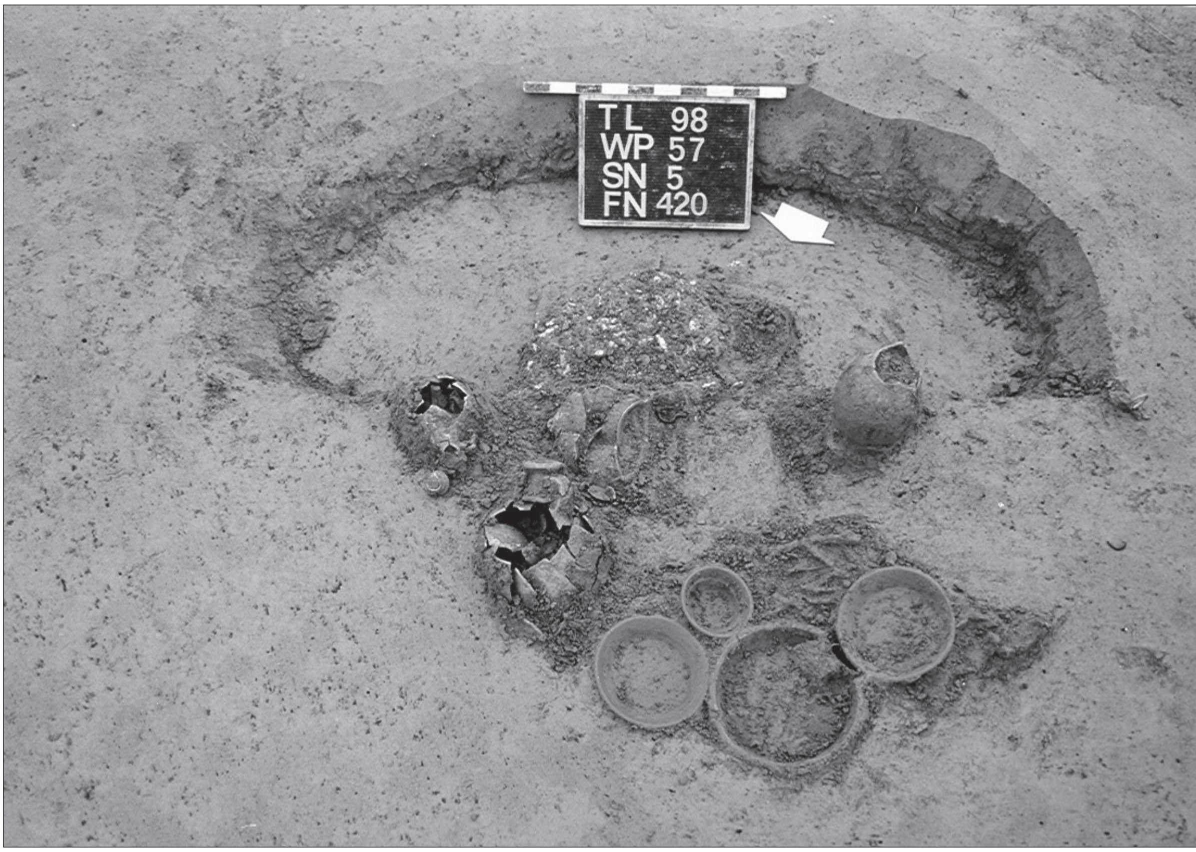

Fig. 4.4. Cremation grave from Tiel-Passewaaij containing unburnt bones from a chicken suffering from osteopetrosis.

Body part	Left	Right	Total
Front leg	2	1	3
Hind leg	2	0	2
Skull	-	-	3 (1 unburnt)
Loose teeth	-	-	5 (1 unburnt)
Unassociated bone (humerus, femur, phalanx 2)	-	-	3 (1 unburnt)

Table 4.5. Body parts of pig in graves (burnt and unburnt).

must have been a male individual. Chicken bones were found in five male, three female and three non-adult graves (table 4.4).

Unburnt chicken bones were found in only one grave. In this grave, a complete chicken was deposited in the grave (fig. 4.4). The chicken is remarkable because it suffered from avian osteopetrosis, a disease in which profuse new bone is formed along the diaphysis of the long bones. The disease first affects the tibiotarsus, but will affect the rest of the skeleton as it progresses.[39] The chicken in this grave was in an advanced stage of the disease: most bones were affected (fig. 4.5). Its bad health must have been clearly visible. The selection of this sick chicken as a grave gift is interesting. Some rational thinking may have

[39] Baker/Brothwell 1980, 61.

Fig. 4.5. Bones from a chicken suffering from osteopetrosis, found in a cremation grave. From left to right: humerus, ulna, tibiotarsus, tarsometatarsus.

influenced this choice. The diseased chicken may not have been considered suitable for human consumption, but it may still have been good enough for the dead. Another possibility is that it was suspected that the animal had a limited lifespan.

Sheep or goat

Fragments from sheep or goat were present in 14 graves. Burnt bones were found in seven graves, and unburnt bones in six graves (table 4.2). One grave contained both burnt and unburnt fragments. In one case, the bones are definitely from a sheep. In the other cases, the bones could be from either sheep or goat. Most of the graves contained only one bone. In three graves, fragments from two bones were present: in one grave a pelvis and femur, in another grave two scapulae, and in a third grave a burnt radius and an unburnt humerus. Fragments from the pelvis are overrepresented: six out of 17 fragments come from the pelvis (35 %).

Little evidence was found for the ages of the sheep. An acetabulum is fused (older than six months) and a distal femur is unfused (younger than 3.5 years). A radius is proximally fused and distally unfused (10 months – 3.5 years), and the humerus found in the same grave is distally fused (older than 10 months).[40] Bones from sheep or goat were found in three male, six female and four non-adult graves (table 4.4). Sheep or goat seems to be slightly overrepresented in female graves, but this could just be a result of small numbers. If the two unsexed adults were males, for instance, this would even out the distribution.

[40] Silver 1969, 285-286.

Goose

Goose fragments were found in three graves. In all cases, the bones were burnt. One grave contained a tibiotarsus, another grave contained two vertebrae and phalanges, and the final grave contained a furcula, synsacrum and two phalanges. Goose bones were found in two unsexed adult graves and one non-adult grave (table 4.4).

Cattle

Cattle bones were found in eight graves. In all cases, there is just a single bone or fragment of unburnt bone (tables 4.2 and 4.3). These fragments almost certainly represent intrusions that entered the pit when it was filled up. The only burnt fragment is a tooth from the lower jaw. It is of course possible that beef played a role in the funerary ritual, but that the meat was filleted. In that case, we would not find any evidence of this. Cattle could therefore be seriously underrepresented in graves. However, since we do find cattle bones in grave ditches, it is far more likely that cattle is not underrepresented but that cattle parts were not selected for burning on the pyre. A deliberate selection of smaller animals may have occurred, since these could be consumed completely during the funerary feast.

Conclusion

Pig, chicken and sheep are the most important species in graves (fig. 4.2). Cattle did not play a role in cremation graves. Bones from pig and chicken are usually burnt, whereas sheep bones can be burnt or unburnt. In the case of pig, either a front or a hind leg, a skull, or a portion of ribs was added to the pyre. Left legs were more frequently included than right legs. For chicken, it is hard to say whether a complete chicken or just part of it was included. In the one case where unburnt chicken bones were found in a grave, it was a complete animal. This chicken was in an advanced state of avian osteopetrosis, which must have been visible to the person selecting this animal for the funerary ritual.

In five graves, remains of both pig and chicken were found. In one of these graves, the remains are unburnt. Pig and goose were found together in one grave. Although pig and sheep were found together in three graves, in all three cases one of the two species was represented by just one small fragment. A small fragment might easily be an intrusion, so this cannot be used as evidence that pig and sheep are associated in graves. The distribution of species over the sexes of the deceased and between adults and non-adults seems to be even. Only sheep seems to occur slightly more often in graves of women.

4.2.2 ANIMAL REMAINS IN GRAVE DITCHES

During the excavation, the fill from all grave ditches was dug up and inspected for finds. Finds from grave ditches could have been placed deliberately in the ditch or ended up in the ditch after the burial mound was eroded. In the latter case, the finds must have been included in the burial mound or left on top of it. Identified animal bones were found in 34 grave ditches.[41] The total number of animal bones from grave ditches is not very high, but the dominance of horse and cattle is obvious (table 4.6). One ditch contained a group of associated dog bones, which results in a high number of dog bones. *Large mammal* dominates over *medium mammal* in the unidentified remains, with 322 *large mammal* fragments compared to 42 *medium mammal* fragments. In other words, 88 % of the unidentified animal bones belong to cattle or horse.

[41] Around 250 grave ditches were excavated.

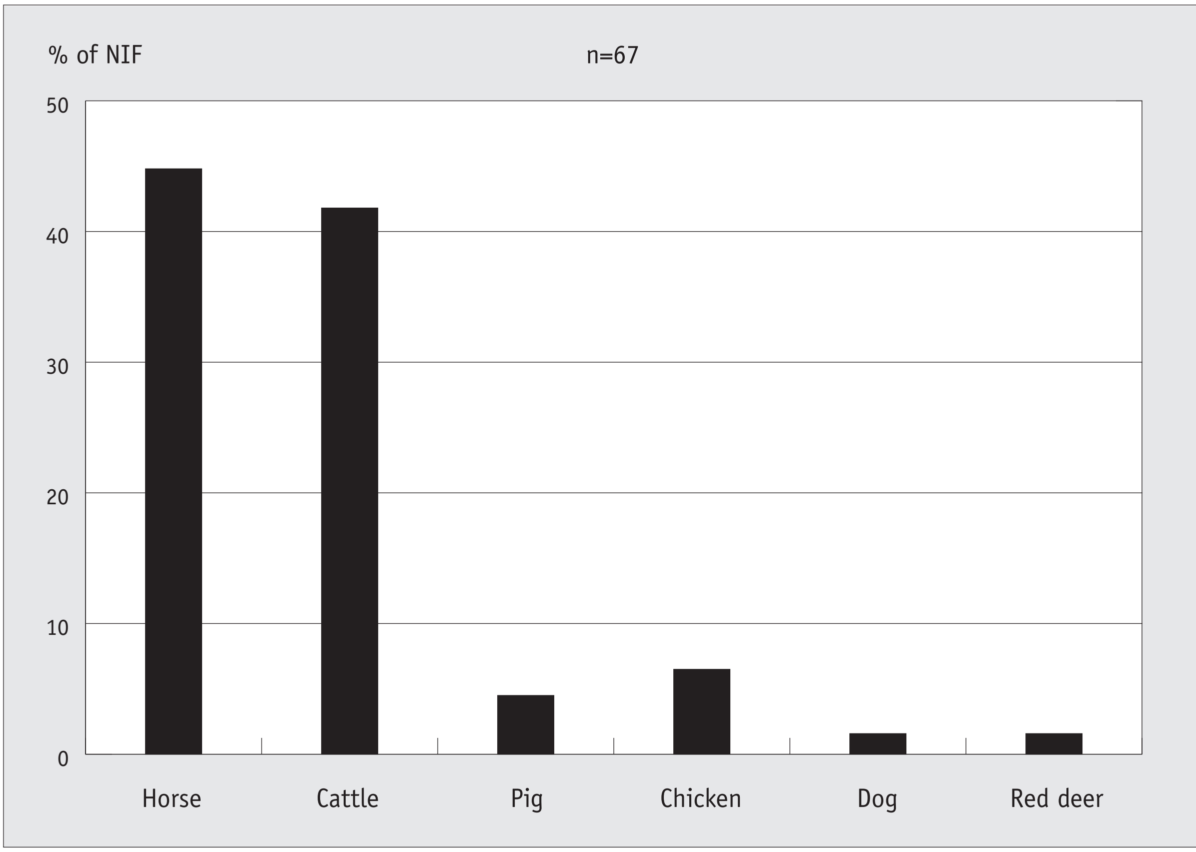

Fig. 4.6. Species distribution of animal bones from grave ditches, percentages out of total number of identified fragments. A concentration of dog bones is counted as one.

Species	**Number of ditches with identified animal bones (n=34)**	**%**	**Burnt**	**Unburnt**	**Total number of fragments**	**%**
Horse	20	58.8	-	20	30	44.8
Cattle	17	50.0	-	17	28	41.8
Pig	3	8.8	2	1	3	4.5
Chicken	1	2.9	1	-	4	6.0
Dog	1	2.9	-	1	1[42]	1.5
Red deer	1	2.9	-	1	1	1.5
Total	**-**	**-**	**3**	**40**	**67**	**100.1**

Table 4.6. Identified animal bones in grave ditches. In eight grave ditches, fragments from more than one species were found.

[42] Although the total number of dog fragments is 24, they have been counted as one because they were found in the same ditch and are from the same dog.

Horse

Horse bones were found in twenty grave ditches; 30 fragments were found in total (table 4.6, fig. 4.6). All fragments are unburnt. No gnawing marks were found on horse bones. Butchery marks are present on two of the bones (6.7 %), a femur and a metatarsal. In one ditch, two horse skulls were found. The skulls were located opposite the opening in the ditch, and one of the skulls was found at right angles to the other one. Among the horse bones found in grave ditches, bones from the hind leg accounted for over 50 % of the horse bones. Bones from the head and front leg were present in similar numbers. Out of nineteen epiphyses, five are unfused, representing horses younger than 3.5 years.[43] One horse skull was found with both deciduous teeth and permanent molars, which means that the horse was younger than 3.5 years, whereas two other skulls are from adult individuals; two loose teeth are from the permanent dentition.

Cattle

Cattle bones were found in seventeen grave ditches; 28 fragments were found in total (table 4.6, fig. 4.6). All fragments are unburnt. All five epiphyses of the long bones are fused. All three mandibles for which the age could be established are from adult individuals; seven loose teeth are from the permanent dentition. The combination of a left and right mandible occurs twice. In one case, bones from a left hind leg were found together with two mandibles. Most ditches only contained one bone. Traces of gnawing are found once (3.6 %). Butchery marks are missing. Several elements are overrepresented: teeth, mandibles, tarsal bones and metatarsals. Teeth account for 25 % of the total number of cattle bones. A similar percentage of loose teeth can be found in some phases of the settlements (table 2.2), leaving only the lower hind leg and mandible to be overrepresented in the grave ditches. However, it is important to realise that the total number of cattle bones is not very high, and the apparent overrepresentation of certain elements may just be attributed to chance.

Pig

Fragments of pig bones were found in three grave ditches. They represent single small fragments. Two of these fragments are burnt (phalanx 2 and fibula), and one is unburnt (scapula). No signs of gnawing or butchery were found.

Chicken

Bones from chicken were found in a grave ditch once. Four burnt fragments were found together: carpometacarpus, femur, left and right tibiotarsus). The fact that several fragments were found together seems to point to a deliberate placing of the fragments in the ditch.

Dog

In one ditch, the remains from two hind legs of a dog were found. 24 bones were found in total. The bones show no signs of gnawing, burning or butchery. It is unclear whether the bones were found articulated, but this seems likely. The bones are from an adult individual.

Red deer

In one ditch, a fragment of antler was found. The antler shows some chop marks and is unburnt.

Conclusion

The finds from grave ditches consist mostly of unburnt horse and cattle bones (fig. 4.6). In one ditch two horse skulls were placed on the bottom of the ditch, right across from the opening. Among the horse

[43] Silver 1969, 285-286.

bones, bones from the hind leg are overrepresented, whereas for cattle, mandibles and bones from the lower hind leg are overrepresented. Mandibles and teeth are likely to be the remains of complete skulls after fragmentation. Although chicken, dog and red deer were all found in grave ditches, all three were found just once. In comparison, horse was found in twenty ditches and cattle in seventeen. Pig was found in three ditches, but all pig finds are small fragments that could have entered the ditch in a non-deliberate way. The bones from horse and cattle, on the other hand, entered the ditch in a more deliberate manner. Bones from sheep or goat have not been found in grave ditches.

Unfortunately, no correlation could be established between the sex of the deceased in a grave and the presence of horse or cattle bones in the surrounding ditch. This is a result of the differential preservation of the southern and northern parts of the cemetery. In the area in which cremation graves have been preserved, only the lowest parts of the ditches were still present. Most of the animal bones in ditches come from a different part of the cemetery, where no cremation graves were preserved.

4.2.3 ANIMAL REMAINS FROM THE ORIGINAL GROUND SURFACE

A large number of the animal bones from the cemetery could not be assigned to any feature. However, many of these bones could be dated to the Roman period based on stratigraphy. Some date to the Iron Age, but they have not been included in this analysis. Although it is possible that some of the bones came from disturbed graves and grave ditches, we cannot discard the possibility that animal bones were deposited on the ground surface during the funerary ritual. They must have been incorporated into the underlying soil fairly quickly or they would not have survived. On the other hand, it is also possible that these bones are refuse from the settlements. The relative frequency of species will be compared with that of the animal bones from the settlements, to find out whether there are significant differences. In total, 202 bones have been identified. Horse dominates this find category, with 70 % of the identified fragments (table 4.7, fig. 4.7). Of the unidentified bones, 938 belong to *large mammal*, compared to 44 fragments of *medium mammal*. In other words, more than 95 % of the unidentified bones belong to either cattle or horse.

Horse
141 horse bones were found in total, or 70 % of the total number of identified animal bones (fig. 4.7). Butchery marks were found on three bones, or 2 % of the total number of horse bones. Gnawing was also found on 2 % of the bones. One fragment (a phalanx) is partially burnt. 45 % of the horse bones are teeth. There are slightly more teeth from the upper jaw than the lower jaw. Taphonomy can provide an explanation for the high percentage of teeth. Teeth are much stronger than bone, and will often be preserved better. Besides, even small fragments are usually identifiable to species. However, the percentage of loose teeth is very high compared to that in the settlements.[44] An alternative explanation is that the high percentage of teeth represents an overrepresentation of horse skulls. When the *large mammal* fragments are taken into consideration, we see that 22 % of these fragments are cranial fragments. In two cases, *large mammal* cranial fragments were found together with horse teeth, which means that a horse skull must have been present. I believe that the high percentage of teeth reflects an overrepresentation of horse skulls that is not taphonomical. Horse skulls were selected specifically to be included in the funerary ritual.

When we look at figure 4.8, we can see that more bones from the hind legs are present compared to the front legs. Loose teeth have been excluded from this figure. The difference (61 % for hind legs compared to 16 % for front legs) is too large to be accidental. Out of 26 epiphyses, only one is unfused

[44] In the settlement Passewaaijse Hogeweg, the percentage of loose teeth varies from 16 to 28 %.

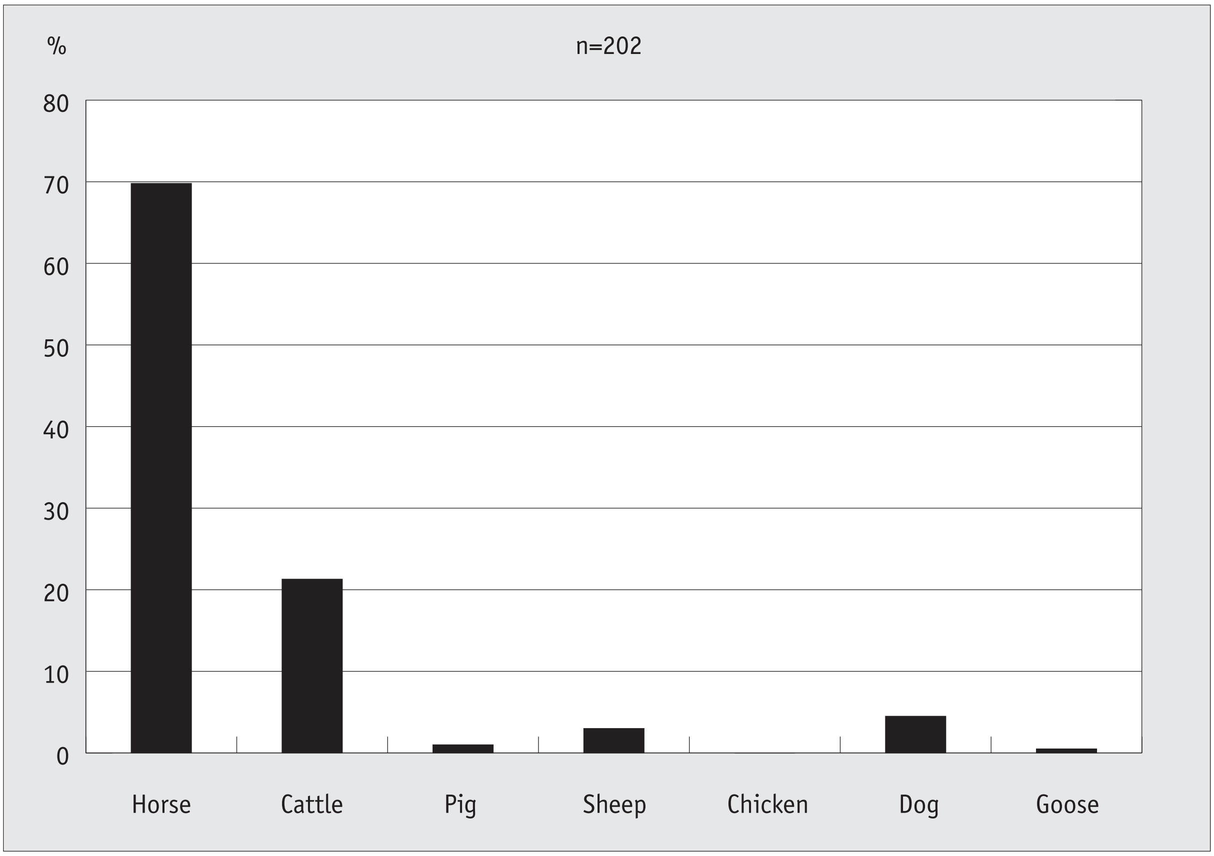

Fig. 4.7. Species distribution of animal bones from the ground surface, percentages out of total number of fragments.

Species	**Number of fragments**	**Percentage**
Horse	141	69.8
Cattle	43	21.3
Dog	9	4.5
Sheep/goat	6	3.0
Pig	2	1.0
Goose	1	0.5
Total	**202**	**100.1**

Table 4.7. Animal remains from the original ground surface.

(distal tibia: younger than two years).[45] A maxilla still has deciduous teeth as well as the first and second permanent molars. This horse must have been around 2.5 years old at the time of death.[46] Two other maxillae and a mandible have permanent premolars and molars. At least sixteen of the loose teeth are permanent teeth. It seems as if the majority of horse bones are from adult individuals, but young horses were found as well.

[45] Silver 1969, 285-286.

[46] Silver 1969, 291, table C.

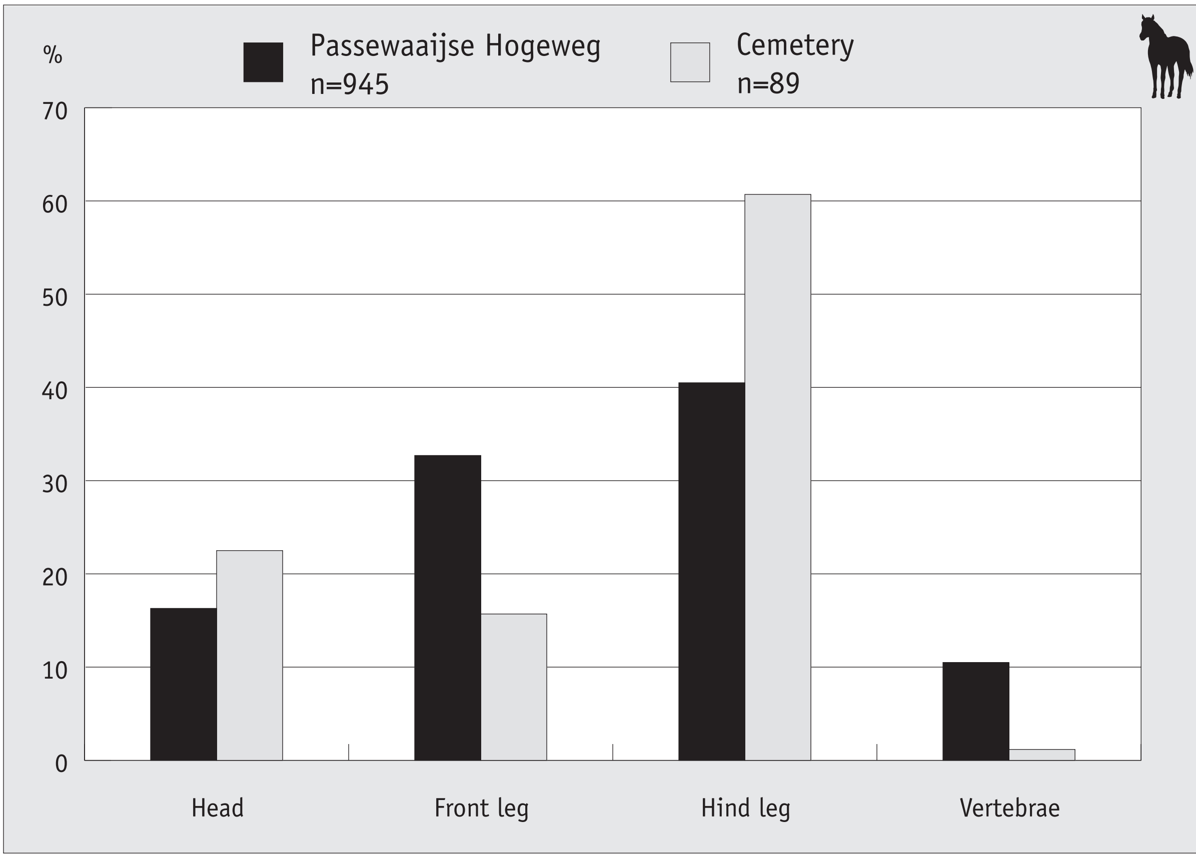

Fig. 4.8. Representation of horse body parts, percentages of numbers of fragments per body part out of total number of fragments.

Cattle

Cattle is represented by 43 bones, or 21 % of the total number of identified animal bones (table 4.7, fig. 4.7). Traces of gnawing were found on two cattle bones (5 %). Another 5 % show butchery marks. None of the bones are burnt. Again, teeth are overrepresented, although not as much as for horse. Teeth form 33 % of cattle bones. There are slightly more bones from the front than the hind leg, but the difference between the front and hind leg is not as significant as it is for horse (fig. 4.9). Ten out of eleven epiphyses are fused. The epiphysis of a calcaneum is unfused, which points to an age younger than 3.5 years.[47] Only permanent teeth were found. Almost all of the cattle bones are from adult individuals.

Dog

Nine fragments of dog were found in total (table 4.7). Dog bones represent 4.5 % of the total number of identified bones. All fragments are unburnt, and show no signs of gnawing or butchery.

Sheep/goat

Six fragments belong to sheep or goat. One of the fragments is from a radius of a young individual; the other fragments are teeth. Three of the teeth were found associated. All fragments are unburnt.

47 Silver 1969, 285-286.

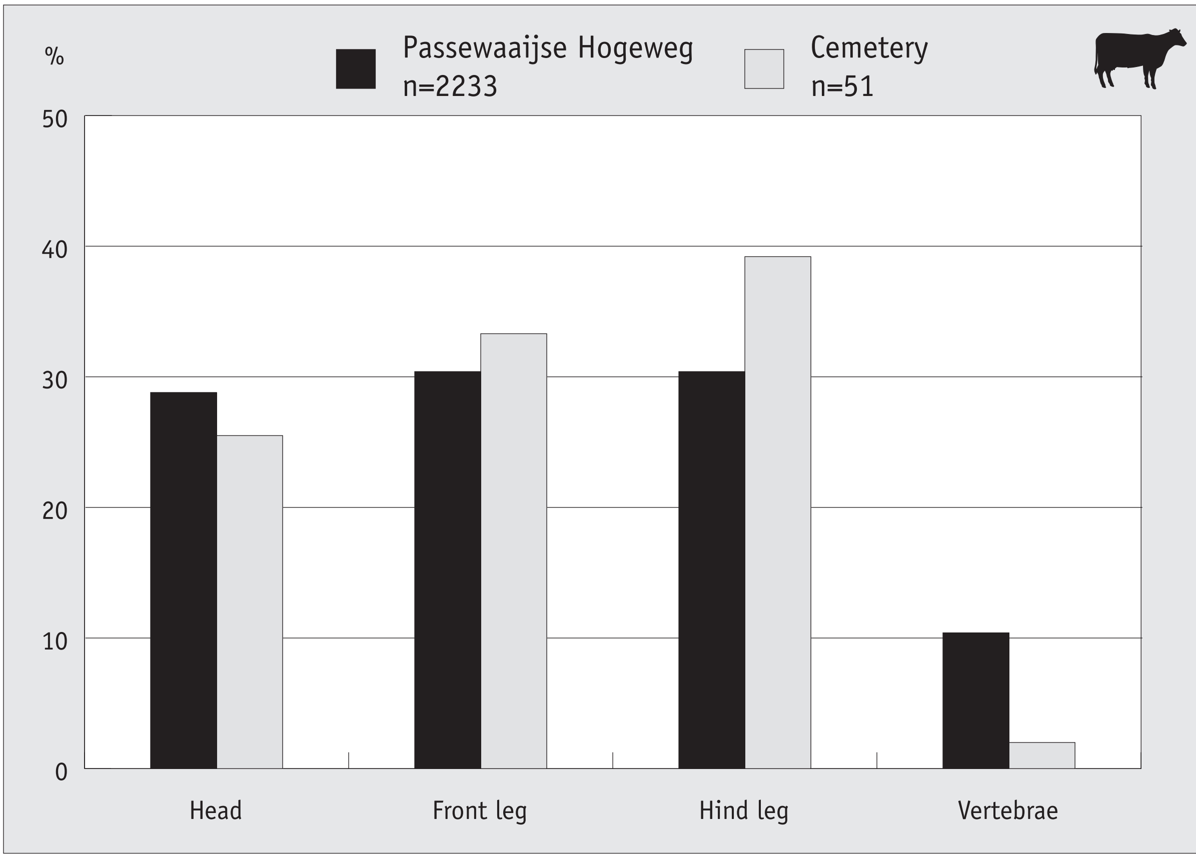

Fig. 4.9. Representation of cattle body parts, percentages of numbers of fragments per body part out of total number of fragments.

Pig

Only two fragments of pig were found in this context. Both are unburnt teeth.

Goose

A single fragment of a goose carpometacarpus was found. The bone is burnt. This fragment is likely to have come from a grave pit or ceremonial pit (see below).

Conclusion

Among the animal bones not associated with features, horse dominates with 70 %. Cattle is the second most numerous species with 21 %. Almost all of the animal bones are unburnt. There seems to have been a specific selection of horse skulls and hind legs. The species distribution of the bones found on the ground surface, as well as in grave ditches, differs significantly from that in the settlements (fig. 4.10). The animal bones are clearly not normal butchery waste. Such a large number of horse bones is not recorded for any other Roman cemetery in the Netherlands. This could be a result of bad preservation (no unburnt animal bone) combined with bad observation.

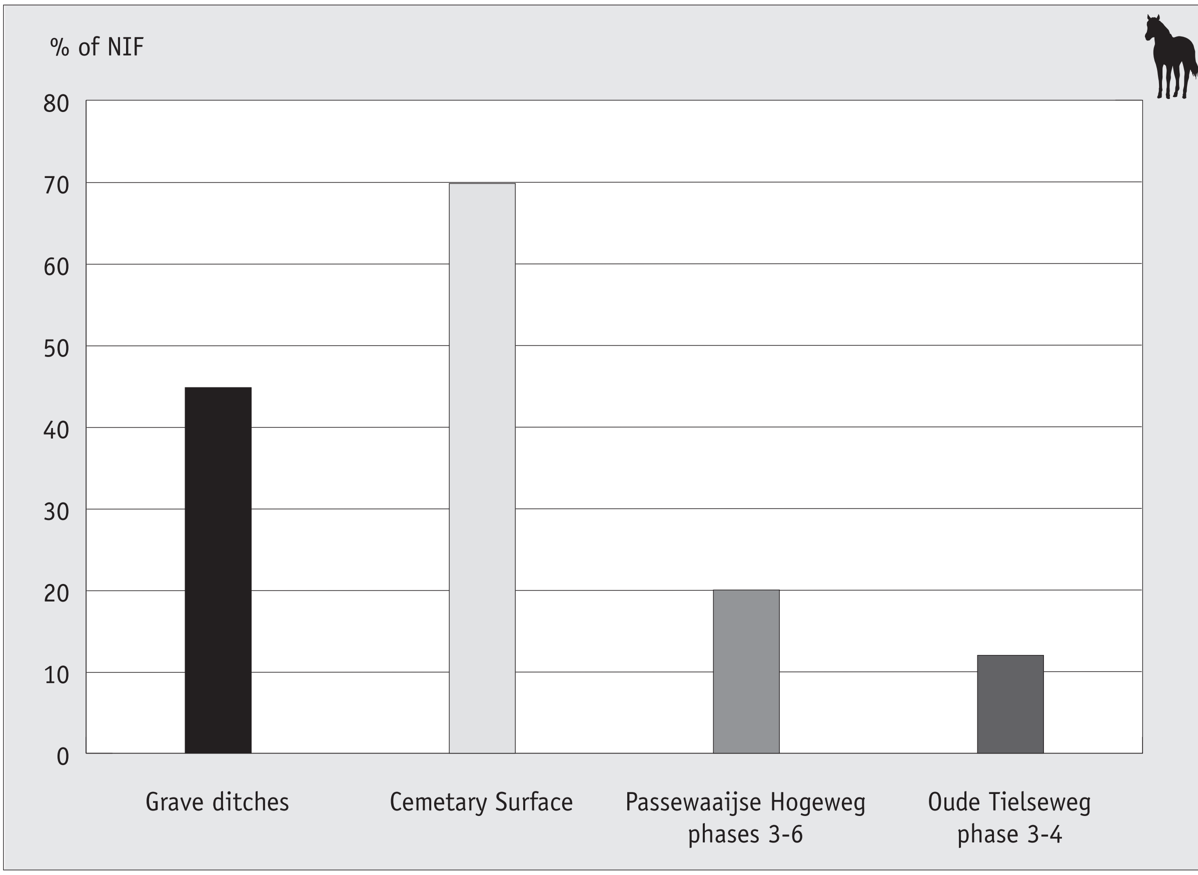

Fig. 4.10. Proportions of horse bones in two contexts in the cemetery and in the contemporary phases in the two settlements, percentages out of total number of fragments.

4.2.4 ANIMAL REMAINS FROM OTHER CONTEXTS

So far, we have looked at three different categories of finds of animal bones: finds from grave pits, finds from grave ditches and surface finds. Another two categories will be described in the following paragraphs: animal burials and ceremonial pits.

Animal burials

Three animal burials were found in the cemetery. A burial of a young foal probably dates to the Late Iron Age, when the cemetery was not yet in use, but a calf and an adult horse are contemporary with the cemetery. The well-preserved horse was buried in a deep pit with the legs pointing upwards (fig. 4.11). The horse is a male adult with an average withers height of 149 cm.[48] This is larger than the average withers height for Tiel-Passewaaij. The horse burial is located in the southern half of the cemetery. Not far from the horse burial, a calf skeleton was found. The bones were badly damaged during excavation,[49] but what is clear is that it is a very young individual: younger than 6 months.[50]

48 Calculated according to May 1985.

49 A student diligently half-sectioned the feature containing the calf skeleton, apparently without noticing the breaking animal bones.

50 Silver 1969, 296, table D; the first molar has not erupted.

Pit number	Pig skull	Pig left hind leg	Pig other	Chicken	Other animals	Pottery
114	-	1	-	phalanx	goose left & right wing	10 pieces
119	-	1	-	tibiotarsus	-	25 pieces
269	1	2	1 right hind leg, humerus	coracoid, phalanx	-	14 pieces, plus glass
271	1	1	hind leg from 2nd individual	left shoulder and wing	fish	8 pieces, plus glass
373	-	1	-	-	-	7 pieces

Table 4.8. Contents of ceremonial pits.

The fact that the burials consist of horse and cattle indicates that they should be seen in the context of the unburnt horse and cattle bones found in grave ditches and on the original ground surface. Burying a complete horse or cow could have been a variant of displaying parts of these animals on top of grave mounds or in ditches.

Ceremonial pits

A phenomenon that was found several times during the excavation of the cemetery is a pit that looks like a cremation grave, but contains no human cremated remains. The pits were located in the periphery of the cemetery and date to the later period: AD 200-270. Burnt bone was present in these pits, but it was only during the inspection by the physical anthropologist that all the fragments were found to be animal bones. The pits are not only characterised by the absence of human remains, but also by the presence of large amounts of ceramics, often burnt (fig. 4.12). Two of the pits contained glass items and hobnails. In one pit, a coin was also found. Three of the pits were surrounded by a circular ditch, whereas the other two pits had no ditch. These pits are sometimes referred to as 'ritual meal pits' because some people believe that they contain the remains from a funeral meal. However, a more appropriate term for this type of pit is 'ceremonial pit'. This is felt to be a more neutral term.

Five ceremonial pits were found in the cemetery of Tiel-Passewaaij. Four contained bones from both pig and chicken (table 4.8). In one of these pits goose bones were also found, and in another some remains of fish were present. The fifth pit contained only pig bones.

Two of the pits contained bones from two pigs (269 and 271). There is a clear preference for hind legs from pigs (table 4.8). There also seems to be a preference for the left side of the body. Remains from six left and one right hind leg of pig were found. Another leg could not be sided.[51] Additionally, tooth fragments point to the presence of a skull in two of the pits. In one pit, a pig humerus was found. The contents of these pits resemble the contents of graves.

[51] A similar side bias was found in an Iron Age cemetery in Yorkshire, where the proportion of left to right sheep humeri was 11 to 1. Legge 1991, 140-142.

Fig. 4.11. Drawing and photograph of the horse burial found in the cemetery.

4.2.5 CONCLUSION

Burnt bones from pig, chicken and sheep are characteristic for cremation graves in Tiel-Passewaaij. Animal bones found in ditches and on the original ground surface consisted mostly of horse and cattle bones. The overrepresentation of certain skeletal elements leads to the conclusion that horse skulls and hind legs were selected for the funerary ritual (fig. 4.8). For cattle, the different body parts were present in roughly equal proportions (fig. 4.9). Horse bones from several young horses were found, although the majority was from adult individuals. Almost all cattle bones are from adult animals.

As we have seen in the previous paragraphs, animal bones are also found in features other than graves and grave ditches. Animal burials were found, as well as the interesting phenomenon of ceremonial pits. A very specific pattern is found in these pits, with all five containing large numbers of burnt ceramics

Fig. 4.12. One of the five ceremonial pits found in the cemetery. The large number of pottery sherds is clearly visible.

and left hind legs of pigs. Most also contained remains from chicken, whereas glass, hobnails and goose bones were found in some. The meaning of these pits will be discussed in the next section.

4.3 ANIMALS IN FUNERARY RITUAL IN TIEL-PASSEWAAIJ

Cemeteries are more than just a collection of graves. Only by including all features and their finds in our analysis can we begin to understand the complexity of funerary ritual among the Batavians. There are several different aspects of funerary ritual where animal bones are involved. Parts of animals were placed on the funeral pyre and cremated with the corpse, unburnt animal parts were placed in the grave pit, animal parts were deposited on top of burial mounds, in grave ditches, or left on the surface between mounds, and animal parts could be burned together with pottery but without a corpse. The different contexts in which animal bones were found in the cemetery of Tiel-Passewaaij have been described above. The task that remains is to try and make sense of these different contexts and to put all the information together in an attempt to reconstruct funerary ritual for this particular cemetery, or at least those parts of the ritual where animals were involved.

4.3.1 THE FUNERAL PYRE

Burnt bones from pig, chicken and sheep or goat dominate the animal bones found in graves. Bones from pig and chicken are usually burnt, whereas sheep or goat fragments can be burnt or unburnt. This implies an important difference in treatment of the meat portion: either it was placed on the pyre and burned with the corpse, or it was put in the grave when the cremated remains were buried. The two actions represent different moments within the funerary ritual. Apparently, pig and chicken were almost exclusively associated with the funeral pyre and the cremation itself. Unburnt fragments of pig and chicken were found in only a few graves. These unburnt fragments, and about half of the sheep bones, can be associated with a later event: the burial of the collected remains. There is another difference between pig and chicken on the one hand, and sheep or goat on the other. If we look at the number of bones found in each grave, we see that pig and chicken are usually represented by several fragments, whereas sheep/goat is represented by just one or two fragments. Based on this evidence, we can formulate the following hypothesis: portions of pig and chicken were placed on the pyre with the corpse and burned with it. While the rest of the animal may have been consumed by the survivors, no evidence for this was found in the cemetery. Sheep or goat meat was consumed during the funeral. One or two fragments were symbolically given to the deceased, either during the cremation when they were thrown on the pyre and burned, or during the burial of the cremated remains.

4.3.2 THE BURIAL PIT

During excavation, the animal fragments were found among the human cremated remains, so no distinction was made during collecting the cremated bones from the funeral pyre. Some but not all of the cremated remains were collected for subsequent burial. Other parts of the cremated remains may have been disposed of elsewhere, or even kept by relatives as keepsakes or objects with magical powers. The collected remains may have been buried immediately, or they may have been buried after a certain period of time had elapsed. When the cremated remains were buried, meat portions could be put in the grave pit, together with other grave gifts. If the burial took place immediately after the cremation, only one moment of slaughter was needed. However, if there was a considerable time interval between cremation and burial, the combination of burnt and unburnt sheep bones in one grave suggests the slaughter of two animals, at different times. Not all graves contained animal bones. Apparently, not every funeral required the slaughter of animals. However, the graves without animal bones may still have contained meat, in the form of boneless pieces of prepared meat. Unfortunately, the presence of filleted meat cannot be detected archaeologically.

4.3.3 CEREMONIAL PITS: MISSING CORPSE OR OFFERING TO THE ANCESTORS?

The animal remains we find in ceremonial pits are very specific, and clearly not the refuse of just a meal. A first explanation is that the animal bones are the remains of a ceremonial meal. The bones and the pottery would have been burned after the meal and buried in a pit. The inclusion of hobnails and a coin seems out of place for a meal, but they could have been included in the pit for symbolic reasons.

However, it is impossible to prove that the remains are from a meal. The meat portions could just as well have been burned completely, as some sort of sacrificial offering to the dead. Burning pottery, glass and meat may have been a way of assuring that their essence reached the deceased. This practice may have occurred some time after the funeral. It may even have been directed at not just one person, but rather at all the dead members of the community. The scarcity of this type of pit suggests that this may have been the case, rather than ceremonial pits being standard practice at every funeral. Furthermore, the scarcity (five ceremonial pits compared to 193 grave pits) suggests that this was not a yearly event.

Another possibility is that these pits represent the funerary rites for a member of the community who died far away from home, or whose corpse was unavailable for cremation due to other reasons (for instance drowning). Many Batavians served in the Roman army, and many must have died during army service abroad. In the absence of a corpse, the funerary rites may have consisted of burning pottery and animal meat portions on a pyre. However, what sets the ceremonial pits apart from the grave pits is the large number of pottery sherds. Perhaps the absence of a corpse to cremate caused concern for the deceased's spirit, and was compensated for by larger amounts of pottery than were included in normal funerary rites. Instead of collecting only part of the burnt remains of bones and pottery, as would happen at a normal funeral, all of it was collected and buried. This explains why we find larger numbers of animal bones in ceremonial pits than we normally do in graves. An argument for ceremonial pits to be interpreted as graves for missing bodies is the fact that three of the five pits are surrounded by a circular ditch, just as many grave pits are. An argument against this interpretation is the fact that ceremonial pits occurred only during the last phase of the cemetery, whereas missing corpses would not be associated with a specific time period.

A last possible explanation for the ceremonial pits is that they are in fact graves, which happen to contain no human cremated remains. This could be a good explanation if the pits contained very little or no cremated bones at all, but we have seen that the number of burnt animal bones is relatively high compared to that in graves. Since animal and human bones were mingled together in all cremation graves, it seems very unlikely that they could have been kept separate in these cases.

The ceremonial pits contained burnt bones of mainly pig and chicken. Almost all pig fragments were from hind legs. An obvious question, considering the finds of pig hind legs, is what happened to the rest of the pigs' bodies. One explanation is that a pig was slaughtered specifically for the ritual that resulted in a ceremonial pit, but that only the left hind leg and in some cases the skull, was used in the rituals. The rest of the meat could have been distributed within the settlement and consumed in non-ritual meals. If this was a regular occurrence, we would expect to find an underrepresentation of bones from the left hind leg among the pig bones from the settlement. However, there is no such underrepresentation: the numbers of bones from the left and right hind leg are similar. However, if this kind of ritual was not performed very frequently, as the small number of ceremonial pits suggest, it would not have a large impact on the animal remains in the settlement. Alternatively, the rest of the pig may have been consumed by the community during the ritual or distributed to visiting relatives from other settlements.

4.3.4 HORSE AND CATTLE IN FUNERARY RITUAL

The cemetery of Tiel-Passewaaij demonstrates the prominent role of horse in the Batavian funerary ritual. So far, excavation and post-excavation strategy in research into Roman-period cemeteries in the Netherlands has resulted in an underestimation of the role of horse. Both among the animal bones found in grave ditches and among surface finds, horse bones dominate. The percentage of horse bones is much higher than that in the settlement phases contemporary with the cemetery (fig. 4.10). For horse and cattle, the percentages of butchered and gnawed bones are much lower than those for the settlement Passewaaijse Hogeweg. This confirms the idea that the horse and cattle bones in the cemetery are not normal settlement refuse. But what is the role of horse and cattle in this cemetery? First, we must ask whether the bones found in ditches and the surface finds derive from the same stage in the funerary ritual. The animal bones from these two categories show similarities in that they consist mostly of unburnt horse and cattle bones, but there are differences. Horse has a much higher percentage among the surface finds. The representation of body parts is also slightly different. For horse, grave ditches show an overrepresentation of hind legs, whereas among the surface finds it is the head which is overrepresented. For cattle, finds in grave ditches are mostly bones from the head and hind leg, whereas the front leg is found among surface finds, together with the head and the hind leg. It is difficult to say whether these differences are real, or due to the small number of bones from grave ditches.

Fig. 4.13. Reconstruction of the display of a horse's head on a burial mound.

The animal bones from grave ditches and from the surface show a similar composition in that they consist mainly of horse and cattle bones. Taphonomical processes such as erosion may have resulted in animal bones from one location (on top of the burial mound) being moved to two apparently different locations (grave ditch and ground surface). Therefore, it seems most likely that the two find categories are in fact one category in the funerary ritual, originating during the same stage in the funerary rites. The dominance of horse and cattle, together with the unburnt state of the bones and the low percentages of butchered and gnawed bones, is found in both categories. Both the bones in ditches and those from the original ground surface could represent material that was originally placed on top of burial mounds, and subsequently displaced as a result of erosion or subsidence.

We have already established that these bones should not be interpreted as settlement refuse. They are the remains from a specific part of the Batavian funerary ritual. Isolated body parts of horse and cattle were brought to the cemetery. For horse, heads and hind legs were preferred. These body parts were not butchered any further, so it seems that the meat was not consumed. Almost all of the butchery marks that were found indicate skinning and not segmentation of the carcass. All this does not necessarily mean that horse and cattle were slaughtered specifically for these rituals. It is possible that whenever a large animal was killed, or died from natural causes, part of its body was offered to the ancestors or the gods that controlled death and the afterlife. These body parts may have been buried in shallow pits that were later disturbed. Alternatively, they may have been left on the ground between the burial mounds, or on top of one of the mounds (fig. 4.13). A practice closely related to this one is the burial of a complete horse and a calf. This is a variation on the rite in which body parts of horse or cattle were left on the burial mound.

Not only animals played a part in this stage of the funerary ritual. Apart from animal bones, pottery has also been found in grave ditches. The types of pottery found in ditches are different from those found in graves.[52]

[52] Many of the sherds found in ditches are from Grey Ware cooking pots, a type of pottery not found in cremation graves.

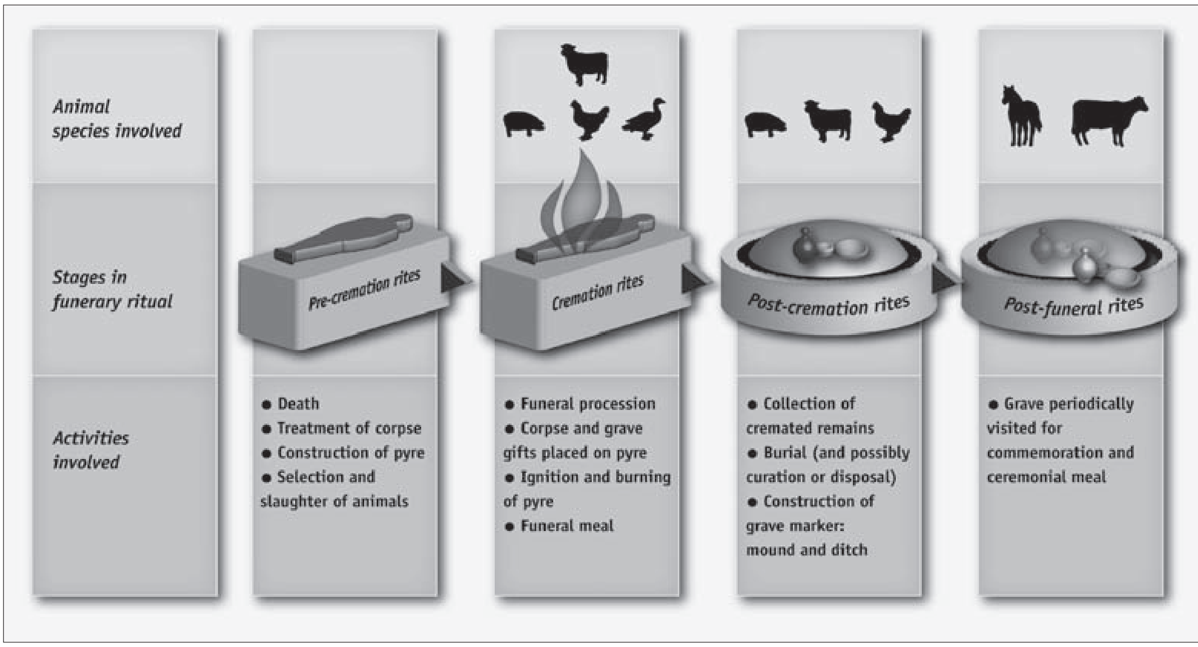

Fig. 4.14. Funeral rites in Tiel-Passewaaij: a reconstruction. After Aarts/Heeren 2007.

4.3.5 FEASTING

Food played an important role in funerary ritual in the cemetery in Tiel-Passewaaij. Joints of meat were placed on the funeral pyre or buried with the cremated remains of the deceased. The meat that was selected, pork and chicken, was not the kind of meat that was eaten in everyday life. Some of the bones found in graves may represent refuse from a funerary meal held next to the grave at the time of burial. The animal bones found in ceremonial pits may or may not represent refuse from meals. Body parts of horse and cattle were used in ritual activities performed after the burial. It is unclear whether their meat was consumed by the people attending these rituals.

The animal bones from the cemetery provided no clear evidence for feasting. However, the animals in graves and other features were rarely complete. When only part of an animal was used in funerary ritual, the rest of the animal was almost certainly consumed by members of the community.

4.3.6 CONCLUSION

Without looking at all find categories, as opposed to looking at just the animal bones, a complete and definitive reconstruction of the Batavian funerary ritual cannot be made.[53] An analysis of any finds other than animal bones is not the object of this research. However, based on just the animal bones and the different contexts in which they are found, we can get a good idea of the different processes involved in the funerary ritual (fig 4.14).

After the death of a member of the community, the funeral would be prepared. Wood needed to be collected for the funeral pyre. Food and pottery were selected for the cremation. Pre-cremation rites probably dictated that the body was washed and dressed in a special way.

[53] Although a lot of work has been done on the cemetery, the final publication is not yet finished. For most find categories, only preliminary results are available.

The cremation itself probably took place in the cemetery. The body was placed on top of the funeral pyre, together with portions of pig, chicken or goose, pottery and in some cases personal items. It would have taken hours for the cremation to be completed. Someone would have tended the fire to make sure that it kept burning and that the body burned evenly. A funeral meal was held near the pyre, possibly consisting of mutton. A small part of the meal would be placed on the pyre, so that the dead could share the food of the living.

Post-cremation rites consisted in the first place of the selection of part of the cremated bones for burial. The cremated remains may have been buried immediately, but it is also possible that a certain time period had to pass before the burial could take place. The cremated bones were wrapped in a piece of cloth, leather or skin and placed in a pit. Several complete pots were placed in the pit, together with other items such as glass bottles or coins. Meat portions were sometimes placed in the pit, although this was less common than placing food on the funeral pyre. It is possible that another meal was consumed during this part of the funeral rites, and again the dead would be offered part of it. The pit was filled with earth and a round or rectangular ditch was dug around the grave. The earth from the ditch was deposited on top of the grave to produce a low mound. The funeral itself would now be complete, but the grave would be visited at least once more, but more likely periodically, for commemorative rites. During these rites, body parts of horse and to a lesser extent cattle were placed on top of the burial mound. At least one complete horse and calf were buried in pits during these rites. The use of horse and cattle may have referred to the close ties between man and these two animal species in life, or the importance of horse and cattle to the whole community.[54] We can assume that the survivors would have enjoyed a meal on or near the grave, sharing the food with the deceased. Perhaps the ceremonial pits represent the remains from commemorative meals.

4.4 COMPARISON WITH OTHER SITES

The present research focuses on the Batavian region, and it is felt that a wide comparison with cemeteries outside this region falls outside its scope. Unfortunately, not many cemeteries from the Roman period have been fully excavated in the Batavian region. Results from those that have been excavated are mostly unpublished. Besides, for only a few cemeteries for which a reasonable number of graves has been excavated have the animal bones been analysed. Even then, a comparison is not always possible, because there are often differences in the analysis of the animal bones. Another drawback is that for almost all cemeteries, only the animal bones from grave pits have been collected and analysed. The results from the cemetery in Tiel-Passewaaij show that animal bones from other features in a cemetery can provide valuable information. Any comparison at this moment will have to be limited to animal bones from cremation graves. For these reasons, only general similarities and differences can be observed at this moment.

Previous research on animal bones from cemeteries from the Roman period has shown the predominance of burnt bones of pig, chicken and sheep or goat in graves.[55] A recent publication on funerary ritual during the Late Iron Age and the Roman period in the Maas-Demer-Scheldt Area summed up results from several cemeteries. Hiddink concluded that the differences in relative frequencies of animal bones in graves are large, and that they cannot be explained by differences in agrarian economies, consumption patterns in nearby settlements, or the proximity of Roman towns or military sites.[56] Apparently, the choice for certain animal species depended on the taste or preference of the people in the community.

[54] If the close relationship between man and horse or man and cattle led to their use in funerary ritual, the near absence of dog remains in the cemetery is strange, because it is dog that is usually seen as the companion of humans, and in many different cultures, buried with people.

[55] Lauwerier 2002, 65-66; Lauwerier 2004, 69.

[56] Hiddink 2003, 27-28, table 7.

Species	Tiel-Passewaaij Burnt + unburnt (n=44)	Tiel-Passewaaij burnt only (n=30)	Cuijk[57] (n=15)	Oss-Ussen[58] (n=4)	Nijmegen-Hatert[59] (n=15)
Pig	36.4	43.3	43.8	100.0	53.3
Chicken	28.3	38.7	-	-	13.3
Sheep/goat	30.4	25.8	60.0	25.0	13.3
Cattle	17.4	3.2	9.4	-	13.3
Goose	6.5	9.7	-	-	6.7
Horse	4.3	-	-	-	-

Table 4.9. Percentage of animal bones in graves, out of total numbers of graves with identified bone. All animal bones from Cuijk, Oss-Ussen and Nijmegen-Hatert are burnt.

Table 4.9 shows the frequencies of animals in graves in the cemetery of Tiel-Passewaaij and three other cremation cemeteries. The number of graves with identified animal bones is low in the other cemeteries, especially in Oss-Ussen. For a fifth cemetery, in Kesteren, no detailed data were published, but it is mentioned that most of the burnt animal bones are from pig, and especially suckling pig.[60]

Pig was important as a grave gift on the pyre in all four cemeteries: burnt pig bones were found in 40 to 50 % of all graves with identified animal bones (table 4.9). Although pig was found in all four graves at Oss-Ussen, the small number of graves means that the 100 % pig can be misleading to use as a comparison. Chicken can be absent (Cuijk and Oss-Ussen), it can be present in a small percentage of graves (Nijmegen-Hatert), or it can be present in a larger percentage of graves (Tiel-Passewaaij). Sheep or goat varies from 13 to 60 %. Cattle bones were found in most cemeteries in small numbers. Goose was found both in Tiel-Passewaaij and Nijmegen-Hatert.

A possible comparison for the ceremonial pits in Tiel-Passewaaij can be found in the cemetery of Wederath-Belginum. The so-called *Aschengruben*, around 500 of which were found in the cemetery among the cremation graves, contained large quantities of burnt pottery while human cremated remains were conspicuously absent.[61] Animal bones were found in these pits and consisted of burnt bones of pig and chicken.[62] *Aschengruben* have been interpreted as pits in which pyre debris was buried, after the human remains had been collected and buried in a separate grave.[63] However, it seems unlikely that an easy distinction could be made between human and animal cremated bones.

A high percentage of non-articulated horse bones, such as was found in Tiel-Passewaaij, is not found in other cemeteries from the Roman period in the Eastern Dutch River Area. Burials of complete horses do occur occasionally. Because of the small number of cemeteries excavated in the Eastern Dutch River Area, two examples from slightly further away are mentioned here. In the cemetery in Valkenburg, a 6 to 7-year-old male horse was buried among the human graves.[64] Although a cavalry unit was stationed in the nearby *castellum*, the excavators believe that it was mainly the inhabitants of the *vicus* that were buried in this cemetery.[65] Several horse burials are known from cemeteries in Cologne. One of these horses had its throat cut and was found associated with an iron knife.[66] A large number of horse burials was found in

57 Cuijck-Heeswijkse Kampen. Lauwerier 1990, 3.

58 Lauwerier/IJzereef 1998, 354.

59 Thijssen 1990, 191.

60 Hessing 1993, 308; Lauwerier 1992, 84.

61 Abegg 1989, 395, 398.

62 Cordie-Hackenberg *et al.* 1992, 110, table 1.

63 Abegg 1989, 398.

64 Verhagen 1987, 94-97.

65 Bult/Hallewas 1986, 47.

66 Riedel 2000, 195.

the cemetery in Kesteren, which lies in the Eastern Dutch River Area, but these turned out to be older than and therefore not associated with the human burials.[67]

To find cemeteries with unburnt horse bones, we have to look outside our research area. The first cemetery we should look at is the 1st-century BC cemetery of Lamadelaine in Luxemburg. Although ground features were mostly invisible, the location of the different species found shows that pig, chicken and dog were found close to the cremated remains, while cattle, sheep or goat and red deer were found further away from the grave. Horse was found in a peripheral position. The preservation of some of the horse bones suggested that they were exposed to the air.[68] A second cemetery in which horse bones were found is Brougham in northern England. This 3rd-century AD cemetery was associated with a fort and included burials of soldiers and their wives and children, possibly of Pannonian origin.[69] Entire or partial horse carcasses were cremated and the remains included in the grave. Horse was associated with both male and female burials. This is the first evidence for the presence of horse in Roman cremations in England.[70]

The absence of isolated horse bones in Roman cemeteries in the Eastern Dutch River Area does not mean that horses did not play a role in other cemeteries, but rather reflects the excavation strategy employed as well as the state of preservation. In most cemetery excavations, only finds from grave pits are collected, whereas the ditches are not normally excavated. Even when ditches are inspected for finds, the soil needs to be suitable for unburnt animal bones to be preserved.

4.5 CONCLUSION

The animal bones from the cremation cemetery in Tiel-Passewaaij show the potential of animal bones to help us understand the funerary ritual in the region. Excellent preservation combined with an excavation strategy that ensured that animal bones from different contexts were collected has resulted in some surprising new evidence. When research is focused only on cremation graves, much of the evidence is overlooked. Animal bones from grave ditches and the original ground surface in the Tiel-Passewaaij cemetery revealed that horse and cattle played an important role in funerary ritual, something that had never before been realised. Analysis of the animal bones within their contexts has allowed a reconstruction of the different components of funerary ritual.

Burnt bones from pig, chicken, sheep and goose represent food given to the deceased before or during the cremation, while unburnt animal bones in graves represent the next stage in the funerary ritual: the burial of the collected cremated remains together with food, pottery and sometimes personal items. Alternatively, the animal bones could be the remains of a meal shared between the dead and the surviving members of the community. Unburnt bones from horse and cattle represent the final stage in the funerary ritual: periodic returns to the grave to remember the dead. Body parts of complete animals were exposed on the burial mound, or sometimes buried in a separate pit.

These results from the analysis of the animal bones from the cemetery of Tiel-Passewaaij demonstrate the need for a change in excavation strategy for Roman cemeteries. Instead of focusing on the central graves, it is imperative that all features are fully excavated and sieved and all finds collected. Only then can we begin to understand funerary ritual and find out whether the situation in Tiel-Passewaaij is exceptional or a normal pattern.

67 Hessing 1993, 310-312; Lauwerier 1992,96-98.

68 Metzler *et al.* 1999, 369-370.

69 Cool 2004, 463-466; McKinley 2004, 308.

70 Bond/Worley 2004, 326, 330.

3. Animals and ritual within a rural settlement

During the excavation of the settlement Passewaaijse Hogeweg, numerous cases were found of animal bone deposits that struck the excavators as 'odd' in some way. This 'oddness' was felt intuitively at first, but was actually based on completeness of the bones, concentration of several bones, or association with other, non-bone finds. In short, the animal bones in the deposits deviated from what was considered 'normal' bone refuse. For many of these animal bone deposits, the author was called on site to inspect the animal bones and record any information. A protocol was developed for excavating and recording these animal bone deposits. Detailed drawings or photographs were made of most of them.

No definitive interpretations were made in the field regarding the ritual or non-ritual nature of these deposits; an open mind was felt to be important for the analysis of the data. However, the possibility was recognised that the deposits could have been created during some kind of ritual. Thanks to the care with which this settlement was excavated, a large set of data on animal bone deposits is available for analysis. Apart from the animal bone deposits recognised during the excavation, some deposits were only recognised during the analysis of the animal bones in the laboratory. Because these deposits were not recognised in the field, not all the relevant information was recorded; for example, no drawings or photographs were made. As a result, the interpretation of these deposits will be more difficult and tentative.

Although many archaeologists agree on the special nature of the sort of deposits found in Passewaaijse Hogeweg, opinions differ on whether they should be interpreted as resulting from ritual activities. Other explanations for special animal deposits include purely functional activities and taphonomic processes. This chapter will attempt to establish whether the special animal deposits from Passewaaijse Hogeweg originated in a ritual context.

Before describing the specific character of the special deposits from Passewaaijse Hogeweg, it is necessary to discuss what 'ritual' is and to define the term for the purpose of this analysis. After discussing the nature of ritual, the question of whether it is possible to recognise ritual in archaeology must be answered. Next, previous research into ritual in archaeology and the relationship between ritual and economy will be discussed. The criteria used by other archaeologists to identify ritual in archaeology are examined and used to develop criteria relevant to the specific cases from Passewaaijse Hogeweg. After describing the special animal deposits from Passewaaijse Hogeweg themselves, it will be established whether they should be seen as ritual or not. Once their ritual character has been established, an attempt is made to interpret their meaning and importance within the settlement. Finally, the special deposits from Passewaaijse Hogeweg will be compared with other special animal deposits from the Netherlands, and a few examples from outside the Netherlands.

3.1 THE NATURE OF RITUAL

It is not necessary to start from scratch when studying ritual in archaeology. Anthropologists have done much work in this field that we can use, both in theoretical and in field studies. Field studies by anthropologists of rituals of exotic people in faraway countries may not seem relevant when discussing ritual in the Netherlands during the Roman period, but it helps us to broaden our modern western minds. Archaeologists can also take advantage of the theoretical framework anthropologists have created in their studies. Anthropological research will give us a better understanding of ritual. Furthermore, it will be useful when formulating the questions we can and must ask of ritual deposits in archaeology. Finally, it is an indispensable tool when interpreting ritual in archaeology.

3.1.1 Division between ritual and non-ritual

Before we can discuss what exactly ritual is, we must ask ourselves whether it is possible to differentiate between ritual and non-ritual behaviour. De Coppet believed it is essential to understand the difference between ritual and non-ritual in the society under scrutiny.[1] A first question is whether ritual can be seen as a separate kind of behaviour, or whether it is part of many kinds of social action. Anthropologists have tended to see ritual either as a distinct and autonomous type of behaviour, or as an aspect of all human behaviour.[2] The truth probably lies somewhere in the middle.

It is important to realise that participants always know whether they are performing a ritual or not. A ritual is consciously experienced by the people taking part in it. The question is whether it is recognisable for an observer who is not part of the community. Lewis suggested that ritual is often intuitively recognised by researchers.[3] It is the alerting peculiar aspect of ritual which calls to us for attention.[4] There is a "central area of general agreement on what is ritual".[5] However, there are no clear boundaries separating ritual from other kinds of behaviour.[6] When studying ritual, we must accept that there are grey areas and doubtful cases. This is the nature of the subject. Parkin agrees with Lewis that anthropologists will recognise a ritual when they see one.[7] The sense of special occasion that they recognise is also recognised by the participants in the ritual. That is in fact one of the defining aspects of ritual: the fact that the participants realise that they are behaving in a way that is different from how they would behave on non-ritual occasions. Many kinds of behaviour include a ritual aspect. It seems that we cannot draw absolute lines between ritual and non-ritual behaviour. However, it is clear that the central core of ritual behaviour will be easily recognised.

3.1.2 Definitions of ritual

There are as many definitions of ritual as there are researchers. Ritual is defined differently for different societies, because religion and spatial and temporal contexts are culturally defined. A general cross-cultural materialist definition may not be possible.[8] However, it is important to define what we mean by ritual.

Merrifield defined ritual customs as practices that set out to manipulate supernatural powers into providing some advantage or preventing disaster, for the benefit of an individual or the community.[9] He later defined ritual as "prescribed or customary behaviour that may be religious, if it is intended to placate or win the favour of supernatural beings, magical if it is intended to operate through impersonal forces of sympathy or by controlling supernatural beings, or social if its purpose is to reinforce a social organisation or facilitate social intercourse".[10] Platvoet defined ritual as an "ordered sequence of stylized social behaviour that may be distinguished from ordinary interaction by its alerting qualities which enable it to focus the attention of its audiences – its congregation as well as a wider public – onto itself and cause them to perceive it as a special event, performed at a special place and/or time, for a special occasion

1 De Coppet 1992, 8-9.
2 Bell 1992, 70.
3 Lewis 1980, 7.
4 Lewis 1980, 20.
5 Lewis 1980, 7.
6 Lewis 1980, 6-7.
7 Parkin 1992, 15.
8 Garwood *et al.* 1991, viii.
9 Merrifield 1987, xiii.
10 Merrifield 1987, 6.

and/or with a special message".[11] In order to do this, ritual uses culturally specific symbols. Parkin came up with the following 'minimal' definition: "Ritual is formulaic spatiality carried out by groups of people who are conscious of its imperative or compulsory nature and who may or may not further inform this spatiality with spoken words".[12] His concern with spatiality is obvious. Turner described ritual as "formal behaviour for occasions not given over to technological routine, having reference to beliefs in mystical beings or powers".[13] Garwood *et al.* saw ritual as a distinct social phenomenon that can be distinguished by "its particular temporal and spatial context, the codified and symbolic form of the performance, and its particular cultural referents".[14]

The concept of rites of passage was first formulated by Van Gennep and has since become an important part of ethnographic research into rituals.[15] Rites of passage are those rites which involve a transformation in the person undergoing them. Examples are initiation rites, marriage and funerary rites. In most societies, important stages in a person's life cycle are marked by rites of passage. Parkin suggested that all rituals are in some way rites of passage.[16]

It is important to note the differences between ritual on the one hand, and ceremony and custom on the other. The latter are behaviours that share some characteristics with ritual behaviour. Ceremony and custom can be formal, repetitive and bound by rules, which we will see are some of the characteristics of ritual. The main difference between ritual and custom or ceremony is that ritual is concerned with communicating with the other world, whereas secular ceremony is concerned only with this world.[17] Another difference between custom and ritual is that custom is silent whereas ritual is loud; it demands public attention.[18]

Similarities in the different definitions of ritual are: the importance of the supernatural, formality or rule-governed behaviour, a social aspect, the use of symbols, a special time and place, and efficacy. In the next paragraph, we will discuss some of these aspects in more detail. Rituals may or may not be religious. It is not necessary to make the distinction for pre-modern societies. In non-industrialised societies, religion is part of everyday life; religion is 'embedded'.[19]

3.1.3 CHARACTERISTICS OF RITUAL

There is no clear demarcation between ritual and non-ritual behaviour, and no universal definition of what ritual is. However, when studying the anthropological literature on ritual, some aspects of ritual recur on which everyone agrees. These are the distinctive characteristics of ritual that are found throughout different societies and different time periods. Some of these aspects are more noticeable when observing rituals than others. These aspects are communication with the supernatural, formality, the adherence to rules, repetition, public attention, and the importance of spatiality.[20]

- Communication with the supernatural is an important aspect of ritual. Rituals are often intended to request the supernatural for something, whether it is fertility, protection or a safe passage to the afterworld. There is usually an element of reciprocity: something is given in return for the favour asked. In ritual sacrifice, the supernatural is the recipient of (at least part of) the slaughtered animal or human being.[21]

11 Platvoet 1995, 41.
12 Parkin 1992, 18.
13 Turner 1967, 19.
14 Garwood *et al.* 1991, vii.
15 Van Gennep 1960, 1-3, 10.
16 Parkin 1992, 12.
17 Moore/Meyerhoff 1977, 14.
18 Parkin 1992, 15.
19 Bloch 1989, 122.
20 Bloch 1989, 42; Goody 1977, 28; Meyerhoff 1977, 199; Moore/Meyerhoff 1977, 4, 7.
21 Green 2001, 22.

- Formality and rules

This aspect is variously described as stereotypy, rigidity, stylization, standardised behaviour, rule-governed behaviour or prescribed behaviour.[22] Formality can be expressed in formalised language, movements or dress. The language used in ritual is different from everyday language. Ritualised speech and singing, for instance, are important aspects of ritual.[23] A solemn and measured voice can also be used.[24] Formalised language has associations of being timeless, polite, respectful and holy.[25] Participants in ritual often use slow and deliberate movements and gestures.[26] Formality creates a distance between the ritual actions and the time, location and participants. Thus, these actions become timeless and associated with the supernatural.[27]

Formality also encompasses the explicit rules that guide the order and sequence of rituals. These rules, known by the people involved, are not self-evident, but artificial and arbitrary.[28] Hill emphasised that what is important is that the rules and sequence of the event are clear to the participants.[29] The actions performed within a ritual gain a significance they would not otherwise have. Although the rules of ritual are known by the participants, the meaning may or may not be known.[30] As Lewis described it: "What is clear in ritual is knowing how to do it rather than knowing what it means".[31] The formality of ritual alerts both participants and observers.[32] It demands attention from the audience and deflects questioning. Even when performed for the first time, stylization and repetition make the ritual tradition-like.[33]

- Repetition

Repetition of occasion, content or form is another aspect found in ritual.[34] There are two aspects to repetition: the repetition of how a ritual is performed, and repetition within a ritual. Because the words and actions are repeated in a similar manner every time the ritual is performed, it is recognised as ritual and meaningful. Repetition of words and actions within a ritual serve to emphasise the special circumstances. Because ritual is not an argument, its messages cannot be expanded; they can only be repeated.[35] Moore/Meyerhoff saw the function of repetition as insisting on the truth of the messages involved in the ritual.[36]

- Public aspect

Ritual usually includes an aspect of public attention; it is often performed in front of an audience. Lewis suggested that although not every ritual is watched by an audience, every ritual contains a public aspect: the ritual is ruled and taught and learned. The rules are determined and recognised by the community. A ritual can also belong to a restricted community within society.[37] Even where a ritual is private, the supernatural can still be regarded as the audience for which the ritual is performed.

- Spatiality

Parkin emphasised the importance of spatial orientation and directionality in ritual, and of spatial movements especially.[38] Ritual may prescribe spaces, positions and directions for participants. As an example, Parkin mentioned the importance of the spatial orientation of the body in burials in an ethnic group in

22 Platvoet 1995, 28; Merrifield 1987, 6; Lewis 1980, 13; Moore/Meyerhoff 1977, 4, 8.
23 Bloch 1989, 20.
24 Middleton 1977, 80.
25 Bloch 1989, 27.
26 Middleton 1977, 80.
27 Bloch 1989, 44.
28 Lewis 1980, 8, 20.
29 Hill 1996, 26.
30 Lewis 1980, 19.
31 Lewis 1980, 116.
32 Lewis 1980, 25.
33 Moore/Meyerhoff 1977, 8.
34 Moore/Meyerhoff 1977, 7.
35 Bloch 1989, 42.
36 Moore/Meyerhoff 1977, 17.
37 Lewis 1980, 21.
38 Parkin 1992, 16-17.

Kenya. He not only discussed the literal meaning of spatiality but also the metaphorical one. He saw the concept of rites of passage as referring to both physical and social and cosmological movement. Apart from spatial orientation and movement, the concern with space can also be expressed in setting apart a special space where ritual is performed.

Most of the characteristics mentioned above can be seen as devices used to alert the public.[39] Lewis saw these features as being responsible for creating the peculiar quality of ritual.[40] This quality not only serves to let the members of a society know that they are watching or participating in something special, but also allows the researcher to recognise ritual.[41]

Not all aspects of ritual are easily recognised, especially in archaeology. Communication with the supernatural may be visible archaeologically in some rituals, especially where images of gods or inscriptions naming gods are involved. Special spaces where rituals are performed, such as ritual rooms, buildings or enclosures, may be present in some societies. The public aspect is important to keep in mind when searching for rituals in archaeology. Large rooms may reflect an audience composed of more than just family members or local people. The aspects of formality and repetition are crucial for archaeologists in recognising ritual. It is these aspects that can result in recurring patterns of deposits, which are recognisable to archaeologists.

3.1.4 FUNCTION OF RITUAL

Ritual has three different functions. First, there is a very practical side to ritual: it is performed for a particular reason with the intention of affecting the environment. Second, ritual plays an important role in creating or maintaining social relations within a society. Finally, ritual has a psychological effect that is especially important in times of crisis. These three functions are closely interlinked and cannot always be separated.

Efficacy of ritual

Ritual is performed in order to order, rectify or transform a particular situation.[42] It is also a way to create order in situations of disorder.[43] An increase in the performance of rituals could reflect situations of instability. Finally, ritual provides people with guidance on how to act in a particular situation.[44] Two examples of reasons for performing rituals are to thank the gods for their generosity and to ensure the fertility of land and livestock.[45] To consider ritual as irrational behaviour would be to judge other people and periods by our own western standards. It will also ignore the widespread superstitious beliefs still held today by many western people. Participants in a ritual believe that the ritual will be effective. To them, it is not irrational; it is a functional means to control an unpredictable world. It helps people to survive by giving them the feeling that they can control their environment. If a ritual works (by maintaining or increasing health or prosperity), people would have no reason to doubt their beliefs in the efficacy of the ritual.[46]

Other scientific fields can explain why people believe in the efficacy of ritual. Animal behaviour and psychology studies have shown the significance of the so-called confirmation bias that is essential in learning by both the animal and human brain. When two events occur close together in time, the brain

[39] Lewis 1980, 97.

[40] Lewis 1980, 7.

[41] Lewis 1980, 20.

[42] Bell 1992, 108.

[43] Middleton 1977, 81.

[44] Lewis 1980, 34.

[45] Derks 1998, 76.

[46] Lewis 1980, 14.

associates them, and believes that one is caused by the other.[47] In many cases, there is a true association, but in others, the two events are separate and their occurrence in time coincidental. Confirmation bias is the basis of superstition. Without knowledge of the true reason behind events, it is not surprising that people believe rituals cause desired events or end disastrous ones.

Ritual and social relations

There is an important social aspect to ritual. Ritual can function to demonstrate social relations and to enhance social bonds. The participation in rituals can help to strengthen bonds between people by drawing attention to their shared identity. Participation in a ritual can indicate social status.[48] It can also serve to gain social prestige by showing off wealth.[49] Participation in a ritual may not be open to everyone; it can be restricted to a certain section of the community.

It is not necessary to believe in a ritual in order to participate in it. Those who do not believe in the efficacy of a ritual may participate for other reasons, such as celebrating or proclaiming their ethnic unity.[50] Performing a ritual can also be a symbolic statement to outsiders or consolidation of internal values and meanings.[51] Ritual can serve to solve social conflicts. For instance, Turner described how the decision to perform a ritual in a particular tribe in Zambia was guided by social conflicts.[52]

When considering ritual, we must ask who performed ritual in a particular society. Some societies have ritual specialists, whereas in other societies rituals are performed by non-specialists. A ritual specialist functions as an intermediary between this world and the other world.[53] Ritual specialists are typical for societies with a certain social stratification.[54] If ritual specialists do not exist, is a ritual performed by one individual, a family, a part of the community or the whole community?

Apart from the relations within a community, ritual is concerned with the relations between man and the supernatural. Relations between man and god are renewed by an exchange of gifts during the ritual.[55] An anthropological study showed the twofold nature of rituals: individual and communal. In a village in northeast Thailand, rituals were observed to appease the village guardian spirits and to appease malevolent spirits.[56] The guardian spirits were propitiated in two contexts. The first context is a collective ritual that took place twice a year: to request a good harvest and to give thanks after the harvest. In the second context, individuals appealed to the guardian spirits to withdraw their anger directed at this person. The value of the offering in the second case was dependent on the seriousness of the situation. There was a clear scale of increasing value of offerings, from chicken to buffalo.[57]

The psychology of ritual

Apart from the practical and social functions, ritual also has a psychological function. In times of uncertainty or conflict, it is important that people feel that they are in control of their environment. Performing rituals can give them this feeling. The psychological function of ritual is "to calm the anxiety that arises from confrontation with the unforeseen, the unknown, the incommensurable, the event that eludes understanding and technical action, and the uncontrolled (…) It allows a person to be reassured or to take courage and go forward again with tenfold strength".[58]

Confronted with disastrous and little-understood events such as epidemics or extreme weather, a society that has suitable rituals for such situations may be more likely to remain stable. The adverse conditions may be easier to bear just because the society has a response available.

47 Grandin/Johnson 2005, 98.
48 Lewis 1980, 89.
49 Hoekstra 2001, 31, 33, 34.
50 Baumann 1992, 112.
51 Baumann 1992, 100.
52 Turner 1969, 10.
53 Derks 1998, 212.
54 Bell 1992, 130.
55 Derks 1998, 73.
56 Tambiah 1969, 439.
57 Tambiah 1969, 439.
58 Jamous 1992, 68-69.

3.1.5 The concept of sacrifice

An important concept we must consider is that of sacrifice. Sacrifice is a particular kind of ritual in which either a living animal or person is killed and its essence or body offered to the gods, or an inanimate object or food is destroyed or taken out of circulation by offering it to the gods.

Because this study is concerned with animal remains in ritual deposits, sacrifice plays an important role. As in other rituals, the sequence of events of a sacrifice is important. Green described a sacrifice as a kind of performance.[59] Often, different acts such as dancing, singing and praying are involved. The sacrifice is often preceded by a procession and the decoration of the victim. During this process, tension is built up that is released by the completion of the sacrifice: the death of the animal. Sacrifice is usually a group event. The responsibility is shared by the community and the rewards are also reaped by the community.

Sacrifice establishes "a means of communication between the sacred and profane worlds through the mediation of a victim, that is, of a thing that in the course of the ceremony is destroyed".[60] It involves reciprocity: something is given to the gods in return for a favour asked.[61] To make it possible for an offering, whether it is an animal or an object, to move from the secular world to the sacred world, it has to be transformed. In the case of a living offering, this usually means that is has to be killed; inanimate objects are destroyed so they can no longer be used in this world.[62]

3.1.6 Feasting: types and functions

A useful definition of feasts is "communal food consumption events that differ in some way from everyday practice".[63] Differences from everyday food consumption can be found in the number of people involved, the quantities and types of food consumed, the types of food containers and serving platters, the duration, the occasion, and the setting. These characteristics are variable for different types of feast. Feasts are often part of rites of passage such as weddings, funerals and childbirth, but also occur during house construction, to cure disease and to promote fertility.[64] Feasts are "ritualised social events", in which food and drink are the main mediums of expression.[65]

Different types of feast can be distinguished, and each type has its own specific function, which can be symbolic, social, political or economic. Instead of describing the various classificatory systems in full, I will just mention some examples here. First, the work-party feast is a means of getting a large number of people together to cooperate in a task that is too large for one household (for instance building a house) or small village. The workforce is attracted by and compensated for by a feast. Work-party feasts are typical for agrarian societies.[66]

Second, several types of feast are concerned with social status. Diacritical feasting, for instance, is a way to legitimise and emphasise social inequality within a society. In this particular type of feast, the emphasis is on rare or expensive foods and food service vessels, whereas in other feasts the emphasis is more on the quantity of food offered to guests.[67] Hayden saw competitive feasting, another type of feast concerned with social status, as a mechanism for "converting surpluses in subsistence economies into wealth and power".[68]

59 Green 2001, 34-35.
60 Hubert/Mauss 1964, 97.
61 Green 2001, 22.
62 Green 2001, 24.
63 Dietler 1996, 89.
64 Adams 2004, 62; Dietler 1996, 89.
65 Dietler 1996, 89.
66 Adams 2004, 62.
67 Dietler 1996, 97-98.
68 Hayden 1996, 144.

Celebratory or solidarity feasts strengthen social bonds within a household, village or larger region. Food is provided by many households and there is no emphasis on prestige items or foods.[69] This means that this type of feast will be difficult to detect in archaeological contexts. A final type of feast, the mortuary or funerary feast, will be described in the next chapter.

3.2 RITUAL IN ARCHAEOLOGY

3.2.1 RECOGNISING RITUAL BEHAVIOUR IN ARCHAEOLOGY

Now that we have some idea of the nature of ritual, we must move on to the problem of identifying ritual in archaeology. There is such a wide range of ideas about what constitutes ritual that it seems hopeless to try and identify ritual behaviour in archaeology. Nevertheless, ritual events play such an important part in human lives that we can never fully understand the past without any knowledge about them.

The study of ritual in archaeology is hindered by limitations. An archaeologist cannot observe people performing a ritual, hear their words or see their gestures. All we are left with are the material remains left by the ritual. Some rituals will consist only of acts, speech and gestures; these rituals will be invisible to the archaeologist. All we can hope for is that the society we are studying will have had rituals that resulted in material remains entering the ground. Of necessity, our study of rituals in a certain society will be incomplete.

Figure 3.1 illustrates what archaeologists can expect to find of ritual behaviour: only material remains deposited in the ground during or after a ritual. Rituals that do not make use of material culture or organic substances such as animal bones are invisible to the archaeologist. The survival of the material remains of rituals is influenced by taphonomic processes and preservation. Excavation strategies determine whether the material remains will be recovered, and finally the archaeologist and specialist are responsible for recognising the remains as those of a ritual.

For a long time, archaeologists have been reluctant to recognise behaviour that does not seem to have a material purpose.[70] Some say that it is impossible to understand such behaviour and we should not try. On the other hand, archaeologists hardly understand all functional behaviour, but see it as their job to do so. Furthermore, it seems dangerous if not short-sighted to rule out a whole range of human activity that we know took place. Just as other behaviour, ritual practices may leave material remains for archaeologists to find. The key is to look out for such remains and to be able to identify them correctly as resulting from ritual behaviour. When using archaeology to study ritual, we must limit ourselves to searching for rules rather than for meanings or explanations. The rules may be visible in material remains, whereas the meanings of rituals are based on speculation. Also, the original meaning of a ritual may be lost over time.[71]

So when we have decided that it is possible to study ritual behaviour through archaeological remains, what do we look for? When establishing a set of identifying characteristics for ritual remains, the most obvious starting point are archaeological contexts that are clearly ritual, such as sanctuaries and cemeteries. Identifying ritual in settlements will not be as easy, but this is where the knowledge gained from clearly ritual contexts will be invaluable. There are several tools we can use to help us identify remains from ritual behaviour.

First, intuition seems an invaluable tool. The alerting aspect of ritual described by Lewis for ethnographic studies is also present in archaeological cases. Every archaeologist with field experience in a certain region and time period instinctively recognises deposits that are 'different' from everyday finds.

69 Adams 2004, 61.

70 Merrifield 1987, 1.

71 Lewis 1980, 11.

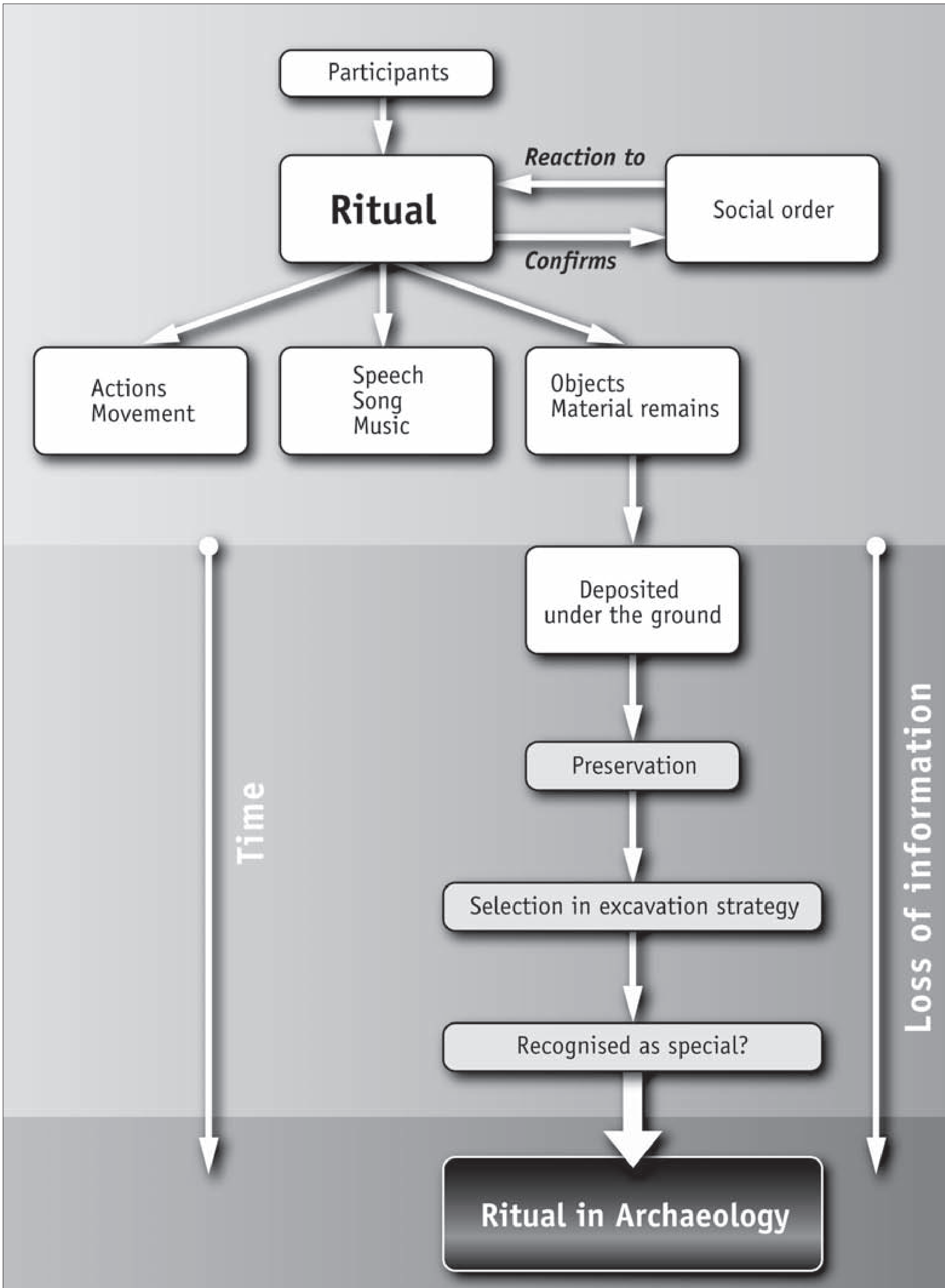

Fig. 3.1. Archaeological evidence for rituals: a taphonomical approach.

This may not seem a very scientific method, but Lewis emphasised the importance and validity of this instinctive recognition of ritual.[72] Intuition may guide us to special behaviour, but criteria are needed to establish whether this behaviour can be seen as ritual. Certain structured deposits can result from non-ritual behaviour. For example, concentrations of horncores have been associated with leatherworking, and concentrations of scapulae with the smoking of meat.[73]

Second, some of the aspects of ritual recognised in ethnographic studies can be useful in recognising ritual in archaeology in a more structured manner. Repetition, an important characteristic of ritual behaviour, can result in similar finds over time and between different settlements. Another characteristic, formality or rule-governed behaviour, can be reflected in the manner of deposition. Both repetition and formality can contribute to recognisable, patterned deposits. Finally, the study of material remains from archaeological ritual contexts results in a list of criteria that can identify such remains from non-ritual contexts. Of course, these criteria may differ between different regions and time periods.

Archaeologists distinguish several categories of ritual: rituals in sanctuaries, funerary rituals, rituals associated with buildings, and rituals associated with fertility of livestock and crops. These rituals took place at different social levels. Some rituals involved large numbers of people, for instance in regional sanctuaries. At the other end of the spectrum are rituals at household level. It is the latter that are of most interest to the present study, because these are the sort of rituals that took place in every rural settlement. Feasting forms a particular type of ritual, with its own set of criteria, and will be described in the next paragraph.

3.2.2 FEASTING

Recognising feasting

The characteristics of feasting make it possible for anthropologists and archaeologists to recognise it. Hayden listed six criteria that are significant for archaeologists.[74] Although Hayden's list of criteria for identifying feasting is focused on competitive feasts, most are valid for other types of feasting as well.

1. The resource base should be abundant enough to allow the production of a surplus.
2. Special foods are often selected for feasts. The special nature of these foods is found in their rarity or the fact that they are difficult to procure or labour-intensive to produce. Copious leftovers and greater wastage than normal are typical for feasting. In the case of animal bones, the marrow is often not used, and some bones may still be articulated. Single deposits of large quantities are typical feasting refuse.[75] Certain types of food are only consumed at feasts.[76]
3. Special vessels are often used during feasting, both for preparing and serving food and drink. Archaeologists should look out for large size, elaborate decoration and materials that are difficult to obtain.[77]
4. Food can be converted into prestige items that are non-perishable. These items are obtained through regional exchange networks.[78]
5. Large feasts require special facilities such as feasting grounds or structures. Anthropological studies have so far not provided archaeologists with useful guidance on where and what to look for.

72 Lewis 1980, 20-21.

73 Prummel 1978, 399; Lauwerier 1988, 61.

74 Hayden 1996, 137.

75 Hayden 1996, 137-138.

76 Adams 2004, 60.

77 Hayden 1996, 138-139.

78 Hayden 1996, 139-140.

6. This criterion is specific for competitive feasting. This type of feast requires the presence of so-called Triple A personalities. Evidence can be found in rich burials, unusual burial treatment, craft specialisation and site hierarchy.[79]

The second criterion is most relevant for the present study because it relates to animal bone assemblages. Special foods can be identified when comparing species representation of possible feasting remains with a "normal" species representation. Particular species of wild or domestic animal may be perceived as appropriate for feasts. There may also be a selection for certain age categories such as young animals. Both the quantity of the remains and the homogeneity within the deposit are important arguments when distinguishing between feasting waste and everyday rubbish. Other criteria, focusing on pottery and structures, can be used to recognise additional evidence for feasting.

Feasting in archaeology

Feasting is a ritual activity that is of particular importance to the archaeologist because it is more likely to leave archaeologically visible remains than many other rituals. Feasting has indeed been identified in archaeology. One example is the Neolithic site of Durrington Walls in England. Both the quantity of animal remains and the less intensive butchery were seen as indications for feasting, together with evidence for missing skulls and ritualised hunting of domestic pigs.[80] Durrington Walls is a causewayed enclosure, which is a type of site that has been interpreted as a communal centre for feasting and exchange.[81] Dietler believed that the building of large Neolithic monuments (such as Stonehenge) depended on work-party feasts.[82] The Neolithic in England seems to be particularly rich in evidence for feasting, but feasting is also found in other periods. A Beaker-period barrow in Northamptonshire revealed that forty cattle were killed and eaten at the site, probably over a relatively short period of time. A large number of cattle skulls was brought to the site from elsewhere.[83] Excavations of an underground chamber next to the chapter house of the cathedral in Worcester unearthed 17th-century consumption waste from either a single ecclesiastical feast or a series of high-status meals. Half of the domestic mammals and birds were killed at young ages, and the wild animals included several species known to be high-status food items.[84]

As an example that feasting is not restricted to England, evidence for feasting was also found in a sanctuary in Mycenaean Greece and a Roman Mithras temple in Tienen (Belgium).[85] The Greek sanctuary showed feasting for a socially restricted group of people. Feasting was combined with sacrifice, in this case the burning of defleshed bones.[86] At the Mithras temple in Tienen, several pits were found to contain consumption waste of a single event, at which 286 chickens (most if not all male), 14 lambs, 10 piglets, as well as some fish, beef and wild birds were consumed. The feast, which can be situated in June-July, must have fed a hundred to several hundred people.[87] Arguments used in these archaeological cases for interpreting the animal bones as the remains of a feast are species representation, body part representation, age of the slaughtered animals, abundance, pottery (function or quantity) and context.

Feasting may be easier to identify in special contexts such as sanctuaries. However, it has also been found in settlements. Three examples from the Netherlands should be mentioned here. An animal assemblage from a military latrine in early Roman Nijmegen shows several wild animal species, some of the earliest chickens found in the Netherlands, and at least four suckling pigs. Based on species representation, species diversity, and the pottery found with the bones, the remains were interpreted as those of a festive meal.[88] At a Late Roman settlement in Heeten, several large concentrations of bone were found.

79 Hayden 1996, 140-141.

80 Albarella/Serjeantson 2001, 40-41.

81 Dietler 1996, 105.

82 Dietler 1996, 104-105.

83 Davis/Payne 1993, 19.

84 Thomas 1999, 345, 349-351.

85 Hamilakis/Konsolaki 2004; Lentacker *et al.* 2004.

86 Hamilakis/Komsolaki 2004, 143, 146-147.

87 Lentacker *et al.* 2004, 85.

88 Lauwerier 2002, 63-64.

The species distribution was unremarkable, but the bones showed less intensive butchery compared to bones found elsewhere on this site. One of the bone concentrations consisted of remains from nine cows and four pigs, all slaughtered and butchered over a short time. The amount of meat suggested that a large number of people were involved.[89] At a Roman settlement in Houten, evidence was found for a ritual meal in which the meat of a horse was apparently consumed. Other horse bones from the same site indicated that horse meat was not normally eaten.[90]

3.2.3 RITUAL AND ECONOMY INTERTWINED

Ritual practices were traditionally seen as being distinct from functional, everyday behaviour. For a long time, ritual and economic behaviour were studied and discussed separately. The persistent desire to class actions and decisions as either ritual or economic stems from the simple fact that this distinction is made in modern western society. However, the relation between ritual and economy in pre-industrial societies is strong. Piot's study of the Kabre in northern Togo provides an excellent example of how ritual and economy are interdependent.[91] The opposition between the two in this African community provides a structure for a regional system. Piot demonstrated how the community is divided into ritual and economic sub-communities, who are dependent on each other for survival.[92]

The interdependency between ritual and economy was also recognised in archaeology. Grant points out that no clear separation can be made between the economic and the symbolic in archaeology.[93] Trying to separate them is a mistake. We must question whether it is even possible to distinguish between ritual and economic. It is unlikely that human behaviour was motivated by either strictly economic or strictly symbolic considerations.

Hill also warned against maintaining the 'sacred-profane dichotomy'.[94] All human actions have a symbolic dimension. Neither the contents of ritual practices nor the location can be separated from non-ritual activities. Because the contents are not always different from non-ritual contents, studying what is done with them is the only way of recognising rituals. Hill advised to study the nature of the events that created the deposit being studied.[95] In our case, we must ask ourselves how the animal bones ended up in a specific context.

An important question that comes up when discussing the relation between ritual and economy is whether sacrificed animals constituted a loss of valuable meat to the economy. In other words, what are the consequences of ritual for the economy? These consequences may not have been as negative as has been believed. There were two ways in which economic loss to the community could be minimised, whilst still fulfilling ritual obligations. First, there may have been a selection for those animals that were not or less valuable, such as weak or sick animals (especially when an animal was to be buried whole; otherwise it may have posed a health risk) or those animal species that were not used for consumption. Grant suggested that the choice of sacrificial animals at Danebury may have been guided by such economic factors.[96] At Danebury, horses and dogs frequently occurred in special deposits. Because these species were not eaten at Danebury, they constituted only a small economic loss. One example of choosing a sick animal for a ritual is found in the cemetery in Tiel-Passewaaij, where a chicken suffering from avian osteopetrosis was buried as a grave gift (fig. 4.5). Another example of second-rate offerings is a building offering from Passewaaijse Hogeweg, consisting of two pots with manufacturing flaws (fig. 3.2).[97] Of

89 Lauwerier 2002, 64-65; Lauwerier *et al.* 1999, 176-178.

90 Lauwerier 2002, 69-70.

91 Piot 1992.

92 Piot 1992, 35-38.

93 Grant 1991, 109.

94 Hill 1996, 23.

95 Hill 1996, 26.

96 Grant 1984b, 223-226.

97 Heeren/Van Renswoude 2006, 236.

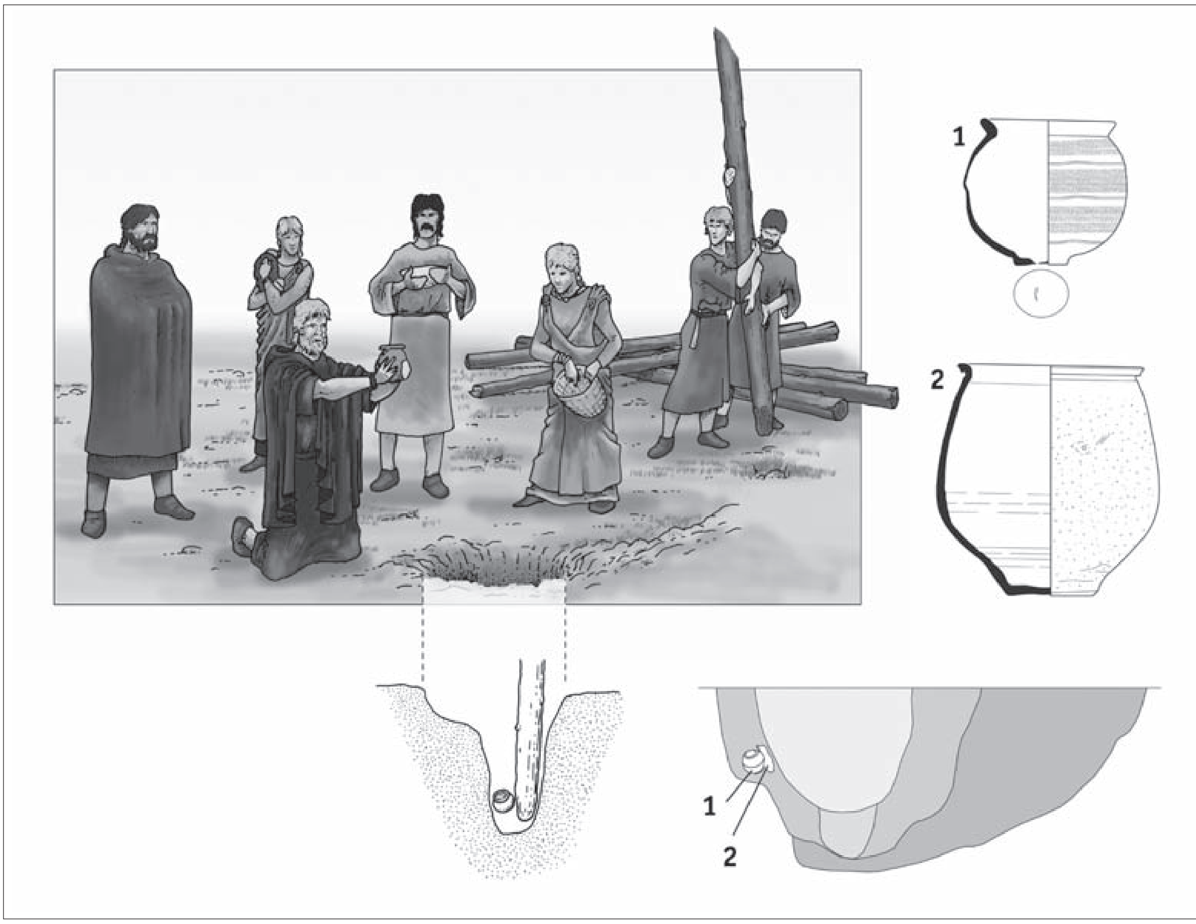

Fig. 3.2. Foundation deposit from Tiel-Passewaaij and a reconstruction of the moment the pottery was buried. Drawing M. Kriek. Both pots were found to have manufacturing flaws.

course, choosing "second-rate" offerings may have been inappropriate in some societies or rituals, where the quality of a sacrifice was enhanced by the degree of loss associated with it.

A second option is to offer only part of the animal to the gods, and consume the majority of the meat. Sacrifice of an animal may thus not necessarily have resulted in the loss of much meat. The skin, tendons and bones could also be used. However, when the meat was consumed by the whole community, it still constituted a loss to an individual person. Both options can be recognised in ethnography as well as archaeology. Ethnographic parallels show that it is common for a sacrificed animal to be consumed by the community. Piot described a cow that was sacrificed to a spirit; the meat was subsequently divided between homesteads.[98] A similar practice probably took place in Gallo-Roman temples and sanctuaries, where the meat of sacrificed animals was consumed within the sanctuary (see 3.2.4).

At many sanctuaries, the meat from sacrificial animals was consumed, so the meat was not lost to the community. Veenman warned against studying ritual animal bones outside of their economic context.[99] The separation between the two aspects is artificial; it would be advisable, therefore, to study animal bones from ritual and economic processes in relation to each other. Lauwerier also considered that the meat of sacrificed animals was consumed.[100] However, the young age at which cattle were sacrificed at two Roman temples (Elst-Grote Kerk and Empel, see 3.2.4) in the Netherlands demonstrates a remark-

98 Piot 1992, 43.

99 Veenman 2002, 133.

100 Lauwerier 2004, 68, 71.

able deviation from the elderly age at which most cattle in settlements were slaughtered. It is possible that the young animals that were selected were not the strongest or healthiest animals, thus minimising the loss to the economy. On the other hand, they may have been selected for opposite reasons, such as the purity of youth. At a temple in Nijmegen, chickens and mammal legs were sacrificed by burning.[101] The presence of all skeletal elements is used as an argument that at least some of the chickens were burnt whole. Although meat was lost for consumption in this ritual, it seems to have involved only small numbers of chicken.

Apart from the choice of animals for sacrifice, and the possible loss of meat to the community, we must acknowledge the practical function that ritual was expected to have for the economy. To a society that believed in the efficacy of their rituals, the sacrifice of an animal was not so much a loss, but rather an investment. Just as sowing a field ensured a good harvest, so would sacrificing an animal have ensured prosperity or fertility. Veenman used the terms 'ritual economy' to refer to a system where rituals are carried out to benefit the economy.[102] Ritual can be seen as an economic act that was meaningful and practical to the people who believed this would accomplish something, and not as irrational behaviour.

The economy depended on animal husbandry and arable farming, which are both heavily affected by outside forces such as the weather and disease. These factors could not be controlled by man directly, but it is likely that they were believed to be controlled indirectly through rituals. Examples of this sort of ritual are an appeal to the gods for good weather, fertility rites, and rituals to ensure the good health of livestock. We may now believe these rituals to be irrational and ineffectual, but to the people involved they must have been powerful ways (or the only way) of controlling uncontrollable factors.

Lauwerier considered the sacrifice and burial of complete animals as an economic loss, but recognised a possible profit in terms of status to compensate for this loss.[103] Piot's ethnographic study mentioned that the sacrifice of a cow served to maintain good relations between humans and spirits, thus ensuring the fertility of fields.[104] Hill pointed out that one of the functions of ritual is maintaining social relationships and gaining political power, which is economic behaviour.[105]

3.2.4 PREVIOUS AND CURRENT RESEARCH INTO RITUAL IN ARCHAEOLOGY

Ritual in archaeology has mostly been studied for sanctuaries and cemeteries, contexts for which the sacred nature is certain. Most researchers feel confident in assigning the label 'ritual' to animal bones found in sanctuaries, where they would hesitate in doing so in the case of special deposits from settlements. Another ritual context is formed by cemeteries. As animals in funerary ritual form the subject of the next chapter, in this chapter we will limit ourselves to sanctuaries. First, we will discuss some examples of studies of animal bones from obvious ritual contexts. Then we will move on to non-bone finds, originating from non-ritual contexts, that have been interpreted as ritual. Finally, we will see what research has been done into the subject of ritual animal bone deposits in settlements.

Animals played an important role in Late Iron Age sanctuaries in Northern France, such as those at Gournay-sur-Aronde and Ribemont-sur-Ancre. The precise details vary between different sanctuaries, but basically there were two distinct processes taking place. The first revolved around the decomposition of animal carcasses. There is evidence that carcasses of cattle and horses were buried temporarily and moved after decomposition. The second process consisted of consumption of different animal species (sheep and pig) and disposal of the remains. Remains of these processes were found in pits and the large

101 Zeiler 1996, 5.
102 Veenman 2002, 133.
103 Lauwerier 2004, 69.
104 Piot 1992, 44.
105 Hill 2001.

ditches surrounding the sanctuaries. Other practices, such as the burial of complete skeletons, the consumption of dogs, the display of horse and human skulls, and the construction of ossuaries out of horse bones were limited to just one sanctuary.[106]

An excellent example from England of the study of animal bones from sanctuaries is that by Legge *et al.*[107] The detailed analysis of sheep mandibles from two Roman temples in Britain provided clues to the frequency and season of religious events. At Harlow Temple in Essex, lambs were killed in two narrow age ranges: 6 to 8 months and 18 to 20 months.[108] If the lambs were born around the same time in spring, which is very likely, they must have been killed in a short period in the autumn. They were probably all killed during a religious festival lasting for a few days or weeks. At Great Chesterford, also in Essex, two narrow age ranges were also found for sheep: newborn and 6 to 8 months.[109] This suggests that there were two periods of sacrifice, one in the spring and one in autumn. About two thirds of the lambs belonged to the older age group killed in autumn. The religious festival taking place then was probably more important than the one in spring.

King provided an overview of animal bones in temples in Roman Britain.[110] Temples were split into groups based partly on the nature of the animal bone assemblages. Many temples showed a selection for certain species or age categories, evidence for seasonal festivals and in some cases individual deposits. Unlike sanctuaries in Northern France, little evidence was found in English temples for the offering of complete animals. Instead, most of the meat was consumed.[111]

For the Netherlands, animal bones from two Roman temples have been analysed: the temples of Elst and Empel. At the temple of Empel, only disarticulated bones were found, almost all from cattle, sheep or goat and pig.[112] The assemblage from the early period (25 BC – AD 70) is dominated by cattle (60 %), with a sizable percentage of sheep (32 %) and not much pig (8 %).[113] The animal bones from the later period (second half 2nd century – early 3rd century) show a decline in cattle and a marked rise in pig. The distribution of species in this period especially is very different from that in nearby settlements. The percentage of cattle is much lower, while the percentages of sheep or goat and pig are higher.[114] Since higher percentages of pigs are found in military sites, the rise in pig numbers in Empel was seen as a possible reflection of changing sacrificial rituals of soldiers and ex-soldiers.[115] Many animals reached the temple compound alive and were slaughtered there. Pigs formed an exception: the overrepresentation of hind legs demonstrated that at least some if not all pigs were slaughtered outside the sanctuary.[116] The ages of the animals show a preference for young cattle (15-30 months) and adult or even elderly sheep.[117] This culling pattern differs from that in the rural settlements in the region.[118] Seijnen suggested that ritual feasting took place at Empel, during which the sacrificed animals were consumed. Ritual slaughter and consumption of animals in sanctuaries is a well-known phenomenon in both Celto-Germanic and provincial-Roman religion.[119]

Lauwerier discussed the animal bones from the 1947 excavation of the temple at Elst.[120] More than 90 % of the bones are from cattle, with a low percentage for both sheep or goat and pig bones. The number of horse and chicken bones is negligible. The cattle were mostly killed between 1.5 and 2.5 years old.[121] A recent excavation confirmed Lauwerier's findings, only now they were based on a much

106 Meniel 1992, 25-36.
107 Legge *et al.* 2000.
108 Legge *et al.* 2000, 153.
109 Legge *et al.* 2000, 154.
110 King 2005.
111 King 2005, 357-362.
112 Seijnen 1994, 171.
113 Seijnen 1994, 165.
114 Seijnen 1994, 169.
115 Seijnen 1994, 171.
116 Seijnen 1994, 165.
117 Seijnen 1994, 165-167.
118 Seijnen 1994, 169.
119 Seijnen 1994, 171.
120 Lauwerier 1988, 111-121.
121 Lauwerier 1988, 115-117.

larger assemblage. This allowed for a more detailed analysis of the age distribution, resulting in identifying seasonal slaughter peaks of both cattle and sheep in spring and autumn.[122] A second temple in Elst shows a similarly high percentage of cattle and low percentages of sheep and pig bones. However, the percentage of horse bones is relatively high.[123] As at the other temple site in Elst, cattle were killed between 1.5 and 2.5 years old.

A temple in Ulpia Noviomagus/Nijmegen shows a very different pattern: most of the animal bones found here were burnt chicken bones.[124] This may be related to a difference in cult practice. This temple was dedicated to Fortuna, whereas the rural temples were dedicated to Hercules Magusanus.

In short, there are several aspects of animal bone assemblages from sanctuaries that differ from those from settlements. First, the ratios of species are different when compared to an average species ratio for rural settlements. Second, the ages at which the animals were killed differ from those in settlements. Finally, the finds from some temples demonstrate the seasonal aspect of the faunal assemblages.

Although research on animal bones from sanctuaries and cult places is important and has taught us much about the ritual use of animals, we can no longer ignore rituals within the settlement. Ritual in settlements has received little attention compared to ritual in cult places. The use of animals in settlement rituals is difficult to study, because the remains from rituals can be hard to separate from butchery and consumption waste. Animals must have played a part in rituals within the settlements such as those associated with the construction or abandonment of buildings and rituals associated with fertility. There are numerous examples of ritual outside ritual contexts such as sanctuaries and cemeteries. Not all of these involve animal bones, but they can still be relevant to our study. Apart from animal bone deposits, there are offerings associated with building or abandoning houses (consisting of pottery) and hoards of metal artefacts or coins. Although these consist of different categories of material, the methodology involved in studying them is similar. We can learn from the criteria other archaeologists use to identify ritual deposits and the way in which they reach their interpretations.

The first topic we will discuss is the study of coin and metal hoards. Because the contents of these hoards have always had much appeal, they have been studied for a longer time than animal bone deposits. So what criteria have been used to establish whether hoards are ritual?

Galestin discussed the nature of coin hoards in the northern provinces of the Netherlands.[125] These coin hoards could either have been hidden for safekeeping or deposited as a votive gift.[126] To make this distinction, Galestin studied the context in which the hoards were found, and the composition of the hoards. She concluded that large hoards found in wet contexts outside settlements were deposited as votive deposits, whereas smaller hoards buried in settlements are economic hoards that were not retrieved by their owners.[127] In this case, the criteria used are contents and context of the finds.

Levy used the following criteria in her study on metal hoards from Bronze Age Denmark: "the stereotyped, careful arrangement of many hoards, the common occurrence of pairing in the hoards, and common deposition in wet places".[128] Based on ethnographic sources, she formulated more elaborate general criteria for identifying prehistoric ritual deposits:[129]

1. Location
   a. specially protected
   b. away from ordinary living space
2. Limited choice of objects
   a. specific species, colour, sex of sacrificial animal and food
   b. well-formed animals or pieces of food

[122] Robeerst in prep.

[123] Robeerst 2005, 96-97.

[124] Zeiler 1996, 5.

[125] Galestin 2001.

[126] Galestin 2001, 81.

[127] Galestin 2001, 98.

[128] Levy 1982, 17.

[129] Levy 1982, 19.

c. certain kinds of personal valuables
3. Association with food
 a. ritual meals
 b. ritual slaughtering
 c. ritual libations

Levy went on to formulate even more elaborate criteria specific to the material and period she is working on, but those criteria are too specific for our study. Criterion 1b, "a location away from ordinary living space", is interesting to the present study. It seems to contradict our finds from Passewaaijse Hogeweg. However, Levy mentioned that ritual offerings in the home do occur in ethnographic sources, but not in Bronze Age Denmark. It is interesting that the choice of animal is important, as well as the association with food.

Fontijn tried to avoid the ritual-profane distinction in his study of bronze deposition practices in the Dutch Bronze Age. Instead, he stated that ritual "permeated all fields of life".[130] This may have been the case, but one of the characteristics of ritual is that the participants perceive it as different from everyday actions. This does not necessarily imply that it should be seen as irrational behaviour. From our view, ritual deposition may seem irrational, but as long as we realise that ritual behaviour was rational behaviour to the people we are studying, this should not be a problem. Fontijn is right in questioning the self-explanatory nature of an economic interpretation.[131] Why should a ritual interpretation always be proven, when its importance to past societies is clear? However, he went on to distinguish between permanent (ritual) and non-permanent (non-ritual, failure to retrieve temporary hoard) deposition of metal objects. Identifying patterns in location is the key to identifying intentional permanent deposition.[132] This approach is specific to the Bronze Age, and also to the find category. With the exception of antler, which can be stored for later use, animal bones would not be buried for later retrieval.

Hoards of coins or metal objects, especially those considered as ritual deposits, are usually found outside settlements. The settlement is where farming people spent most of their lives. Therefore, we can expect certain rituals, especially those concerning the health and fertility of livestock and the protection of houses and households, to have taken place within the settlement. Finds of statues of gods in Passewaaijse Hogeweg indicate that ritual and religion was practised at household level (fig. 3.3).

A find category from settlements that has confidently been interpreted as ritual is that of building offerings in houses. Gerritsen distinguished three different kinds of offerings connected to houses.[133] The first category consists of offerings that took place during or soon after the construction of the house, so-called foundation deposits.[134] Ethnographic parallels suggest that the whole community was involved both in constructing the house and in the rituals surrounding the construction. Foundation deposits are usually found at the base of postholes, in wall ditches or near the entrance of the house. In archaeology, most finds of foundation deposits are complete pottery vessels. The use of organic material is offered as a possible explanation for the relative paucity of foundation deposits in Gerritsen's study area. A second category consists of deposits that were made during the habitation of the house, so-called site maintenance practices.[135] The final category consists of deposits made at the time of abandonment of the house.[136] Abandonment in this context is meant to signal the end of habitation, but not necessarily the end of use of the house. Abandonment deposits typically consist of pits filled with large quantities of refuse. The short time span in which these pits were filled, their spatial relation to houses, the consistency of their contents and the use of fire suggest that these pits are not simply waste disposal pits. They

130 Fontijn 2002, 20-21.
131 Fontijn 2002, 17.
132 Fontijn 2002, 37-38.
133 Gerritsen 2003, 63-65, 79-95, 96-102.
134 Gerritsen 2003, 63-65.
135 Gerritsen 2003, 79-95.
136 Gerritsen 2003, 95-102.

Fig. 3.3. Terracotta head of Minerva and bronze statues of Mars and Mercury, found in Passewaaijse Hogeweg.

should rather be seen as either the remains of a feast, or the final site maintenance practices connected to the building. Building offerings involving pottery were also found at Tiel-Passewaaij. These typically consist of one or sometimes two complete vessels found in one of the central postholes of a farmhouse (fig. 3.2). In one case, a coin was found with two pots. Six building offerings were found in Passewaaijse Hogeweg and two in Oude Tielseweg. In two cases, the pots have manufacturing flaws. This could mean that the quality of the offering was less important than the act of burial.

When we move on to studies on animal bones, the following general remarks can be made. Complete or partial animal skeletons are found regularly in archaeological sites. The way in which these are treated and interpreted varies. Numerous zooarchaeological reports mentioned the occurrence of one or several skeletons, but failed to make any interpretations.[137] When an explanation for complete animal burials was offered, it was often the dumping of animal carcasses. Many of these reports had limitations of time, space and money and necessarily focused on themes such as distribution of species and age. Another reason why animal burials or other 'odd' deposits are not discussed is because too few are usually found in each site, and for regional analyses there is usually not enough time.

It seems as if many zooarchaeologists are unsure of what to do with these awkward deposits. In the relatively empirical branch of zooarchaeology, any step towards such a vague and slippery subject as ritual burial is avoided or made hesitantly. It is true that the distinction between a buried animal and a dumped carcass is difficult to make in archaeology, but the distinction is so important that we must make an effort to understand it if we are to come closer to understanding the people we study.

A recent study focused on settlement rituals in several settlements from the Iron Age and Roman period in Noord-Holland.[138] Excellent preservation of organic remains allowed for a detailed study of special deposits. Material remains used in rituals included animal bones and wood. The location of ritual

137 Van Dijk 2002, 2, 6; Hagers 1999b, 90-91; Lauwerier/ Laarman 1999, 130, 132, 136-137; Zeiler 2007.

138 Therkorn 2004.

deposits was meaningful. Pits were filled seasonally, three times a year. Therkorn saw pits and linear features with special deposits as being part of constellations which were projected on the settlement plan. Some of the special deposits show similarities to those found in Passewaaijse Hogeweg, as we shall see in paragraph 3.5.

An excellent example of a site for which special animal deposits were analysed in detail is that of Danebury. Special animal deposits from this Iron Age hillfort in southern England have received much attention during the last two decades. Grant was the first to interpret the special animal deposits from Danebury as ritual.[139] Grant distinguished three categories of special deposits: articulated or mainly articulated animal skeletons; complete or nearly complete animal skulls and complete horse mandibles; and articulated limbs.[140] Although such deposits are found in all Iron Age sites, they were previously considered as economic evidence not needing further explanation.[141] Cunliffe saw the deposition of human and animal remains in Iron Age pits as being part of a fertility rite.[142] The gods were thanked for protecting the grain during storage, and asked for a good harvest.

The special animal deposits from Danebury and other hillforts were reanalysed in Hill's detailed study.[143] He considered non-bone finds in relation to the animal and human bones to find out how the pit fills were structured and what activities produced them.[144] Hill emphasised the need for a close look at formation processes if we are to understand the special deposits. He also advocated the need to involve all classes of material in studying special deposits, to find out whether finds in special deposits have a different 'signature' from finds in non-special deposits.[145]

Hill distinguished four categories of 'exceptional deposits': pottery (a few large sherds or many smaller sherds); animal bones (articulated bones or large numbers of bone fragments); small finds (two or more); and human bone. To avoid hasty conclusions on the ritual nature of special animal deposits, Hill preferred to use the term *Articulated/associated Bone Groups* (ABGs).[146] I will continue to use the term "special deposit", because the preservation and completeness of the deposits are special in the way that they differ from everyday bone finds. This difference does not necessarily mean that the deposits are in any way ritual.[147] We need additional criteria to establish whether they are ritual. In the next paragraph, we will discuss the criteria that were used for identifying ritual deposits in Iron Age Danebury and decide whether they are useful for our study of Roman Tiel-Passewaaij.

3.2.5 CRITERIA FOR IDENTIFYING RITUAL ANIMAL DEPOSITS

During the last two decades, several papers appeared on whether and how ritual practices in archaeology can be recognised. Our discussion here will focus on the special deposits from Danebury because of the wealth of material and literature.

Before we look at the criteria developed for Danebury, we will reconsider one other settlement context, namely that of offerings (both animal and non-animal) connected with buildings. In his discussion of ritual deposits connected with buildings, Gerritsen used three criteria.[148] First, there is the recurrent patterning of deposits through space and time. Second, when it is suspected that an offering is made and not just rubbish disposed of, we should think of a ritual context. The final criterion is a public context. A deposit that was made in the presence of a group of people is more likely to be a ritual deposit.

139 Grant 1984a, 543.
140 Grant 1984a, 533.
141 Hill 1995, 13.
142 Cunliffe 1993, 22-27.
143 Hill 1995.
144 Hill 1995, 1, 30, 31.
145 Hill 1995, 16-17.
146 Hill 1995, 16.
147 Hill 1995, 16.
148 Gerritsen 2003, 83.

For Danebury, Grant used several criteria to identify the deposits as ritual.[149] First, two or more animals were sometimes found together. It is unlikely that they would have died a natural death at the same time. The second criterion also distinguishes between natural death and ritual deposition. If the animals in the special deposits had died from disease, then the incidence of burials for each species should reflect the percentage of that species from the total sample. At Danebury, this was not the case. Next, differences in butchery patterns were used as evidence for the special nature of the deposits. Skull meat was commonly eaten in Danebury. Skull fragments among the butchery waste show butchery marks, and sheep skulls were found chopped in half. Deposits of complete skulls can therefore not be seen as refuse. However, Grant recognised that articulated lower limbs could be considered either as primary butchery waste or as a ritual deposit. Finally, apart from the bones themselves, the location, manner of deposition, and association with other finds were used to identify the deposits as special. For instance, deposits that were laid on the bottom of empty pits were considered special, as well as deposits associated with slingstones, chalk blocks or human bones.[150]

Wilson presented a critical discussion of the criteria commonly used to identify ritual deposits in Iron Age sites.[151] Although he did not doubt the presence of ritual deposits on Iron Age sites, he questioned the validity of many of the arguments used.[152] Wilson saw the special deposits from the Iron Age as unusual because they have escaped the normal destructive taphonomic processes.[153] They are found in pits because these, being deep and narrow, tend to offer more protection to bones than ditches. This explains why archaeologists find complete skulls, articulated bones and skeletons. It also explains an age and species structure differing from that found in normal waste.[154] Wilson saw the accumulation of bones on the bottom of a feature as a natural process. When a feature was backfilled, it would happen quickly and bones would not have the time to enter the filling.[155] Wilson claimed that the association between horse and dog bones is evidence only for the fact that these two species received different treatment from others, so that their bones experienced different taphonomic processes. Disposal of animals not commonly eaten would be expected to differ from that of food animals.[156] Although Wilson was critical of interpreting deposits as ritual too readily, he did believe in the existence of ritual deposits. He saw positioning of bones as the most promising criterion for identifying ritual, but few examples are known.[157] Wilson believed Romano-British ritual practices show more formality regarding positioning bones than Iron Age practices.[158]

Although Wilson's criticism is valid, we need not be overly concerned with the problems he mentioned. In Passewaaijse Hogeweg, it is not just special animal deposits that were found in pits and ditches; normal refuse was found in the same circumstances. This means that special deposits are not just concentrations of rubbish that escaped taphonomical processes, but a real phenomenon. Furthermore, it is not just dog and horse that were found in these deposits; food species were found in similar deposits. It is not differential treatment of non-food species that resulted in deposits less affected by taphonomy; the special deposits from Passewaaijse Hogeweg reflect genuine and deliberate human activities.

Hill claimed that criteria for identifying ritual are not universal.[159] Ritual practices differ between cultures and time periods, so new criteria should be formulated for each sample. For the British Iron Age, Hill did not make a distinction between articulated bones and deposits of disarticulated bones that were clearly associated and/or buried when fresh. In the Iron Age, both kinds of deposit share many

149 Grant 1984a, 542.
150 Grant 1984a, 542.
151 Wilson 1992.
152 Wilson 1992, 341.
153 Wilson 1992, 342.
154 Wilson 1992, 344-345.
155 Wilson 1992, 342-343.
156 Wilson 1992, 343.
157 Wilson 1992, 345.
158 Wilson 1992, 346.
159 Hill 1996, 23-24.

similarities in the way the bones were treated.[160] What is important is the way in which the deposit is structured.[161]

The preference for certain body parts can be used as a criterion for ritual behaviour. The use of heads in ritual is a recurrent phenomenon in Iron Age and Roman Britain.[162] Merrifield considered repetition of seemingly functional burials or a significant context of the burial as good criteria for recognising ritual behaviour.[163] Mulville used the following criteria: a deviating left-right ratio in bone fragments, the presence of human remains, the presence of uncommon species, the combination with artefacts, and a species distribution that does not reflect the distribution at site-level.[164]

To summarise, I will list the criteria that have been used by different archaeologists to identify ritual animal deposits in archaeology, mostly at Danebury:

1. Associations of more than one animal.[165]
2. A species distribution that differs from that at site level.[166]
3. Difference in butchery patterns.[167]
4. Location or context.[168]
5. Manner of deposition/ positioning of bones,[169] or reconstruction with remains from two separate animals.[170]
6 Association with other finds.[171]
7. Way in which the deposit is structured.[172]
8. Preference for certain body parts.[173]
9. Repetition.[174]
10. Deviating left-right ratio.[175]
11. Presence of human remains.[176]
12. Presence of uncommon species.[177]

It is likely that not all criteria are useful in every situation. The specific criteria used for a certain region and period depend on the nature of the rituals practised there. In the next part of this chapter, we will examine the special animal deposits from Passewaaijse Hogeweg, and decide on the criteria that can be applied to this material.

3.3 THE SPECIAL ANIMAL DEPOSITS FROM PASSEWAAIJSE HOGEWEG

3.3.1 INTRODUCTION AND RESEARCH QUESTIONS

Now that we have seen what ritual is and how we can identify ritual deposits in archaeology, we will move on to discuss the special deposits from Passewaaijse Hogeweg, the larger settlement in Tiel-Passe-

160 Hill 1996, 19.
161 Hill 1996, 20-22.
162 Green 2001, 97, 104.
163 Merrifield 1987, 30.
164 Mulville 2001.
165 Grant 1984a, 542; Grant 1984b, 222.
166 Grant 1984a, 542; Grant 1984b, 223; Mulville 2001.
167 Grant 1984a, 542; Grant 1984b, 223.
168 Merrifield 1987, 30.
169 Grant 1984a, 534 (fig. 9.30), 542; Wilson 1992, 345.
170 Hill 2001.
171 Grant 1984a, 542; Grant 1984b, 222; Mulville 2001.
172 Hill 1995, 95-96.
173 Green 2001, 104.
174 Merrifield 1987, 30, 32.
175 Mulville 2001.
176 Mulville 2001.
177 Mulville 2001.

waaij. As mentioned in the introduction to this chapter, during the excavation animal deposits were encountered that were felt to differ in their contents from normal animal bone refuse. An effort was made to record as much information as possible about these deposits. A recording sheet was designed so that all the relevant data could be recorded on one piece of paper both during the excavation and during the analysis. It is possible that some of these deposits were not buried as part of a ritual, while others are likely to be related to ritual behaviour. Hopefully, analysing the special deposits carefully and in relation to each other will provide information on the rituals that took place within the settlement Passewaaijse Hogeweg.

I regard as special deposits any deposits consisting of animal bones and/or other finds where the contents and/or context are felt to differ from what is normally found. Ritual deposits are those special animal deposits that were created within a ritual context. With ritual, I mean formalised behaviour guided by rules, intended to communicate with superhuman entities, and/or to affect some change or prevent change in the environment. Special deposits are not necessarily ritual deposits, as Wilson's arguments pointed out.[178] This chapter is limited to the study of ritual activities involving animal bones in the settlement. Ritual activities involving animals also occurred in the cemetery, but that is the subject of the next chapter. It is possible that some of the rituals performed in the cemetery overlapped with some of the rituals in the settlement; for instance, part of an animal may have ended up in a grave pit, and another part in a ritual deposit in the settlement.

There is much that we can learn from the special deposits from Passewaaijse Hogeweg, as long as we ask the right questions. A list of questions that can be considered has been drawn up for the deposits from Passewaaijse Hogeweg.

- Can the special deposits from Passewaaijse Hogeweg be interpreted as ritual deposits? To answer this question we must use specific criteria to decide which special deposits we can regard as ritual deposits.
- Were different species of animal treated differently? In other words, were some species more suitable for certain rituals than others? It is possible that there was a preference for certain animal species for use in rituals, and that others were never used.
- Can patterns in the special deposits be recognised? If so, do they stay consistent over different time periods or are there changes?
- It would be interesting to see whether the buried animals were actively killed in sacrifice or whether they died natural deaths. It is possible that the deposits consist of natural deaths treated in a ritual manner. Unfortunately, it is often impossible to establish the cause of death for buried animals. If killing animals involved smashing their skull, we may find evidence of this if the skull is not only complete but well-preserved. If the method of killing was slitting the throat, we will usually not find any evidence of this. However, in the case of wild animals, it is more likely that they were actively hunted and therefore killed.
- Was the meat from ritually deposited bones consumed or not? This question should be asked when we encounter a partial skeleton or articulated limb, or a deposit consisting of disarticulated remains. Ritual burial of animal remains after the consumption of meat could provide evidence for feasting. To answer this question, we will look at the presence and location of butchery marks, and the fragmentation of the bones. When the meat from animals buried in ritual deposits was not consumed, this means a loss of meat to the community. This could have had an impact on the local economy.
- Is there continuity in the special deposits during the period that the site was inhabited? Do ritual practices involving animals change over time?

178 Wilson 1992, 342-345.

- Is the location of the deposits significant? To answer this question, we must look at the location of special deposits in relation to each other, and in relation to structures such as buildings and boundary ditches. This question overlaps with the previous question.
- What was the function of special deposits within the settlement? Can we, for instance, identify building sacrifices? Is it possible to distinguish between different kinds of rituals archaeologically? The location of deposits near houses or boundaries may tell us about their function.
- Can we say anything about the people involved in these rituals? Did the rituals involve the whole community or only part of it? Are there any indications for the existence of ritual specialists?

Before we can consider any of the other questions, we must answer the first: are the special animal deposits from Passewaaijse Hogeweg ritual deposits? This question will be answered in the next paragraph.

3.3.2 CRITERIA SUITABLE FOR PASSEWAAIJSE HOGEWEG

The criteria used for Passewaaijse Hogeweg for the identification of special animal deposits were developed during the excavation and analysis. At first, anything that was felt to be 'different' from normal animal bone refuse was seen as a special deposit. This was the criterion on which animal bone deposits were designated 'special'. To be more precise, the following criteria were used:

- Different fragmentation and preservation compared to normal bone refuse.
- The presence of articulated elements or complete skeletons.

Special deposits draw attention because the animal bones they contain are less fragmented and well preserved. Although this is of course determined by taphonomy, it is indirect proof for different treatment because the animal bones were not subjected to intense butchery and buried in a fresh state. Of course, it is hard to establish what 'normal' bone refuse looks like. Refuse is not a homogeneous category. Within animal bone refuse, different categories such as butchery waste, consumption waste and bone working waste can be distinguished. However, as long as we keep in mind that labelling a deposit as 'special' does not say anything about its provenance, this is not a problem. Some special deposits may contain not the remains from a ritual but a special type of bone waste. It is only after a careful analysis that we can decide whether any of the special deposits are ritual deposits.

During the analysis of the special deposits, it was realised that another set of criteria needed to be formulated to discover whether the deposits were ritual or not. A fault in the argumentation here is that the criteria for identifying the ritual nature of the deposits were only formulated after an initial analysis of the data and comparison with the normal bone refuse. However, because specific criteria have to be formulated for each situation, this could not be avoided. The criteria based on the special animal deposits from Passewaaijse Hogeweg can be used for identifying ritual animal deposits in other settlements in the region dating to the same period. The criteria used in Tiel-Passewaaij for the identification of ritual animal bone deposits are as follows:

- Different fragmentation and preservation compared to normal bone refuse. This is not just a result of the location of the deposits in pits or ditches, but more a result of the immediate burial of fresh bones.
- The presence of articulated elements or complete skeletons. Although articulated bones are occasionally found among normal refuse, there is a difference. Articulated bones among refuse are often not complete, but chopped through. Also, the articulated bones among refuse usually consist of only two bones and not complete limbs.

- The species of animal. Burial of a wild animal that was considered edible can hardly be seen as the dumping of a carcass. It must have been hunted and deposited for a reason. In the case of species considered as pests or inedible, the situation is more complex.
- The way in which the bones were deposited. In some cases it was clear that bones were not thrown in a feature randomly, but placed in a certain, meaningful way.
- The association of more than one species. A single skull or a single burial could be interpreted as waste or the dumping of a carcass, but to find a burial and a skull together is hard to explain in a functional manner.
- The presence of more than one individual. This argument is similar to the previous one.
- Different species distribution from that at site level.
- Location within certain features such as house ditches.
- Association with other finds such as pottery and metal. The finds meant here are typically different from those among normal refuse, for instance large pottery sherds, complete pottery vessels, or complete metal objects.

The first two criteria were also used to identify special animal bone deposits in the field. There is a close similarity between these criteria and those used by others.[179] This is hardly surprising since we are dealing with similar material and similar problems. The presence of human remains is deliberately not mentioned here, because nowhere do we find evidence that human bones played a role in special animal deposits in Passewaaijse Hogeweg. In fact, loose human bones have not been found at all for the Roman period in Passewaaijse Hogeweg. Passewaaijse Hogeweg is not typical in this respect; isolated human bones are found frequently, but in small numbers, in rural settlements in the Netherlands.[180]

3.3.3 THE SPECIAL ANIMAL DEPOSITS

In this paragraph, the special animal deposits from Passewaaijse Hogeweg will be described.[181] This paragraph will focus on the different categories of special deposit. Their occurrence throughout time will be addressed in 3.4.2. The criteria mentioned above will be used to decide whether the deposits can be related to ritual practices. In many cases, this question will remain unanswered, but an attempt will be made to explain in what way the animal bones entered the ground. The special animal deposits from Passewaaijse Hogeweg can be separated into five different categories:

- Complete or nearly complete skulls
- Complete skeletons
- Articulated limbs
- Combinations of the categories mentioned above
- Large concentrations of disarticulated bones

Again, most of these categories have been recognised by others. The final category, concentrations of disarticulated bones, is the most problematic one, and has only been recognised by a few archaeologists.[182] Refuse usually consists of disarticulated bones, so what makes a bone concentration different from

[179] Grant 1984a, 542; Mulville 2001.

[180] For example in Kesteren-De Woerd (Zeiler 2001, 238) and Wijk bij Duurstede-De Horden (Laarman 1996b, 376). In Oude Tielseweg, some isolated human bones were found in phases 2 and 5.

[181] All information on the special deposits can be found in appendix B.

[182] Hill 1995, 28, 63, 70-71; Maltby 1985, 55-56, 60-61; Meniel 1992, 30, 91-105.

Category	Cattle	Horse	Dog	Sheep	Pig	Crow	Red deer	Total
Skull	8	10	7	2	3	0	0	30
Complete	1	1	8	2	0	0	1	13
Articulated	2	3	0	2	0	0	0	7
Combination	1	2	2	1	0	1	1	8
Bone conc.	4	3	0	2	0	0	0	9
Total	**16**	**19**	**17**	**9**	**3**	**1**	**2**	**67**

Table 3.1. Special animal deposits from Passewaaijse Hogeweg. Complete=complete skeleton, Articulated=articulated limbs, Combination=deposit consisting of a combination of other categories, Bone conc.=bone concentration. Total is the number of deposits a species was found in. Because some deposits contain more than one individual, the numbers do not add up.

'normal' refuse? First, the large number of bones makes a bone concentration stand out. Bone rubbish is usually found more dispersed. Next, the limited fragmentation and excellent preservation, indicating that the bones were buried in a fresh state, differ from animal bones found as refuse. Finally, the ratio of species found in bone concentrations confirms that they are not simply rubbish.

Table 3.1 shows the numbers of special animal deposits in each category. Totals for each category are not simply the total number of deposits mentioned, because some deposits contain more than one species, i.e. the combination deposits and bone concentrations.

3.3.4 SKULL DEPOSITS

Many complete or nearly complete skulls were found in the settlement Passewaaijse Hogeweg. Some of these were recognised and recorded during excavation, while others were encountered during the animal bone analysis and felt to be complete enough to belong to this category. All skulls which were half complete or more were initially singled out for inclusion in the special deposit skull category. It is difficult to determine whether the skulls that were not recognised during excavation should be seen as special or not. The manner in which they were deposited is not recorded. These skulls are often fragmented or incomplete, although fragmentation could have occurred during excavation; some of the skulls that were felt to be complete during excavation were also very fragmented and incomplete by the time they reached the laboratory.

Skulls were found in pits, ditches and wells. In total, 30 skull deposits were found (table 3.1). This number does not include the skulls found in combination deposits. Some of these skulls seem to be buried deliberately, while others are more likely to be rubbish. A few examples will be discussed here. The number in brackets refers to the Special Deposit number that can be found in the catalogue of special animal deposits (Appendix B).

A cattle skull was found in a pit (SD 1, fig. 3.4). It has sustained some damage: the fragile nose is missing. Most of the molars are also missing. This shows that the skull was buried after the flesh had decomposed, allowing the molars to fall out of the skull. The skull was lying upside down. The pit contained many more animal bones. This skull was probably not deposited as part of a ritual, but entered the pit as part of a rubbish clearing operation. Arguments against a ritual interpretation are the presence of animal bone waste, the lack of freshness of the skull when it was buried, and the lack of a deliberate arrangement of the skull within the pit. A second cattle skull was found in a ditch surrounding a house (SD 9, fig. 3.5). This complete skull was not just thrown in the ditch, but positioned right way up, looking inward to the house. The location and position of the skull in relation to the house suggest that this

Fig. 3.4. Special deposit 1: cattle skull. This skull was probably not buried as a ritual deposit.

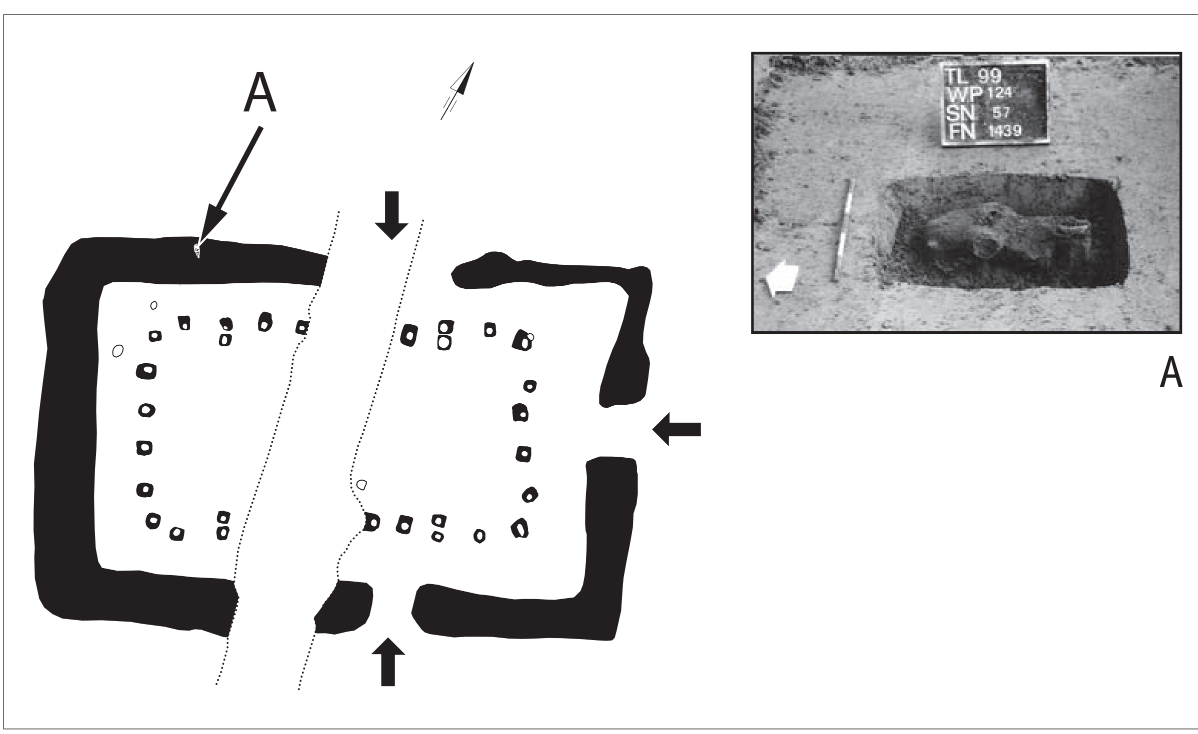

Fig. 3.5. Special deposit 9: cattle skull found in a house ditch. Drawing J. van Renswoude.

Fig. 3.6. Special deposit 6: two horse skulls. The placement of the skulls side by side is an argument for a ritual interpretation.

could be a foundation deposit. However, the ditch that the skull was found in did contain lots of other animal bones.

Special Deposit 6 consists of two horse skulls lying parallel to each other in a pit (fig. 3.6). The skulls seem to have been deposited in a deliberate manner. The mandibles from one of the skulls were found on the other side of the pit. Both horses were younger than 2.5 years (the second molar was not erupted). A fragment from a lower canine from a male pig or wild boar was one of the few other animal bone finds from this pit. Arguments for a ritual interpretation are the deliberate arrangement of the skulls, the freshness of the skulls at the time of burial and the inclusion of skulls from more than one individual. Another horse skull (SD 5, fig. 3.7) was found lying on its side in a ditch, with both mandibles and cervical vertebrae close by, but not articulated. Cervical vertebrae from a second horse and very few other bones were found with this deposit. The freshness and completeness of the skulls and the location in a large boundary ditch containing many more special deposits make it likely that this deposit is a ritual deposit.

Two wells contained skull deposits that have been interpreted as ritual deposits. In the first well, the skull of an adult female horse was found (SD 25). Very few other bones were found in this well, indicating that it was not used for dumping rubbish. The skull showed cracks on the frontal bone, which are almost certainly the result of the horse receiving a blow to the head to stun or kill it. The second well contained two sheep skulls (SD 26 and 27). Although very few other bones were found in this well, the deposit did contain three complete cattle scapulae as well as the mandibles from one of the sheep skulls. In contrast, two cattle skulls were found in another well, together with a lot of other animal bones (SD 8 and 13). These two skull deposits are given a non-ritual interpretation.

Special Deposit 3 consists of a complete dog skull. No other bones were found near the skull. The position of the skull does not seem coincidental: the skull was buried anterior side up, parallel to the axis of the ditch. This is one of the skull deposits for which the interpretation is difficult. A similar deposit of a dog skull in a ditch has been interpreted as ritual, mainly on the basis of the presence of the mandibles, indicating the freshness of the skull when buried, and the association with a rare cat bone (SD 11).

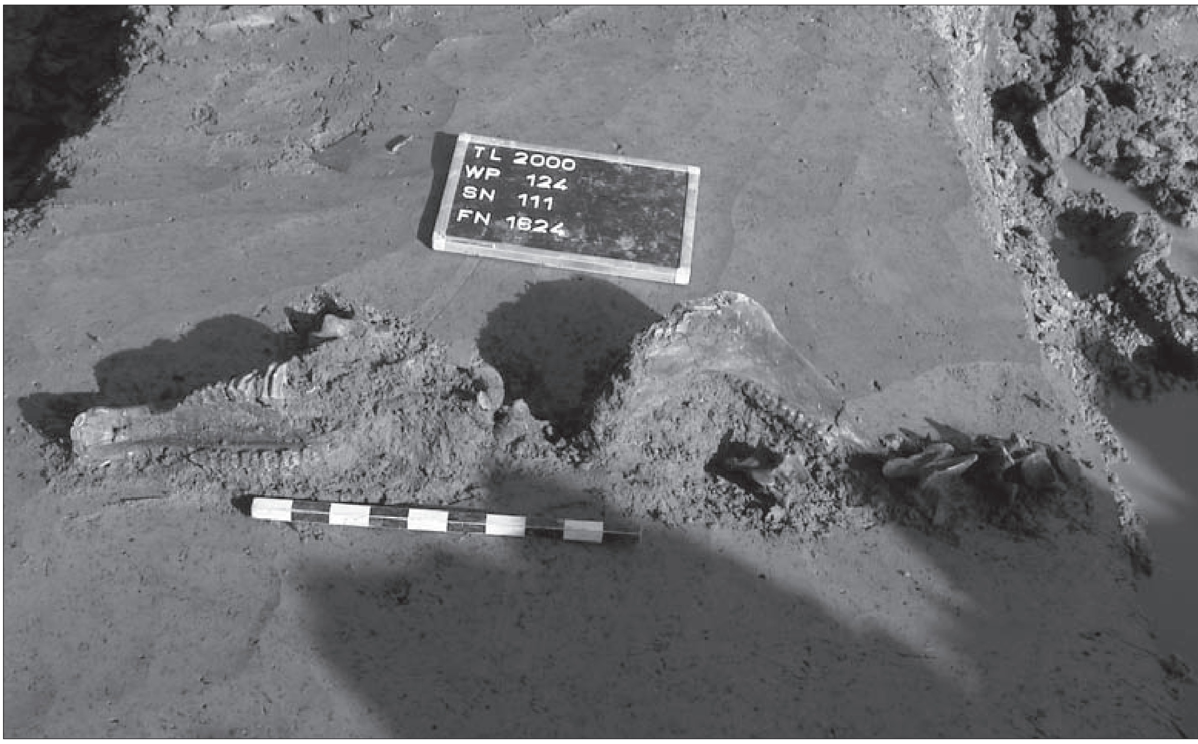

Fig. 3.7. Special deposit 5: horse skull and mandibles, found in a large boundary ditch.

To sum up, most skull deposits consist of skulls of horse, cattle and dog, with sheep and pig occurring in small numbers. No skulls from wild animals were found in the skull deposits. Not all the skulls in this category were deposited in a ritual manner. Of the thirty skull deposits, ten are interpreted as ritual deposits, another ten are almost certainly rubbish, and the remaining ten are uncertain. If we consider our criteria, the following can be applied to skull deposits:

- Different fragmentation and preservation. Unlike the small fragments of skulls usually found among bone refuse, the skulls in special deposits are complete or almost complete.
- Freshness of the bones when buried. Although not all skull deposits were buried in a fresh state, the ones that are believed to be ritual deposits are.
- Positioning of the skulls. What sets the skulls apart from common refuse is their location within the feature. They are often found without other finds and positioned with the anterior side up, indicating that they were put there in an 'organised' manner.
- Association of more than one species. A ritual explanation for the skull deposits is strengthened by the fact that two skulls were found in clearly ritual combination deposits with other species of animal (see below).
- Different species distribution from that at site level. Horse and dog skulls are clearly overrepresented. Of course, this could simply reflect the fact that their flesh was not normally eaten, and therefore that their bodies received a different treatment. However, the main domestic food species also demonstrate a different ratio from that at site level, with sheep being underrepresented.
- Presence of more than one individual. Special Deposit 6 contains two skulls of young horses. It is unlikely that these would have died natural deaths at the same time. They may have been deliberately killed.

Although it could be argued that all skulls are butchery waste, this does not explain all of the skull deposits. The flesh from skulls was commonly eaten during the Roman period. Another argument is that dog

Fig. 3.8. Special deposit 29: skeleton of a dog.

skulls are clearly not butchery waste because there is no evidence that dog was eaten in Tiel-Passewaaij. It seems as if the skulls of some dogs were singled out and buried separately from the rest of the body.

After assigning a ritual or non-ritual interpretation to the skull deposits, it turned out that most of the horse skulls are ritual deposits whereas most of the cattle skulls are rubbish. The sheep skulls are also believed to be ritual deposits, whereas the interpretation of most of the dog skulls and the pig skulls is uncertain.

3.3.5 COMPLETE OR NEARLY COMPLETE SKELETONS

A number of complete animal burials have been found, most of which are dogs (table 3.1). At first, it seemed reasonable to assume that these were carcass dumps of animals that were not eaten. However, two dog burials were found in a combination deposit, which indicates that their burial could be related to ritual practices. Furthermore, another dog was carefully buried on top of pottery sherds, arguing that this was not simply a disposal of a rotting carcass. Two other dogs were buried in the same house ditch. Most of the skeletons were buried in pits, but one dog was found in a well, and a red deer skeleton was buried in a ditch.

Special Deposit 29 contains the burial of a complete dog. The dog, an adult male of above-average size, was lying on its left side, with its front legs folded beneath its chin and its back legs extended under its body (fig. 3.8). The dog was carefully buried in this position in a pit especially dug for the occasion. The pit was dug in the filling of a ditch, which contained a second special deposit, a burial of a complete dog and parts of a red deer (SD 30, see 3.3.7). Special Deposit 32 is a deposit of a complete young red deer that was killed at an age of between one and two years old.[183] A few parts were probably damaged

[183] Heinrich 1991, 29.

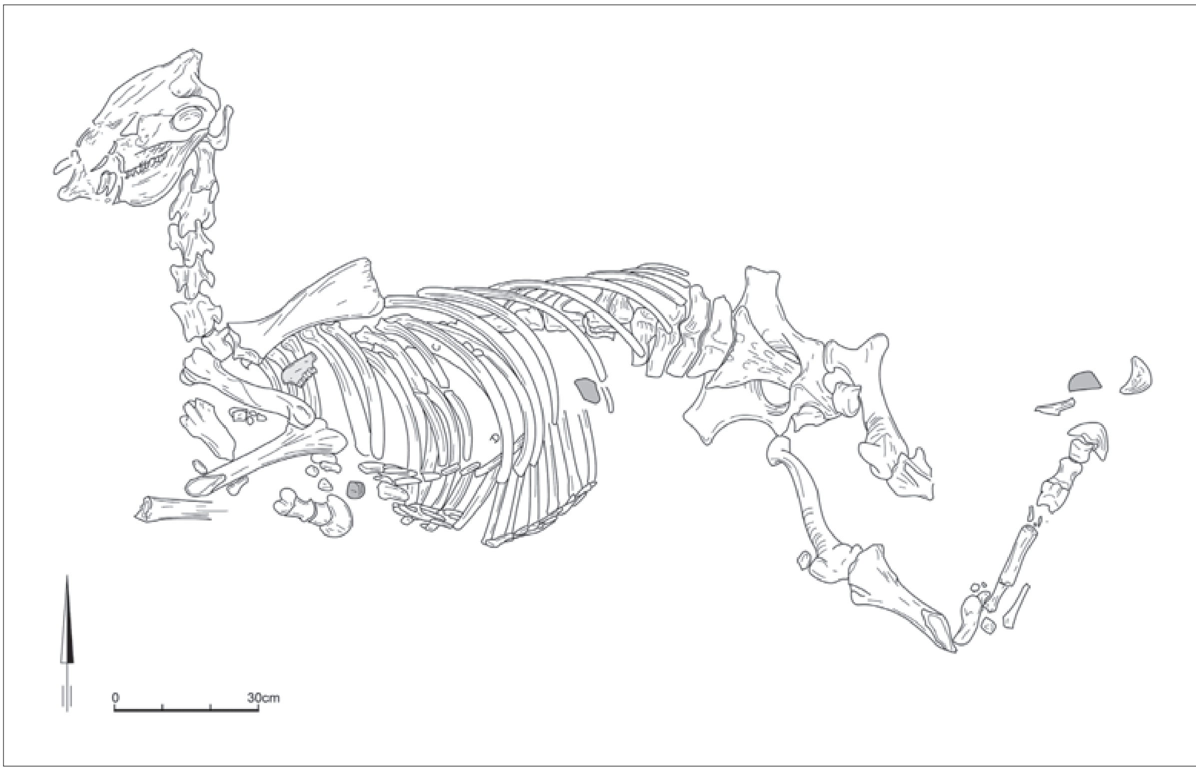

Fig. 3.9. Special deposit 35: horse skeleton. Two bronze brooches were found in the same pit. Drawing: ACVU-HBS.

and accidentally removed during excavation. The right leg was missing, but the calcaneum was present which suggests that the leg was originally buried. The skull was also missing. More special deposits were found in the same boundary ditch that the deer was deposited in.

A skeleton of an adult dog was found in a well (SD 34). Although the skeleton was not complete, it was almost certainly deposited as a complete animal, because bones from all parts of the body were present. More animal bones were found in this well, suggesting that it could have been used as a place to dump rubbish.

Special Deposit 35 consists of a complete horse skeleton (fig. 3.9). The horse was buried in a pit. The lower legs were pointing upwards and were damaged during excavation. One of the front legs was bent under the chest. The upper part of the back legs seems to have been extended, with the lower part bending backwards in an unnatural way. Two complete bronze brooches were found close to the horse's body. This suggests that the buried horse was covered in a piece of cloth, fastened by the brooches.[184] An adult cow was buried in a pit (SD 55, fig. 3.10). The cow was lying on her right side, with the legs folded close to the body. Two sheep burials were found in Passewaaijse Hogeweg. The first, Special Deposit 31, is that of a very young sheep. The head was missing but may have been removed during excavation. A second deposit, of articulated horse bones, was found in the same pit (SD 41, see 3.3.6). The second deposit of a complete sheep contains an adult female and was buried in a ditch (SD 40). A third sheep is found in a combination deposit and will be discussed in 3.3.7.

[184] Remains of a horse were found in association with a closed brooch in a settlement in Oosterhout, De Waalsprong. The brooch is seen as a possible indicator that the horse remains had been wrapped in cloth, as well as an indicator for a ritual meaning of the burial. Van den Broeke 2004, 8.

Fig. 3.10. Special deposit 55, a cow skeleton, during excavation.

Three dog burials were found quite close together. These deposits can all be dated to the same phase. The first one, Special Deposit 37, is an adult dog skeleton in a pit. The lower legs and the head are missing, but have probably been accidentally removed during excavation. However, this could be an indication that the dog was skinned, although no cut marks were found. The presence of a single phalanx and damage to the lower tibias make the first explanation the more likely one. The dog was placed on top of several sherds of a large vessel (fig. 3.11). At first, it looked like the dog had been placed inside the vessel, but the vessel was already broken and not complete when it was buried. Another adult dog skeleton (SD 38) was located about one metre from the previous one, also in a pit (fig. 3.12). No other finds were associated with this burial. Both burials are dated to the second half of the 2nd century. A third dog was found not far from the other two. Although badly damaged and incomplete, the skeletal elements that are present and the fact that one back leg was found articulated suggest that a complete animal was originally buried here. This dog was immature, with some epiphyses unfused. The age could be determined as between 7 and 10 months.[185] Two more dogs were buried in the ditch surrounding a house (SD 51 and 52, fig. 3.13). One of these dogs was lying partly on top, and partly next to large pottery sherds (fig. 3.14). Both the location, the presence of two individuals, and the association of one of them with pottery are arguments for interpreting these deposits as ritual.

In most cases, a pit was dug especially for the burial of the animal. The dumping of a carcass could have occurred in any open feature used for dumping rubbish and did not require a specifically dug pit. Although most of the complete skeletons should be seen as ritual burials, it is of course possible that not

185 Silver 1969.

Fig. 3.11. Special deposit 37: a dog skeleton buried in the lower half of a large vessel.

all of them are. The dog skeleton from a well is sufficiently different from the other deposits to suggest that this simply was the dumping of a carcass. The following criteria suggest that the burial of complete animals should be seen as ritual practice:

- Species of animal. The red deer skeleton cannot be seen as a dumped carcass, nor can the black crow skeleton in a combination deposit (see below).
- Positioning of the bones. Almost all of the skeletons were not thrown in, but positioned carefully on the bottom of a ditch or in a specially dug pit. The removal of a sheep's head and replacement with that of a calf is also evidence for ritual (see 3.3.7, combination SD 36).
- Association of more than one species. Dog skeletons were found in two combination deposits, one with a horse skull and one with a partial red deer skeleton (see below).
- Different species distribution from that at site level. If the skeletons were dumped carcasses of diseased animals, we would expect to find a reflection of the species ratios at site level. Instead, we find a number of dogs, some sheep, two wild animals, very few cattle and horses and no pigs. It is extremely unlikely that not more cattle died from disease during the habitation of the settlement. Because of the near absence of cattle skeletons, we must assume their carcasses were disposed of elsewhere.
- Association with other finds. Two dogs were associated with a number of large pottery sherds, not normally found in refuse. The horse skeleton was associated with two brooches.
- Location within certain features. Two dogs were found buried in a house ditch.

Fig. 3.12. Special deposits 37 and 38: two dog skeletons.

3.3.6 ARTICULATED LIMBS

This category of deposit is rare at Passewaaijse Hogeweg, with six certain deposits and one possible deposit. Because of the rarity of this type of deposit, all of them will be described here. Special Deposit 41 consists of four lower limbs of an adult horse, buried in a pit (fig. 3.15). The only other bone find from the pit is a cattle tarsal bone, small enough to be an intrusion. The horse was very large for the Roman period: the withers height is 158 cm.[186]

The following three deposits share many similarities. Special Deposit 45, found in the upper fill of a well, consists almost entirely of horse bones. The only fragment from another species is a cattle mandible. The bones were damaged during excavation, but fragments were found of a skull with two mandibles and three lower limbs, all from an adult horse. The right foreleg is missing. Cut marks were observed on a metacarpal and a first phalanx, suggesting that the horse was skinned. Very few other bones were found with this deposit. In another well, a deposit of articulated sheep bones was found (SD 28). This deposit contains the skull, neck vertebrae and three lower limbs from an adult sheep. Although other animal bones were found in this well, the missing leg suggests a pattern. Special Deposit 49 consists of three

[186] May 1985.

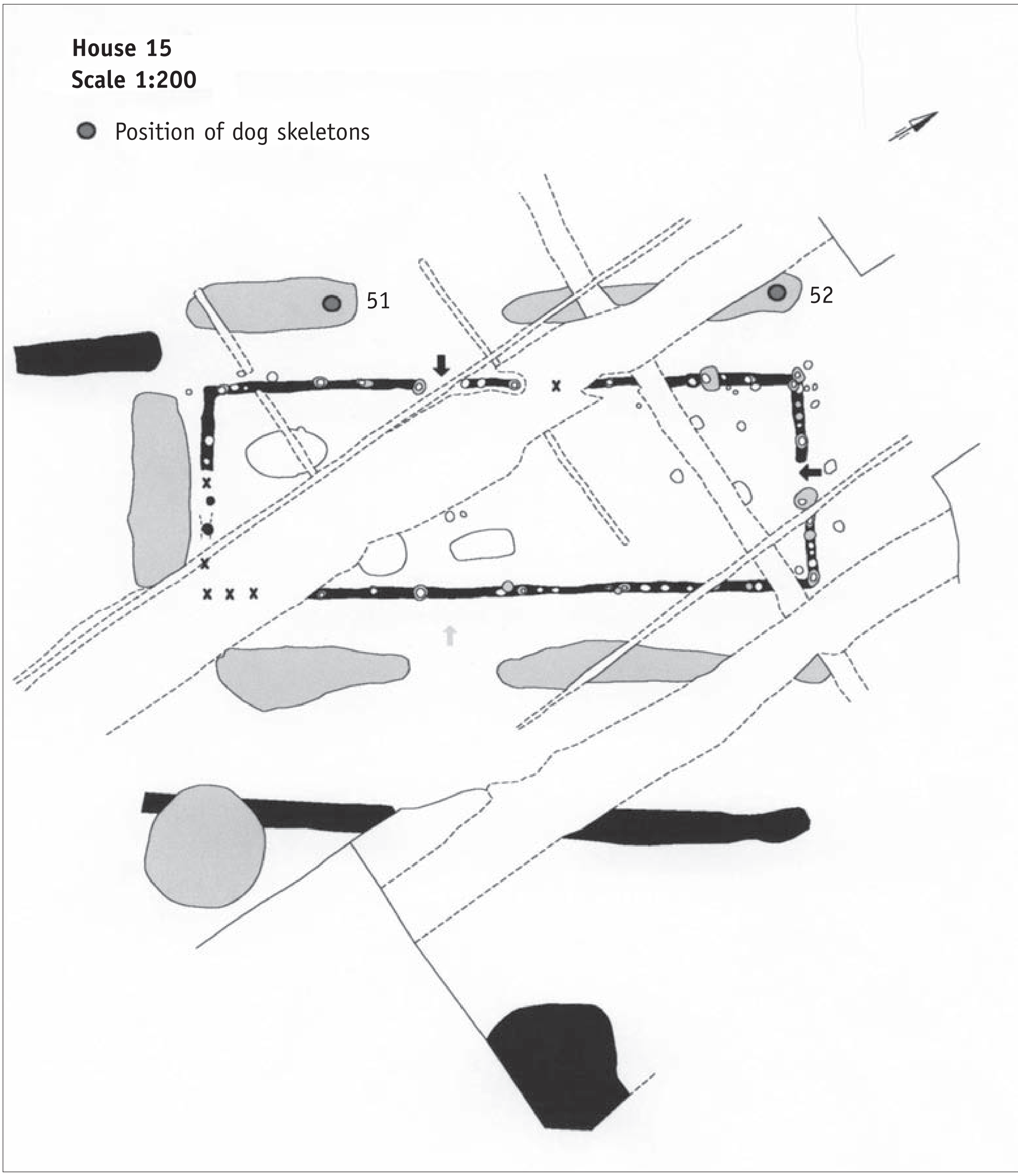

Fig. 3.13. Special deposits 51 and 52: two dogs buried in a house ditch. Drawing J. van Renswoude.

lower limbs of a calf, part of one mandible, a hyoid (tongue bone) and two small fragments of skull bone (fig. 3.16). The presence of the hyoid and skull fragments suggests that the skull was originally buried complete and fresh. The excavators noted that another mandible was possibly removed by the JCB, and that the feature had suffered from ploughing. The right forelimb is missing. It is very unlikely that this was also removed by the JCB, as not even the smaller bones were found. Furthermore, the skull and mandibles were damaged because of their higher position in the ground.

Special Deposit 50 is somewhat different from the previous two deposits. In a ditch surrounding a house, parts of an adult sheep skeleton were found. The excavators noted that parts of the skeleton were

Fig. 3.14: Special deposit 51: dog skeleton in a house ditch, associated with pottery sherds.

articulated, but that the animal was not complete. The deposit consists of the skull and both mandibles, the vertebral column and the lower limbs. Cut marks were found on the cranium, the first three cervical vertebrae, a lower lumbar vertebra and the sacrum. The only other bone find from this ditch is a tooth from a female pig. The location of the deposit and the similarity to the other articulated limb deposits are arguments for a ritual interpretation. Another articulated limb deposit was also found in a house ditch. Special Deposit 54 is the articulated right lower back limb of a young horse (younger than 12 months),[187] found in the ditch surrounding an Early Roman house with very few other bones. Although clearly not from the same animal, this single leg could be related to the deposits with missing legs.

Another articulated bone deposit (SD 61) was recognised during excavation, but unfortunately damaged and not recorded. What was left of the animal bones consisted of several cattle bones from a young animal: scapula, radius/ulna, three carpal bones and a metacarpal. Nothing was recorded on the way the bones were positioned, but it seems likely that they were articulated. This deposit is the only one that contains a single complete leg.

These deposits could be seen as problematic because lower limbs contain little meat and could have been discarded as butchery waste. However, there are several reasons why these deposits could be interpreted as ritual:

- If lower limbs and skulls were standard primary waste, we would expect to find many associations of them among other refuse. This is not the case. Complete metapodials are found on their own, but no associations of them are found among refuse.

[187] Silver 1969.

Fig. 3.15. Special deposit 41: articulated horse bones.

Fig. 3.16. Special deposit 49: cattle skull and articulated lower limbs.

- Repetitive patterns. Missing legs occur in three of the deposits, and two of the articulated limb deposits are found in house ditches.

An argument against the butchery theory is the presence of meat-bearing bones in Special Deposit 61. Furthermore, if these deposits consist of primary butchery waste, why are the right forelegs missing in three of the deposits? Their absence does not seem coincidental. An interesting idea to consider is that the finds of lower legs and skull could reflect the burial of an animal skin.[188] However, the absent legs do not support this theory.

3.3.7 COMBINATION DEPOSITS

Combination deposits are relatively rare: only four were found in Passewaaijse Hogeweg. The exact contents of the deposits vary, but all contain two different species and deposit types. Twice, a complete skeleton is found together with a skull from another species. Wild animals are found in two of the combination deposits. A horse skull was buried in a pit, accompanied by an iron knife (SD 2, fig. 3.17). A skeleton of a black crow was found within the same feature, not more than a metre from the horse skull. The skull belonged to an adult horse. The crow was buried with its wings folded close to its body. A number of animal bones were found in the same pit.

Just a few metres from a complete dog skeleton (SD 29), another dog skeleton was found (SD 30, fig. 3.18). This dog, another adult male, was lying on its right side in a pit with its front legs folded beneath its body. The exact position of the back legs was hard to establish, because they were lying below the water table in shifting sand. It looked as if the dog had sustained an injury from a sharp object to the cranium (above its right eye). The injury was healed or healing. A few cut marks were observed on the mandible and radius. It is possible that the carcass was skinned. Behind the dog's back end, large parts of a red deer were found. Skeletal elements that were present are the mandibles, hyoid and a premaxillare fragment, vertebral column, ribs and sternum, and the upper front legs. Cut marks were seen on a radius and mandible.

A skeleton of a dog was found in a ditch together with a horse skull (SD 19, fig. 3.19). The dog, an older male, was lying on its right side. Some of the bones were displaced, but this could be the result of post-depositional settling and activity from burrowing animals. The dog had suffered a fracture of its right radius and ulna which had completely healed, but shortened the bones considerably. A rib fracture was also healed. The dog had lost several of its teeth during life and its remaining teeth were heavily worn, suggesting an old age. Next to the dog skeleton, a complete horse skull had been placed.

SD 36 shows evidence for the deliberate positioning of bones. A skeleton of an adult female sheep was found in a pit (fig. 3.20). The head of the sheep had been removed and placed behind its body. Just above its back end, a group of neonatal sheep bones was found. Only the leg bones were recovered, but this could be due to preferential preservation. Where the adult sheep's head should have been, the mandibles and one maxilla of a calf were found. Another find from the same pit consisted of an additional set of sheep cervical vertebrae.

It is the combination deposits that are the most convincing of ritual deposits. The deliberate burial of parts of two different animals clearly means something. However, we will discuss the arguments for a ritual nature as we did for the other deposits:

- Species of animal. Two of the combination deposits contained wild animals.
- Positioning of the bones. In all three deposits, the bones or skeletons were carefully positioned in a certain way.

[188] Stallibrass 1996, 38-39.

Fig. 3.17. Special deposit 2: horse skull and iron knife. The skeleton of a crow was buried in the same pit.

- Association of more than one species. This argument applies to all three combination deposits. The occurrence of two individuals makes a natural death less likely.
- Association with other finds. An iron knife was found in the deposit of the crow and horse skull.

3.3.8 CONCENTRATIONS OF DISARTICULATED BONES

This category is problematic, because disarticulated animal bones seem to be precisely what refuse should be. However, the quantity of bones, the completeness of the bones and the good preservation were all very different from the normal bone refuse in this site. Four bone concentrations were found which seem similar. Four others were different from these as well as from each other and could have resulted from very different practices.

Special Deposit 44 contains a concentration of 113 animal bones in a pit (fig. 3.21). Most of the bones are from horse (59 %) and cattle (35 %). During the excavation the pit was seen as different because of the presence of complete skulls and mandibles. Loose teeth, which are very common in the normal bone refuse, were not found in this pit at all. Five skulls (3 horse and 2 cattle) and 15 mandibles (the minimum number of individuals for both horse and cattle is 5) were present in the pit. An almost complete hind leg from a young horse was present, from tibia to first phalanx. The bones are from animals of different ages: both immature and adult animals are represented. Some of the bones were gnawed by dogs. Butchery marks were found on both species, but more on cattle than on horse bones. However, most of the marks on cattle bones were cut marks on mandibles, which usually occur during skinning. The preservation of the material is very good; it was clearly buried when still fresh. The contents of this pit could be the

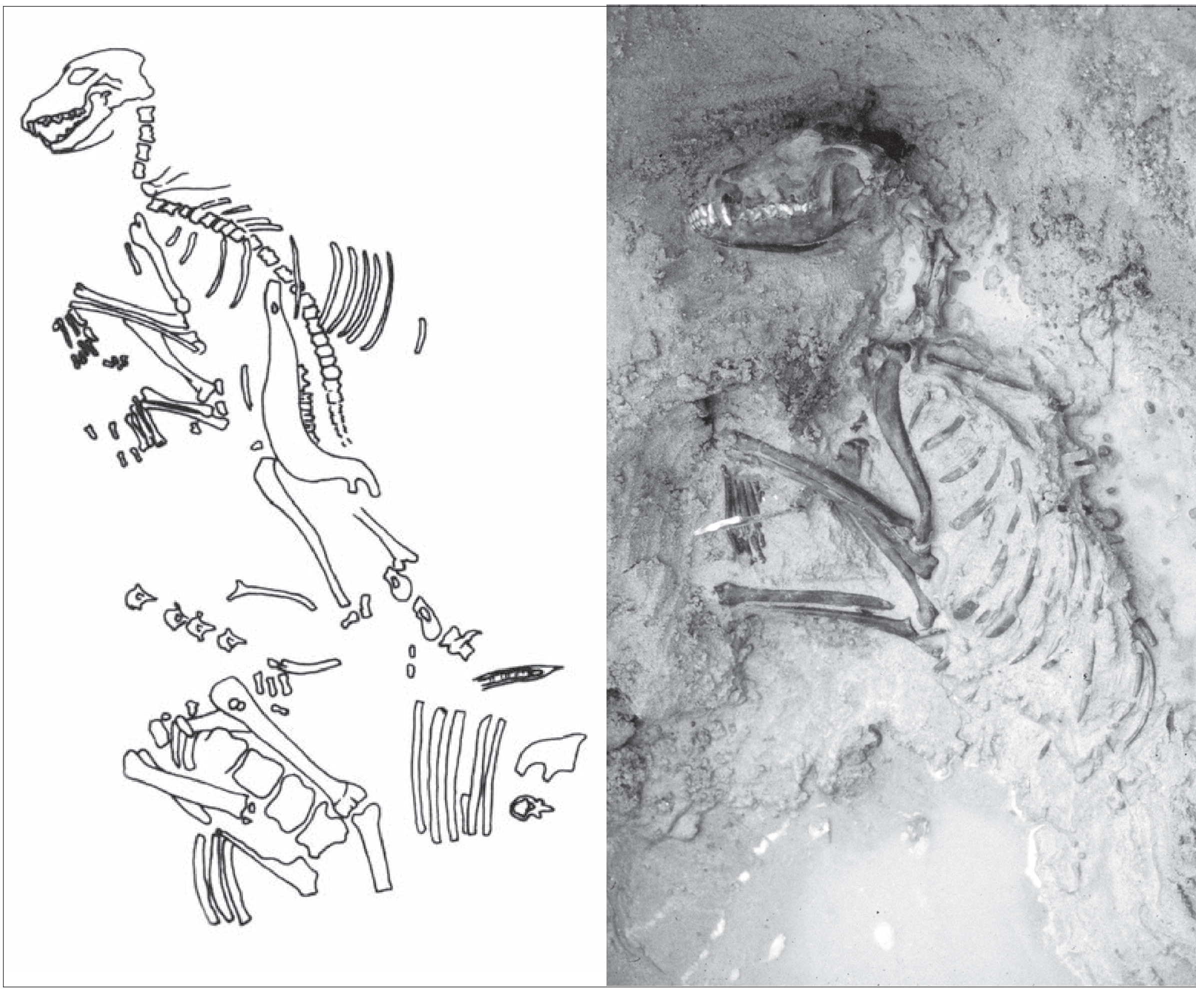

Fig. 3.18. Special deposit 30: skeleton of a dog with red deer bones.

remains of a major event during which at least ten animals were killed. Some of the skulls and most of the mandibles were kept apart for burial, as well as a complete hind leg of a horse. The meat from these animals may have been consumed during a large, possibly festive meal. A lot of people must have been involved, if ten animals were needed to provide food. Some of the remains from the meal were collected (maybe a few days later, giving dogs the opportunity to gnaw some of the bones) and placed in a pit. The other bones must have been treated as normal refuse or disposed of outside the settlement.

Special Deposit 47 consists of a large quantity (n=412) of animal bones deposited in a ditch. The ditch was filled with bones for a length of about twenty metres. Horse and cattle account for most of the bones. Remains of six horses and nine cattle were found in the ditch. Bones from every part of the body were present, although cattle skulls were rare. Most of the bones are from young animals. Butchery marks were found on both horse and cattle bones, but more on cattle bones.

Special Deposit 43 is a deposit of 45 horse bones in a pit (fig. 3.22). Skulls and mandibles are lacking. Most of the bones are limb bones from at least two individuals: an adult horse and a horse that was younger than 12 months. The condition of the bones is good; they were clearly buried when fresh. Some of the bones were found articulated. Butchery marks were found on six of the bones.

Special Deposit 42 contains a large number of sheep bones, buried in a pit. Most of these are from the lower limbs, but there are also mandibles and maxillae from at least three individuals, as well as several long bones and vertebrae. The minimum number of individuals for the lower limbs is four. Because no

Fig. 3.19: Special deposit 19: combination deposit of a dog skeleton and a horse skull.

information was recorded during the excavation, it is uncertain whether the lower limbs were articulated when they were buried. However, the presence of phalanges and sesamoid bones suggests that they were. What is certain is that at least four sheep were killed at the same time, resulting in a substantial amount of meat. In this respect, the deposit is similar to the other bone concentrations (see below). Cut marks were found on two sheep mandibles.

These four deposits should be seen as typical bone concentrations. They contain large amounts of well-preserved bones from horse, cattle or sheep. In all four deposits, remains from two or more animals were found. Despite the fact that most of the bones were disarticulated, there are arguments to see the bone concentrations as ritual deposits:

- Different fragmentation and preservation. The bone concentrations are well-preserved and contain many complete bones.
- Presence of articulated elements. Articulated bones were found in Special Deposits 43 and 44.
- Association of more than one species. Both cattle and horse are represented in two of the bone concentrations.
- Different species ratio from that at site level. Horse is overrepresented in the bone concentrations, whereas pig is underrepresented.
- Repetitive pattern. Two of the deposits contain an entire right hind leg from a horse.

Another argument against normal refuse is the sheer number of animals involved. The remains of ten individual cattle and horses were present in Special Deposit 44. Killing ten large animals at the same time would provide an enormous amount of meat. Some of the meat could have been preserved by salting or smoking. In that case, the bone concentration could represent the refuse of normal late autumn slaughter. However, the large numbers of horse in three of the bone concentrations argues against normal slaugh-

Fig. 3.20. Special deposit 36: sheep skeleton with calf's head. The sheep's head is placed behind its body, next to a concentration of bones from two neonatal sheep. The sheep's head was replaced with parts of a calf skull.

ter. Feasting provides a better explanation. Since feasting often takes place within a ritual, the remains would be treated differently from everyday rubbish. Some parts of the slaughtered animals may have been selected for burial (such as the right hind leg from a horse).

In the settlement Oude Tielseweg, a bone concentration was found that is similar in some respects to the ones in Passewaaijse Hogeweg.[189] The concentration, which can be dated to phase 7, contained a large number of bones (more, in fact, than the concentrations in Passewaaijse Hogeweg). The bones were less fragmented than the other bones from this phase, and showed fewer traces of gnawing and butchery. The ratio of species was also different: mainly cattle and pig, with some remains of horse and sheep. The similarity lies in the number of animals involved, and the fragmentation of the bones, which is less than in other bone refuse. The lower percentage of butchery marks could indicate that not all the meat was utilised.

The other four deposits did not fit any of the other categories and are therefore included here. Special Deposit 53 also contains a concentration of sheep bones in a pit, but the contents are different from Special Deposit 42. Instead of elements from the head and lower limbs, this deposit consists of vertebrae, ribs, and bones from the meaty upper legs, all elements categorised as consumption waste. This deposit could represent the remains of a single meal. Special Deposit 46 contains a number of bones from an eight to ten-month-old calf. It was not recorded whether the bones were articulated or not. Bones are present from the head, ribs and at least two lower limbs. The head and lower limbs are reminiscent of the articulated bone deposits. Special Deposit 48 is a deposit of cattle ribs and vertebrae in a ditch. What

[189] Groot 1999, 54-68.

Fig. 3.21. Special deposit 44: concentration of cattle and horse bones.

makes this deposit special is the presence of a large sherd of samian ware, much larger than what was normally found in the settlement. Finally, Special Deposit 57 consists of several pits filled with animal bones and special finds including an antler comb, complete samian vessel and coins. Bones from several wild animal species were found in these pits, including the bones from the black vulture. These deposits are difficult to interpret and may not be related to ritual practices.

3.3.9 BUTCHERY MARKS AND THE CONSUMPTION OF MEAT

Consumption of meat from animals in ritual deposits is possible or even likely in some cases. For the skull deposits, we can assume that the rest of the animal, insofar as it was considered edible, was butchered and consumed. The articulated sheep bones in Special Deposit 28 show butchery marks that cannot just be explained by skinning, although they could be a result of segmentation of the carcass. It is possible that meat from the neck of the sheep was removed for consumption. Special Deposit 50, articulated bones from another sheep, show cut marks on cervical vertebrae and the sacrum. The other articulated bone deposits only show evidence for skinning. This is not surprising, since they consist of meatless lower legs. Burying the meatless lower legs in a ritual deposit would have left the meaty parts of the body available for consumption. In Special Deposit 30, the combination deposit with a dog skeleton and a partial red deer, both animals show evidence of butchery. Cut marks on the mandible, cranium and distal radius of the dog are consistent with skinning. The red deer bones show similar skinning marks on the mandible, but cut marks on the proximal radius probably indicate segmentation of the carcass or the removal of meat. The meat from the missing hind legs of the red deer was probably consumed.

Fig. 3.22. Special deposit 43: concentration of horse bones.

The bone concentrations are most likely to show evidence of meat consumption, since they are believed to be the remains of feasts. Surprisingly, the sheep bones in Special Deposit 42 show little traces of butchery. The only two cut marks (1.4 %) are probably related to skinning. However, sheep is always butchered less intensively compared to large mammals such as cattle. If the sheep was roasted whole and parts torn off rather than chopped off, butchery marks would be limited to the removal of the skin. The horse bones in Special Deposit 43 show both cut and chop marks. While some butchery marks indicate skinning, others are related to segmentation of the carcass and the removal of meat. The percentage of butchery marks is high: 18 %.

Special Deposits 44 and 47, both concentrations of cattle and horse bones, show similar butchery patterns. Butchery marks are found on both horse and cattle bones, but are more frequent on cattle bones. When the percentages of butchered bones are compared to those for the total number of bones from that phase, there is a difference between the two deposits: the percentages for Special Deposit 47 are very similar to the percentages for phase 7, while for Special Deposit 44, the percentage for horse bones is lower and that for cattle bones is higher. Cut marks on cattle bones from Special Deposit 44 are indicative of skinning, while the cut marks on two horse bones (rib and radius) are more likely to be a result from dividing portions or removing meat from the bone. For Special Deposit 47, butchery marks on both horse and cattle indicate skinning, segmentation and removal of meat.

In conclusion, some or most of the meat from many animals in ritual deposits was consumed. Only the animals buried complete represent a loss of meat. However, since most of the complete animal burials are dogs, the actual loss of meat was small.

3.3.10 Summary of special animal deposits and the identification of ritual animal deposits

For the special deposits from Passewaaijse Hogeweg, it was only after analysis, comparison of the deposits with each other, and careful consideration of possible criteria that an interpretation was reached. Of the 62 special deposits, 36 are believed to be ritual deposits. Four of these may contain the remains of feasting. The special deposits from Tiel-Passewaaij show a large variation. However, some general conclusions can be made. There seems to be a relationship between some animal species and the type of deposit it was used for. Some preferences can be seen among the special deposits that are interpreted as ritual deposits. Dogs were found mostly as complete skeletons, either by themselves or in combination deposits. Horse occurred in all types of special deposit, but skulls were found more frequently than other body parts or complete skeletons. Two of the combination deposits also contained horse skulls. Three out of five articulated bone deposits contained horse bones. Cattle and sheep were found in all types of deposit in similar numbers. Red deer was only found in two deposits: once as a complete skeleton, and once as a partial skeleton as part of a combination deposit. A black crow skeleton was found once in a combination deposit. Pig is conspicuously absent in ritual deposits. Some repetitive patterns were found among the special deposits from Passewaaijse Hogeweg. These are:

- Dog skeletons associated with pottery in two cases.
- Horse associated with metal finds in two cases.
- A missing leg in three articulated limb deposits.

Based on the special animal deposits from Passewaaijse Hogeweg, a set of criteria can be formulated that can be used to identify ritual deposits in settlements in the Eastern Dutch River Area in the Roman period.

- Different fragmentation and preservation from 'normal' refuse, indicating the freshness and completeness of bones at the time of deposition.
- Repetitive patterns of 'odd' characteristics noticed in special deposits.
- More than one individual animal or species.
- Different species distribution from that at site level.
- Wild animals, especially complete or partial skeletons of species that were normally consumed.
- Location in meaningful features such as house ditches or large boundary ditches.
- Position of bones within feature.
- Manipulation of bones, for instance the removal of limbs or rearranging of body parts.
- Association with non-bone finds that can be considered special in some way.
- Association of more than one special deposit, either in a combination deposit or as separate deposits in the same feature.
- The absence of animal bone refuse can be used as an additional criterion in some cases, but the presence does not exclude a ritual interpretation. Some of the animal bones found in ritual deposits may have entered them accidentally during the backfilling of the feature with soil full of refuse. Absence of refuse shows that a pit was dug specifically for the burial of a deposit, and filled up immediately.

Large quantities of bones, even when disarticulated, can be a ritual deposit of the remains from a feast. Criteria that can be used to identify feasting remains are:

- Different fragmentation and preservation from 'normal' refuse, indicating the freshness and completeness of bones.

- Abundance: large quantity of bones and less intense butchery.

Special foods do not seem to have been a part of feasting in Passewaaijse Hogeweg, although it is possible that the overrepresentation of horse in feasting remains means that horse was selected for feasting. A detailed study of the pottery from Passewaaijse Hogeweg could identify special vessels for feasting. However, the special deposits that are interpreted as feasting remains do not contain pottery in any large numbers. Special facilities or constructions for feasting have not been identified in Passewaaijse Hogeweg, but may be present in other settlements.

3.4 DISTRIBUTION OF RITUAL DEPOSITS IN PASSEWAAIJSE HOGEWEG THROUGH TIME AND SPACE

3.4.1 INFLUENCE OF EXCAVATION STRATEGIES ON DISTRIBUTION OF SPECIAL DEPOSITS

Excavation strategy may influence the discovery of special deposits. In order to maximise the number of special deposits, all pits and ditches in settlements should be investigated. All too often, the emphasis is on house features at the cost of pits and ditches not associated with houses. Although some special deposits were found in house ditches, none were found in postholes, and most were found in pits and ditches that were not directly related to a house.

In Passewaaijse Hogeweg, the fillings of many large pits and ditches were excavated, but towards the end of the excavation of the settlement, time constraints limited the number of features that could be excavated in full. The excavation team chose to focus on house plans. This means that some special deposits in large pits and ditches may have been overlooked.

3.4.2 SPECIAL ANIMAL DEPOSITS PER PHASE

So far, the special animal deposits have been described without paying any attention to the phase they date from. In this paragraph, we will look at the ritual deposits in relation to the chronology of Passewaaijse Hogeweg. Special animal deposits occur throughout the Roman period. The highest number is found in phase 7. However, this is more likely to be a result of the large size of the assemblage from this phase. The more material is found from a certain phase, the higher the chance that it will include special animal deposits. Also, half of the special deposits from phase 7 are interpreted as non-ritual special deposits. The deposits with a ritual interpretation show a different picture. Ritual deposits are absent in the Iron Age phase and are first found in phase 2. Rather than taking the actual number of deposits, it is more useful to take the percentage of ritual animal deposits compared to the total number of identified bone fragments (table 3.2).

Compared with the percentage of ritual animal deposits for all phases together, the percentage of ritual deposits per phase is low for phase 2, and high for phases 4 and 5-6. It looks as if the practice of ritual deposits originates in phase 2, rises to a peak in phase 5-6, and decreases in phase 7.

The fluctuating frequency of ritual deposits is interesting in itself, but it would be even more interesting if it turned out that certain types of deposits and certain species were more commonly used in one phase compared to another. However, because the total number of ritual deposits per phase is low, any observed differences between phases may just be a result of coincidence and small sample size. In phase 2, the only ritual deposits are two articulated limb deposits (table 3.3). In phase 3, all types of ritual deposits

Fig. 3.23. Distribution of ritual and special animal deposits in phase 2.

Phase	Special deposits	Ritual deposits	NIF	% special deposits	% ritual deposits
1	1	0	312	0.321	-
2	7	3	1762	0.397	0.170
3	15	9.5	1096	1.369	0.867
4	9	8.5	719	1.252	1.182
5-6	13	8	604	2.152	1.325
7	15	8	1861	0.806	0.430
All	60	37	6354	0.944	0.582

Table 3.2. Number of special and ritual deposits per phase, total number of identified fragments and percentage of special and ritual deposits. Two special deposits could not be assigned to a phase.

Deposit type	Phase 1	2	3	4	5-6	7	Total
Skull	-	-	3	1	2	4	10
Complete	-	-	2.5	5.5	4	1	13
Articulated	-	2	2	-	1	1	6
Combination	-	1	1	1	-	1	4
Concentration	-	-	1	1	1	1	4
Total	**0**	**3**	**9.5**	**8.5**	**8**	**8**	**37**

Table 3.3. Number of ritual deposits per type per phase.

occur. Skulls are most common, followed by articulated limbs and complete skeletons, and finally one concentration and one combination deposit. Phases 4 and 5-6 both show a focus on complete skeletons, with other deposit types occurring in smaller numbers. In phase 7, the skull deposit is the most common type.

Some types of deposit do seem to occur more frequently in some phases. This could reflect a preference for a certain type of deposit, or a shift in ritual practices over time. The choice of species could also be important. Of course, it is possible that the species determined the type of ritual deposit, or vice versa.

In phase 2, the number of deposits is small. Animal species included are sheep, horse and cattle. Phase 3 shows a clear preference for deposits involving sheep bones. Since sheep are found in four deposit types, it seems that the animal species itself is more important than the type of ritual deposit. Phases 4 and 5-6 both have high numbers of dogs in ritual deposits. Dogs are generally buried as complete animals. In phase 5-6, the relative number of deposits involving horse starts to rise. This trend continues in phase 7, where horse is the animal of choice for ritual deposits.

Table 3.4 lists the number of ritual deposits per species per phase. Two animals are clearly related to certain periods: sheep to phases 2 and 3, and dog to phases 4 and 5-6. For sheep, this means that it was used in ritual deposits during the two phases when it formed an important part of the economy. On the other hand, the frequency of cattle and horse in ritual deposits is not influenced by their role in the economy. Cattle was important for the economy in all phases, but this is not reflected in its occurrence in ritual deposits. The percentage of horse steadily increases in phases 3, 4 and 5-6, but this is not seen in the ritual deposits.

One of the research questions was whether the proportions of species is reflected in their occurrence in ritual deposits. Table 3.5 lists the prevalence of ritual deposits per species per phase. The percentage of cattle is always low, indicating the rare occurrence of cattle in ritual deposits compared to the high number of fragments found in the settlement. Dog is overrepresented in ritual deposits. Pig is conspicuously absent.

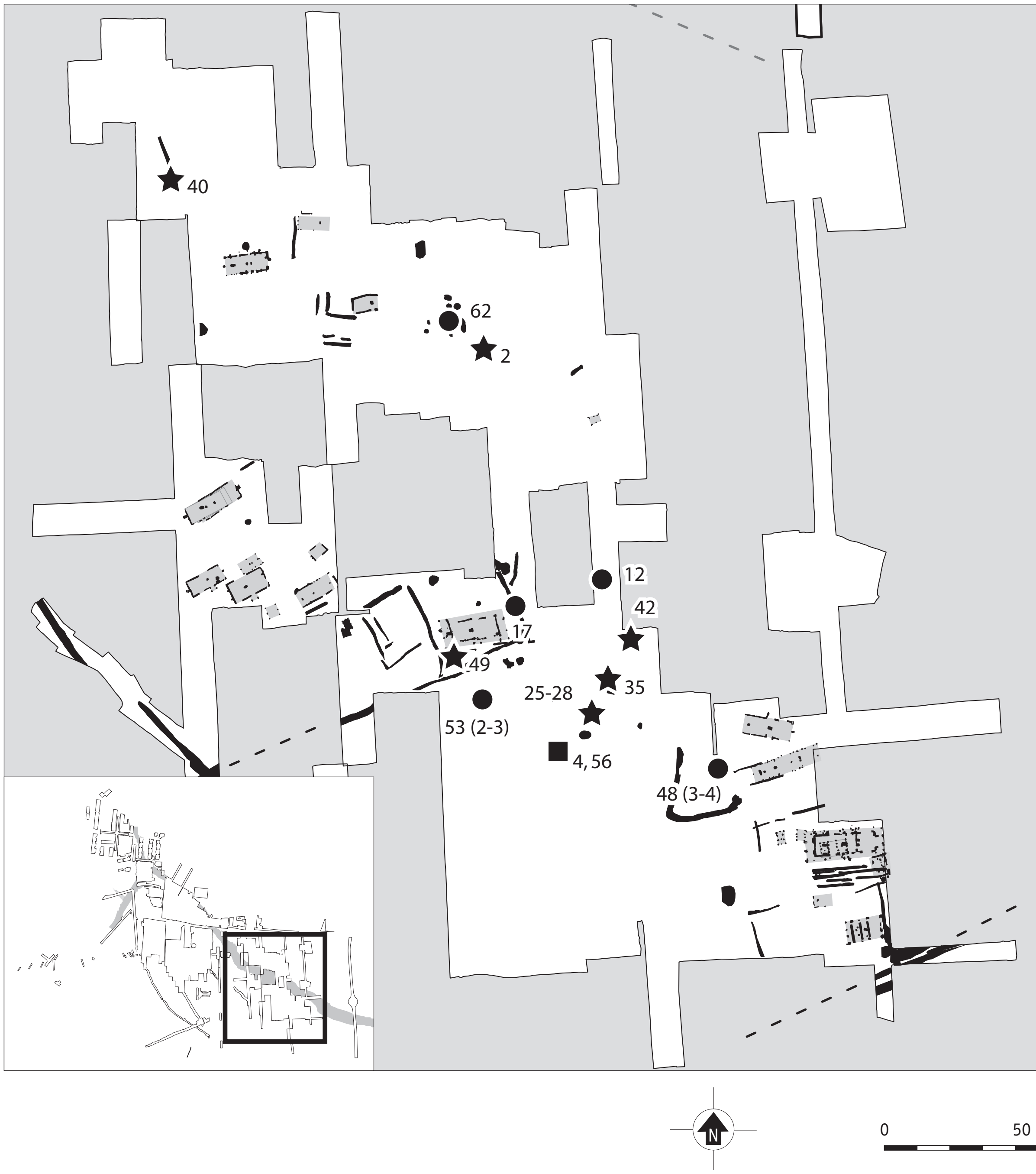

Fig. 3.24. Distribution of ritual and special animal deposits in phase 3. See fig. 3.23 for legend.

3.4.3 DISTRIBUTION OF SPECIAL ANIMAL DEPOSITS IN THE SETTLEMENT

Projecting the ritual deposits on the settlement phase maps reveals some interesting patterns. All three ritual deposits dating to phase 2 were situated close to houses (fig. 3.23). For phases 3 and 4, none of the ritual deposits can be linked to houses (fig. 3.24 and 3.25). Four of the seven ritual deposits from phase 3 were from three wells which are located close together, but not near any of the houses from this period. Special deposit 2 was located in the activity zone on the other side of the stream. All ritual deposits from phase 4 were found outside the farmyards. Phase 5-6 shows a return of the association between ritual

Species	Phase 1	2	3	4	5-6	7	Total
Cattle	-	1	1	2	-	2	6
Sheep/goat	-	2	5	-	1	-	8
Horse	-	1	3	1	3	6	14
Pig	-	-	-	-	-	-	0
Dog	-	-	0.5	6.5	4	1	12
Red deer	-	-	-	1	-	1	2
Crow	-	-	1	-	-	-	1

Table 3.4. Number of ritual deposits per species per phase.

Species	Phase 1	2	3	4	5-6	7	All
Cattle	-	0.147	0.241	0.629	-	0.235	0.226
Sheep/goat	-	0.266	1.116	-	1.515	-	0.494
Horse	-	0.813	2.326	0.625	1.724	1.345	1.333
Dog	-	-	2.273	40.625	16.667	6.250	10.909

Table 3.5. Percentage of number of ritual deposits per species, out of the total number of fragments for that species in that phase.

deposits and farmhouses (fig. 3.26). All ritual deposits were found either as part of the farmhouse plans or within the boundary of the farmyard. In phase 7, two ritual deposits were associated with houses, while six others were found in the large boundary ditch (fig. 3.27).

To sum up, in phases 2, 5-6 and 7, many of the special deposits were incorporated in or close to house plans or farmyard boundaries, whereas in phases 3 and 4, ritual deposits were located outside farmyards or at some distance from farmhouses.

3.4.4 SEASONALITY OF SPECIAL ANIMAL DEPOSITS

For a few special deposits, we can draw tentative conclusions about the time of year when they were made. However, some assumptions must be made: first, that the birth of animals was limited to a certain period in the year; and second, that most births occurred in the spring. This is what would naturally occur, unless man would influence breeding by controlling the access that male animals had to females.[190] Although this is possible, very young animals would be unlikely to survive the winter without shelter and extra feeding, so it would be most advantageous to have all animals born in spring.

The juvenile sheep in Special Deposit 31 was younger than 10 weeks when it died. If we assume that all lambs were born in the spring, it follows that the lamb died in late spring or early summer. The presence of neonatal sheep bones in Special Deposit 36 indicates that the deposit was made in spring. The calf in Special Deposit 46 was eight to ten months old at death. If we assume that calves were also born in the spring, the calf died during the winter. Two young dogs were found in ritual deposits. However, since it is likely that dogs could come into season at any time of the year, they did not have a specific breeding season, so the season of death cannot be determined from age.

In conclusion, there does not seem to be a clear relation between ritual deposits and time of year. Of course, it is possible that the deposits that do give an indication for time of year represent several different rituals.

[190] Legge *et al.* 2000, 152.

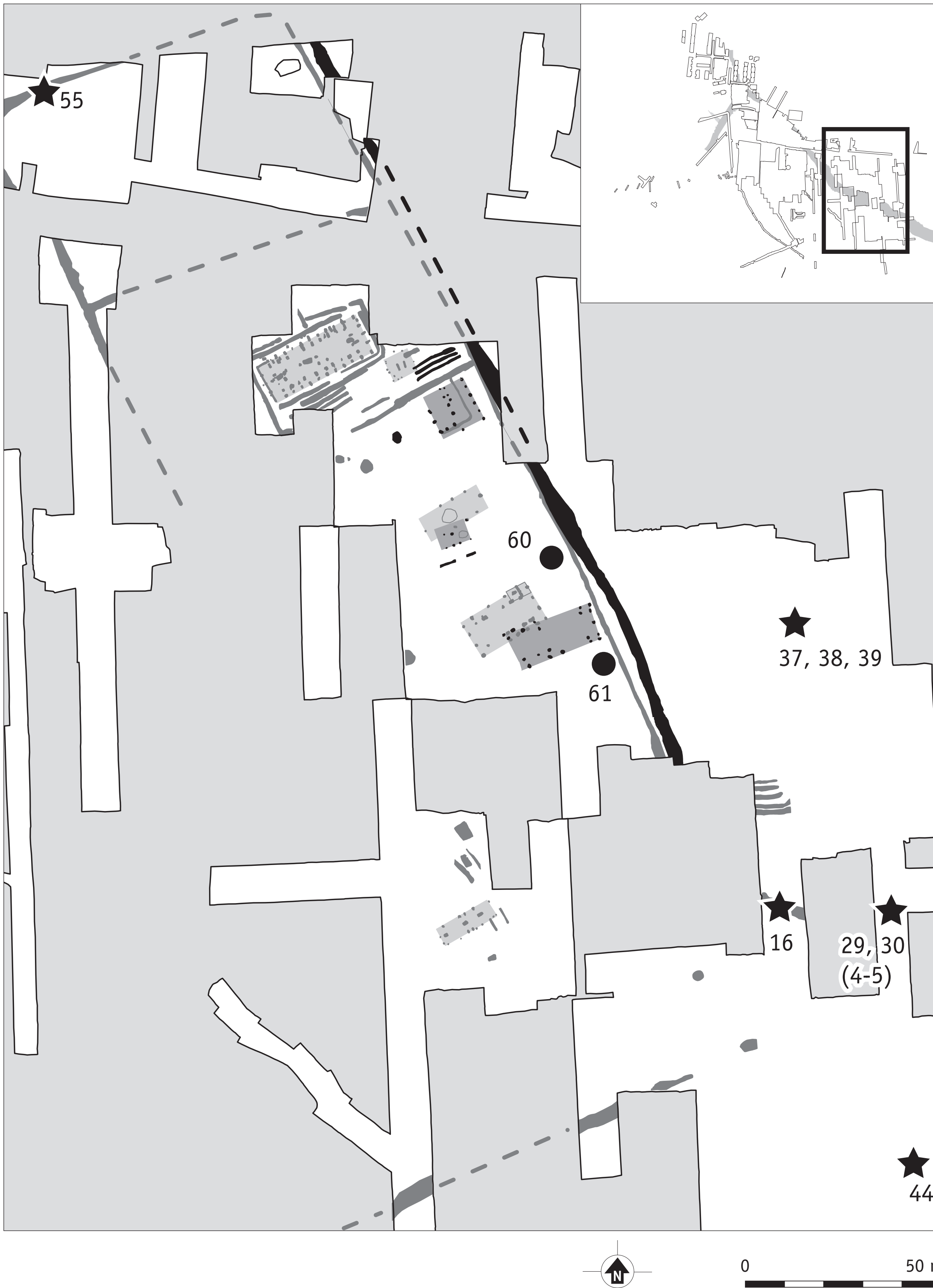

Fig. 3.25. Distribution of ritual and special animal deposits in phase 4. See fig. 3.23 for legend.

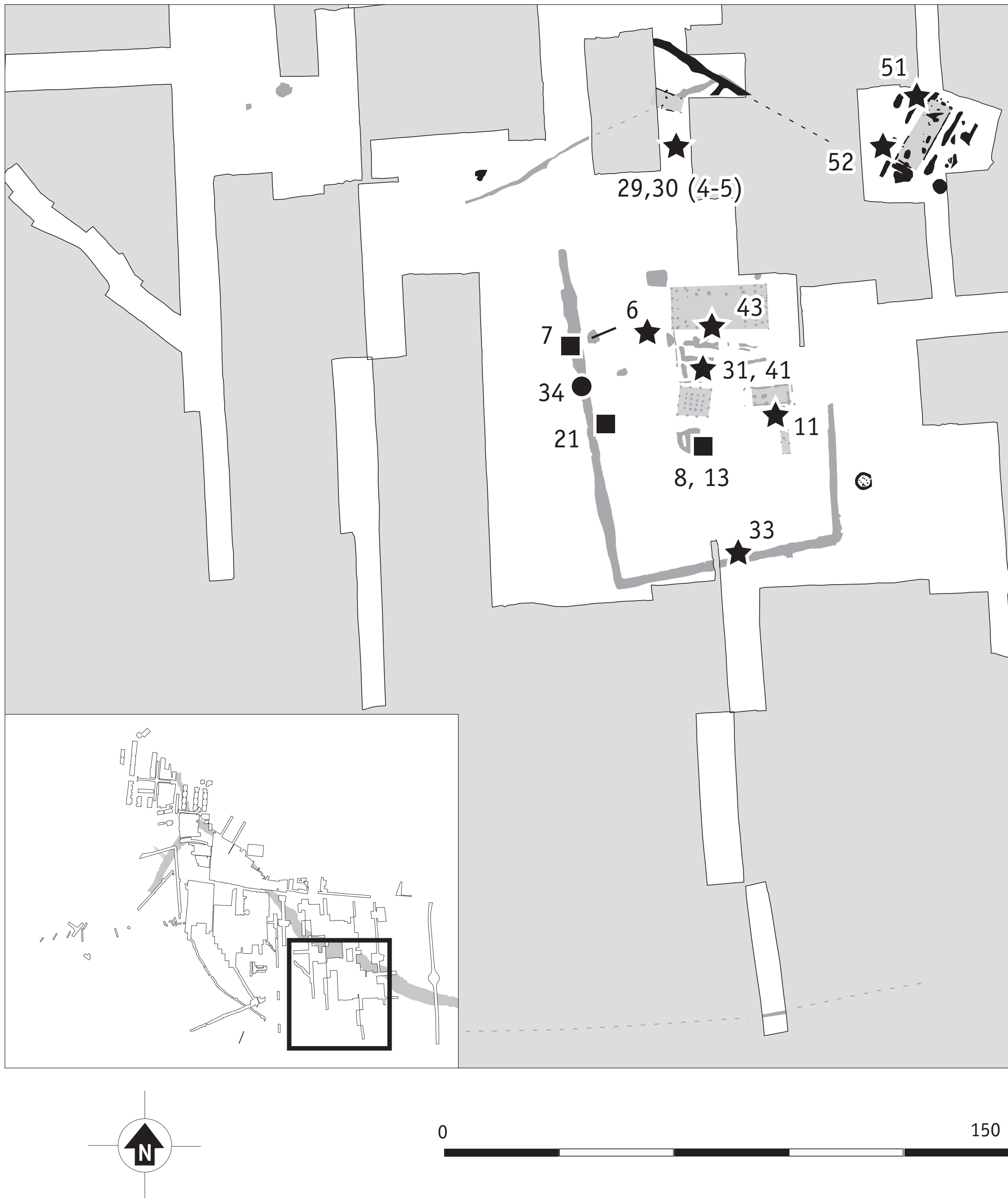

Fig. 3.26. Distribution of ritual and special animal deposits in phase 5-6. See fig. 3.23 for legend.

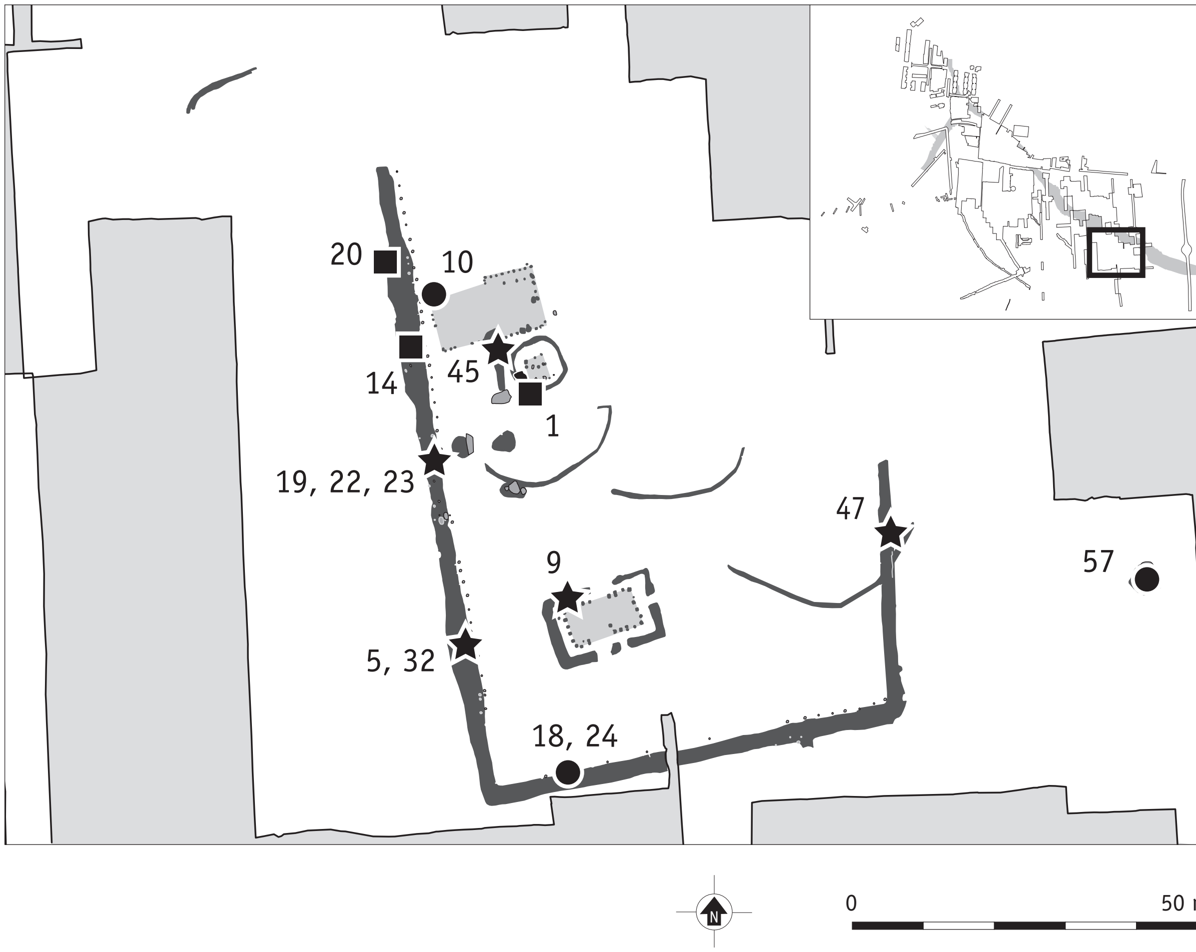

Fig. 3.27. Distribution of ritual and special animal deposits in phase 7. See fig. 3.23 for legend.

3.5 COMPARISON WITH SPECIAL DEPOSITS FROM OTHER SITES

Now that we have seen the different categories of special animal deposits from Passewaaijse Hogeweg, we can start comparing them with special animal deposits from other settlements. Although lots of interesting data are known from sites in Britain and Germany, such as Danebury and Feddersen Wierde,[191] the comparison in this paragraph will be limited to sites from the Roman period in the Netherlands. Most of the special animal deposits in the literature are of complete animals. There is a strong possibility that other animal deposits have not always been recognised by archaeologists. An alternative explanation for the absence of other animal deposits in zooarchaeological literature is that these deposits only occurred in certain regions or settlements and not in others. This seems unlikely, especially because deposits of complete animals are found widely. Also, there is some evidence for special deposits other than complete animal burials.

[191] Grant 1984a; Haarnagel 1979; Hill 1995; Reichstein 1991.

Fig. 3.28. Special deposit from Tiel-Bedrijvenpark (Medel site 6): a horse skull and two lower limbs.

3.5.1 SPECIAL ANIMAL DEPOSITS FROM ROMAN-PERIOD SETTLEMENTS IN THE NETHERLANDS

Special animal deposits were found in various settlements in the Netherlands, both in the southern half that was part of the Roman Empire, and in the northern half. For the Eastern Dutch River Area, special animal deposits of different types have been reported: mostly complete animal burials, but also articulated limbs and a bone concentration that is seen as the remains of a ritual meal.

At the villa-like settlement in Druten, four pits containing complete or partial horse skeletons were found. These horses were interpreted as foundation deposits. Two pits were located next to the entrance of a house. In another house, one pit was located just inside, and the other just outside of the house. The pits are dated to the end of the 1st century AD.[192] Each pit contained remains of a separate individual, but only one of the horse skeletons was complete. One skeleton was missing all lower limbs, another was missing both forelegs and the left lower hind limb, and of the last skeleton, only the back half was present (with the left hind lower limb missing). These parts may have been intentionally removed, but could also have been lost due to bad preservation. Lauwerier mentioned bone-working as an explanation for the removal of especially the lower limbs.[193] All four horses were adult, although one was not much older than 3.5 years. Three of the horses were quite large (144-152 cm), with one smaller individual (128-144 cm).[194]

At Houten-Tiellandt, remains were found of a horse that had clearly been butchered. Cut and chop marks were found on all bones. The horse was a five-year old mare, with a withers height of 139-142 cm.[195] Horse bones found in other features showed no evidence that horse was eaten in this settlement.

192 Lauwerier 1988, 104-105.

193 Lauwerier 1988, 107.

194 Lauwerier 1988, 110-111.

195 Laarman 1996, 349.

If the horse was killed and butchered for normal consumption, the remains would have been scattered around the settlement as the animal was divided into portions. Laarman believed the horse died a natural death after which its flesh was stripped off to feed to dogs.[196] However, Lauwerier noted the absence of gnawing marks and the abundance of butchery marks, both of which do not agree with the dog food theory.[197] He suggested that the remains reflect an occasion at which a horse was butchered and eaten. The absence of evidence for horse consumption in Houten-Tiellandt, added to the fact that the horse remains were all buried together, points to a ritual meal.

In a rural settlement in Beuningen, a burial of a complete horse was found. The horse is a 7-year-old male, with a withers height of 150 cm. Remarkably, the horse was buried with its head gear but without a bit. An offering to the gods from a grateful veteran soldier is mentioned as a possible explanation.[198] A dog burial, with the head missing, was found in the same site. In a rural settlement in Oosterhout, not far from modern Nijmegen, a pit was found containing a horse that was chopped in pieces. The find of a complete, closed brooch among the bones could indicate that the horse parts were wrapped in cloth before burial.[199] Burials of complete horses and dogs were also found in the Roman settlements in the area.

Several special animal deposits were found during the excavation of a settlement not far from Tiel-Passewaaij, Tiel-Bedrijvenpark (Medel site 6).[200] This settlement was excavated by the same team of archaeologists that excavated Passewaaijse Hogeweg. Because of their experience in Tiel-Passewaaij, the archaeologists were very alert to any animal deposits that seemed strange or special in some way. Two of the special deposits found in Medel contained dog burials: one small and one medium-sized adult individual. One of these dogs had been buried in a pit next to the ditch around a house dating to the first quarter of the 1st century AD. The other two special deposits both consisted of horse bones. The first deposit consisted of a complete skull and scapula from an adult female horse. Part of the mandible was also present. In the second horse deposit, a complete skull and two lower legs from a young horse (15 to 18 months) were found (fig. 3.28). The lower limbs were both from the left side, one from the front and one from the back leg. Cut marks on the bones showed that the skin was removed. The bones were found in anatomical position and were very well preserved. They were obviously buried in a fresh state. This deposit could be dated between AD 70 and 130. Recent large-scale excavations in Geldermalsen-Hondsgemet have also revealed a number of special animal deposits, but these are still being analysed.[201]

Special animal deposits are not restricted to the Eastern Dutch River Area. The redevelopment of the landscape of Midden-Delfland, Zuid-Holland, has resulted in many large-scale excavations, some of which covered settlements from the Roman period. Special animal deposits seem to have been common in this area. At site 1.23, a dog and a pot were found in a ditch. At site 19.07, the skull and front legs of a dog were found together with a pot buried in a pit. It is interesting to see that the association between dogs and pottery found in Passewaaijse Hogeweg also occurs in Midden-Delfland. At site 20.11, several pits with special deposits were excavated close together. They included the legs of a foal with a terracotta 'axe', a headless stork, and a pig skull.[202] At site 21.23, three possible special deposits were found. The first consisted of a front and hind leg of a horse. The problem with this deposit is that the bones were not articulated and more than half had butchery marks. The bones had also been gnawed by dogs. A pit contained eight cattle molars but no other bone fragments. The molars were the first and second molar from the upper and lower jaw, from both the left and right side. The burial seems to have been deliberate. The last find was a pot filled with goose bones. The bones came from at least three individuals. The fleshless parts of the body are missing. The pot was deposited in a wet zone close to a house. Two wooden

[196] Laarman 1996, 355-356.

[197] Lauwerier 1999, 109-110; Lauwerier 2002, 69-70; Lauwerier 2004, 71.

[198] Van der Kamp/Polak 2001, 23, 25.

[199] Van den Broeke 2002, 16; Van den Broeke 2004, 8.

[200] Groot 2005, 63-64.

[201] Groot in prep. b.

[202] Pers. comm. Heleen van Londen.

walking sticks and a wooden shoe were found nearby. Although certainly special, it is unclear whether this find should be seen as a ritual deposit or not.[203] At site 5.01/02, a skeleton of a calf of about ten months old was found.[204] No cut marks were found on the bones. It seems that the calf was buried in the settlement. The skull of the calf was destroyed during excavation. The presence of small skull fragments and a loose tooth demonstrated that the skull had originally been present. What is interesting is that during analysis the right lower forelimb was found to be missing. Because the calf was lying on its right side, it is unlikely that this part of the limb was accidentally removed during excavation. The report mentioned the care with which the calf was excavated and its bones collected. It seems unlikely that a complete lower limb would have been overlooked. We must consider the possibility that the right lower forelimb was intentionally removed by the people burying the calf. About 100 metres from the buried calf, three more cattle burials were excavated. These burials seem to have been located at the edge of a settlement.

During recent excavations in Naaldwijk, Zuid-Holland, four special animal deposits were found. Two are burials of nearly complete horses. In one, the lower legs of the 12-month-old horse are missing. The second horse, an adult female, was probably buried complete. The third special deposit consisted of articulated parts of two horses, and the fourth was a partial dog skeleton found in a well.[205] At the rural settlement Rijswijk-De Bult, two front legs of a horse were found together.[206] On the other side of the Netherlands, in Maastricht, a quail was found covered with a samian plate at the bottom of a sunken hut.[207]

North of the border of the Roman Empire, special animal deposits also occurred. At a Roman site in Heeten, some of the animal remains discovered indicate ritual practices.[208] Heeten is situated in the province of Overijssel, outside the border of the Roman Empire. Large amounts of iron slag were found in this settlement, indicating iron production. The site dates to the late 2nd to the 4th century, but most of the finds date to the first half of the 4th century. Four large bone dumps contained most of the animal bones in Heeten. The two largest dumps were found in the same well and seem to originate from a single event.[209] One of the dumps from the well contained bones from at least nine cattle and four pigs. Marrow was not extracted from the bones, suggesting that food was plentiful. There were also indications that not all the meat was taken off the bones. It appears that a large number of animals were slaughtered at the same time. After the meat was eaten, the bones were collected and thrown into the well. Such a large amount of meat could never have been consumed by the inhabitants of the site within a short period. The meat would have spoiled after a few days. A large number of people must have taken part in this event. Some of the meat was probably taken elsewhere. The species ratio for the dumps is very similar to that of the normal refuse. Feasting is mentioned as a possible interpretation.[210]

Eleven certain animal burials were recognised during the excavation at Heeten: one red deer, four horses and five cattle. One of the cattle burials also contained a horse skull. Preservation of the bones was poor. Pits with the same size and shape as the animal graves were examined and interpreted as probable or possible animal burials. Of the ten probable burial pits, nine contained cattle bones and one horse bones. Several complete heads were found, mostly of cattle, and in two cases associated with four lower legs.[211]

The orientation of the burials is not random; it is related to buildings or the enclosure around the settlement. The burial pits in Heeten were found to occur throughout time and space and contained single animals. The red deer provided evidence that the burials were linked to ritual practices. Where the age could be established, no pattern was found. Both young and adult animals were found. The shallowness of the pits is remarkable: the graves were probably visible above the surface. Both small indigenous

203 Groot 1998, 59-61.

204 Van Wijngaarden-Bakker 1996, 20, 23.

205 Groot in prep. a.

206 Clason 1978, 426.

207 Lauwerier 2004, 69; Dijkman 1991, 31.

208 Lauwerier *et al.* 1999, 155.

209 Lauwerier *et al.* 1999, 156-159.

210 Lauwerier *et al.* 1999, 170, 176-178.

211 Lauwerier *et al.* 1999, 178-180.

and large Roman cattle were buried. The animal burials were interpreted as ritual depositions.[212] The burials seem to mark the entrance and demarcate the site. The horse and cattle burials were all found inside the enclosure, whereas the red deer was buried outside the enclosed area. In other words, the domestic animals were found inside the settlement, whereas the wild animal was buried outside the boundaries of the settlement. The burials were probably connected to the demarcation of the site or represent building sacrifices. Finds of horse and cattle skulls were not seen as ritual, because they were found among refuse.[213]

Another site in the Netherlands from the Roman period where horse and cattle burials were found is Wijster, Drenthe.[214] One large pit contained several animals, probably six. Unfortunately, bone preservation was so bad that in most cases only a silhouette of an animal could be seen. The burials can all be linked to houses and granaries. Two remarkable deposits were found at a site in Englum, Groningen. The head and feet from a dog were found inside a pot. It is possible that the head and feet were originally part of a dog skin. Not far from this deposit, a large, complete cod was found on top of a concentration of pottery sherds. Both deposits can be dated to the 1st century AD.[215]

In Castricum-Oosterbuurt, Noord-Holland, a number of special deposits dating to the Roman period were found, not just of complete animals, but also two of horse skulls. One of the skulls showed evidence of being displayed. It was later buried in a boundary ditch, not far from a human skeleton.[216] Three animal burials, of a foal, cow and dog, were recognised during excavation, but several partial burials were observed during the analysis of the animal bones.[217] Several associations of bones probably represent complete burials of dogs and cattle. Other special deposits consisted of lower limbs: twice a single lower hind leg of horse, in one case three lower legs and some other horse bones, and in another deposit lower legs and tails from two horses. A large pit contained two separate concentrations of cattle lower legs. In Velsen-Hoogovens, two partial skeletons of horses were found in a pit. In the settlement Schagen-Lagedijk, several special animal deposits were found. In three cases, these contained the lower legs of horses. Three nearly complete skeletons of piglets were found together in a pit, and three partial skeletons of dogs in another pit.[218]

A recent publication focused on ritual activities in five settlements in the province of Noord-Holland during the Late Iron Age and Roman period, including Schagen-Muggenburg and Uitgeesterbroek.[219] These ritual activities consisted of digging pits and depositing artefacts and organic material including animal bones in the pits before filling them again. Due to the exceptional preservation of the sites, organic materials such as wood and cereals were also found in these pits.[220] Deposits with animal bone varied from complete animal burials to articulated legs and complete skulls.[221] Some of the deposits showed evidence for deposition of single bones. Bones from the feet were believed to be especially meaningful.[222] The manipulation of bones and intentional removal of bones or complete limbs was observed in several deposits.[223] Individual deposits could be connected to a specific season. Deposits were made at certain times in winter, spring and autumn.[224] The deposits were believed to be part of larger patterns in the settlement representing constellations.[225]

212 Lauwerier *et al.* 1999, 180, 185.

213 Lauwerier *et al.* 1999, 186.

214 Van Es 1967, 114-117, 371, 374, 376.

215 Hoekstra 2006, 32, 36.

216 Hagers 1999a, 90.

217 Hagers 1999b, 90-91; Lauwerier/Laarman 1999, 130, 136-137.

218 Van Wijngaarden-Bakker 1988, 170-171.

219 Therkorn 2004.

220 Therkorn 2004, 33, 37.

221 Therkorn 2004, 24, 35.

222 Therkorn 2004, 55, 62.

223 Therkorn 2004, 24, 123-125, 128.

224 Therkorn 2004, 32-33.

225 Therkorn 2004, 41, 177.

Special animal deposits have been found in settlements dating to the Roman period throughout the Netherlands. The most commonly reported special animal deposits are complete or nearly complete skeletons, articulated limbs or skulls. Large bone concentrations, representing the remains from feasts or ritual meals, are less common. Many of the animal burials were found associated with houses or enclosure ditches. The deposits associated with houses probably functioned as foundation offerings, whereas those associated with enclosure ditches marked boundaries.

All species of animal can be found in special deposits, but domestic animals are most common. Horse, cattle and dog seem to be the most commonly used species, while sheep or goat and pig are not used very often in special deposits. Wild birds are occasionally found in special animal deposits, for example a stork in Midden-Delfland and a quail in Maastricht. Although all categories of special animal deposit from Passewaaijse Hogeweg have been encountered elsewhere, the number of finds from this one rural settlement is significant.

Some parallels for specific patterns found in the special deposits from Passewaaijse Hogeweg are found elsewhere. The association of dog burials with pottery, for instance, was also found in Midden-Delfland and Englum, although in the latter case it was not a complete dog but just the head and feet, possibly representing a skin. The association of horse bones and bronze brooches was found in Passewaaijse Hogeweg in a complete horse burial, and in Oosterhout in a deposit of parts of a horse. The removal of body parts in animal burials was found in several cases. Animals with missing legs were found in Midden-Delfland and Uitgeesterbroek. Although the complete animal burials in Passewaaijse Hogeweg mostly seem to have been complete, missing legs were found in articulated bone deposits of cattle, horse and sheep. Three deposits of lower legs contained not four but three lower legs. A similar deposit was found in Schagen-Muggenburg II, consisting of the head and three lower legs of a large cow.[226] Some skeletons showed evidence for the manipulation of body parts. Unambiguous evidence for this phenomenon was found only once in Passewaaijse Hogeweg, in Special Deposit 36, where the head of a sheep was removed and replaced by a calf skull.

One problem in identifying regional or even wider patterns is that special animal deposits are relatively rare. Complete animals are easily recognised, but even then it is often unclear whether bones are missing due to post-depositional processes, excavation methods, or intentional removal at the time of burial. The sites excavated and published by Therkorn are exceptional in the detail and care with which they were excavated.[227] Special animal deposits of articulated bones or skulls are often not recognised during excavation, as was the case in Castricum-Oosterbuurt. As more archaeologists become aware of the existence of special animal deposits and know what to look out for, the number of deposits reported will probably rise.

3.6 DISCUSSION

3.6.1 RESEARCH QUESTIONS

The first question we need to answer is whether the special animal deposits from Passewaaijse Hogeweg could be interpreted as ritual deposits. There are several strong arguments for interpreting a number of the special deposits in Tiel-Passewaaij as ritual deposits. First, there is the combination of more than one animal in some deposits. It is unlikely that two animals would die naturally at the same time. It seems

[226] Therkorn 2004, 51.

[227] Therkorn 2004.

more likely that one or both were deliberately killed and buried. The inclusion of wild species in deposits also forms an argument against the deposits consisting of refuse or dumps of carcasses. Second, in several deposits, animal bones were associated with non-bone, 'special' finds such as an iron knife or large pottery sherds. Next, many of the deposits have clearly been arranged instead of disposed of haphazardly. Furthermore, there is evidence of manipulation of body parts in some of the deposits. Finally, the location of the deposits in phases 2, 5-6 and 7 is meaningful: close to farmhouses or in farmyard boundaries.

The second question is concerned with the choice of species for ritual deposits. The species occurring in the ritual deposits demonstrate clear preferences. Most of the ritual deposits contained domestic animals, although wild animals were found in a few cases. Pig was not found in ritual deposits. Horse was found in all types of deposit, but mainly in skull and articulated bone deposits. Dogs were found as complete burials, either by themselves or accompanied by another find in a combination deposit. Cattle and sheep were found in all types of deposit in equal numbers.

The preference for certain species for certain types of deposit is a first pattern that could be identified. Other recurring patterns are the association of dogs with pottery, horses with metal finds, and missing legs in articulated bone deposits. The location where ritual deposits were made also shows a pattern.

In all cases except one, no evidence was found to establish cause of death. The horse skull in Special Deposit 25 had clearly received a blow. For the other deposits, all that is certain is that the wild animals occurring in ritual deposits were deliberately killed. In deposits containing remains from more than one animal, it is likely that at least one was deliberately killed. Some or all of the burials of domestic animals may have been animals that died a natural death. However, their burial could still have been surrounded by ritual. For an agrarian community, the unexplained and rapid death of an animal through infectious disease must have been a threat to their livelihood. The mysterious circumstances in which an animal died may have set it apart and demanded special treatment. Such an animal may have been given a ritual burial in an attempt to prevent other animals from dying as well. At a time when disease processes were not understood, a divine influence may have been invoked. These animals may have been seen as being chosen by the gods and therefore not suitable as food. Natural death cannot be rejected, although it is very unlikely in some cases. However, whether an animal died naturally or was killed intentionally does not affect the nature of these ritual practices.

The meat from some of the animals in ritual deposits was certainly consumed. In skull deposits of species considered fit for consumption, the rest of the carcass is likely to have been butchered and eaten. Since most articulated limb deposits consist of meatless lower legs, this would have left the meaty parts of the body for consumption. Butchery marks indicate that the meat from horses in three bone concentrations from phases 4, 5-6 and 7 was consumed. Part of the red deer in a combination deposit was probably eaten, while the rest of the animal was buried. Only burials of complete animals can be seen as a loss of meat to the community. Since most of the complete animals are dogs, and there are no indications that dog meat was eaten, the impact on the economy would have been negligible.

Ritual animal deposits occurred throughout the Roman period. Their absence in the Iron Age phase is almost certainly a result of the limited number of features excavated for this period. When compared with the total number of identified fragments per phase, ritual animal deposits are most common in phases 4 and 5-6. The small number of ritual deposits per phase makes it difficult to establish fluctuations in numbers of deposit type through time, but it was possible to establish that complete animal burials were relatively common in phases 4 and 5-6, and skulls in phase 7. The choice of species seems to be associated with the period. Ritual deposits from phase 3 show a preference for sheep, phases 4 and 5-6 for dog, and phase 7 for horse. The location for ritual deposits is also related to the time period.

For many of the ritual deposits, their location within the settlement is significant. In phases 2, 5-6 and 7, deposits were found in or close to farmhouses or farmyard boundaries. Several deposits were found in the large enclosure ditch surrounding a Late Roman section of the settlement. The location of ritual deposits may have been closely related to their meaning.

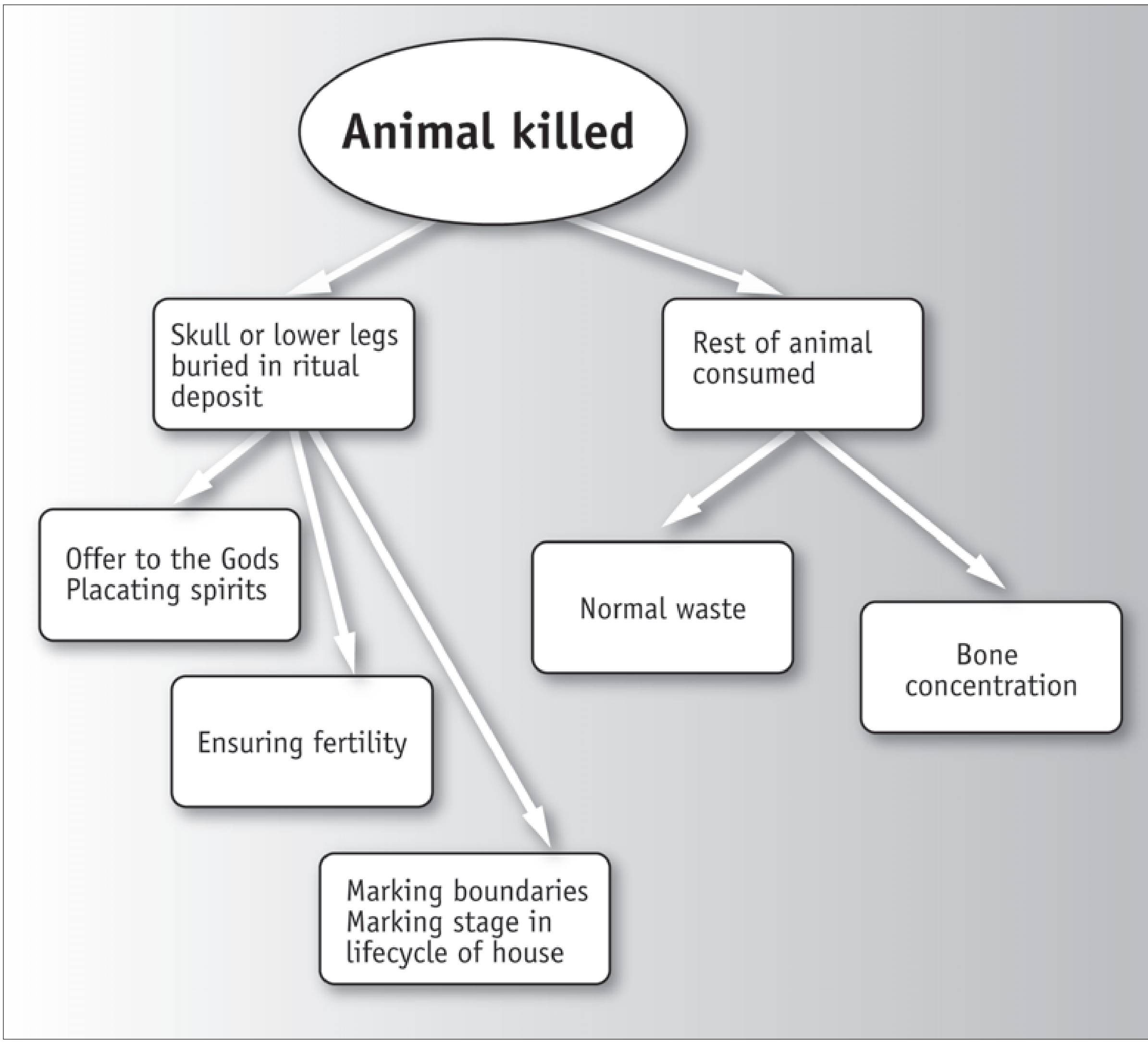

Fig. 3.29. Possible scenarios of the disposal of an animal.

The penultimate question is concerned with the function of ritual deposits. Ritual deposits found in house ditches were probably foundation offerings. One ritual deposit, Special Deposit 50, is more likely to have been an abandonment offering. A large amount of pottery was found near the articulated sheep bones. This kind of refuse has been linked with abandonment rituals.[228] Ritual deposits in farmyard boundary ditches may have served to mark or affirm boundaries.

Finally, can we say anything about the people involved in the ritual animal deposits from Passewaaijse Hogeweg? The scale of the settlement leads us to suppose that there were no ritual specialists in Passewaaijse Hogeweg. The rituals resulting in ritual animal deposits were performed by local people. The rituals may have involved the members of one household, or the entire community.

[228] Gerritsen 2003, 97.

So what are the rituals that resulted in these special deposits? Several different ritual practices may have been involved, with clear differences to the participants. They may have taken place at different times of the year, involving different animals and a different treatment of the remains. However, we can note some general similarities between the rituals:

- They were domestic rituals that involved a small audience.
- They were probably related to households, instead of involving the whole community.
- Some rituals were associated with building or abandoning a house.
- Some rituals were associated with marking boundaries.
- Wild species played an important role in some of the rituals.

Bone concentrations are different in that unlike the other types of ritual deposit, they do seem to involve a large number of people. Bone concentrations will be discussed in the next paragraph.

In Tiel-Passewaaij, no association was found between special animal deposits and human bones. Indeed, the number of human bones found in the settlements is extremely small. In the settlement Passewaaijse Hogeweg, no human bones were found at all, whereas five human bones were found in the settlement Oude Tielseweg. Whatever the rituals were, they clearly did not involve human bones.

We can imagine a scenario for the way in which the ritual deposits took place. Figure 3.29 presents a model that illustrates this scenario. When the need for a ritual arose an animal was killed. Part of the animal, such as the skull or the lower legs, was buried as a gift to the gods as part of a ritual in which the gods were beseeched for certain favours. The skull could have represented the whole animal; alternatively, burying only the skull could be an economic decision.[229] The rest of the animal was taken away by its owner to be consumed. In the case of a large animal, the amount of meat would have been too much for one household, and the owner would have distributed much of the meat. In doing this, as well as in providing the sacrificial animal in the first place, he or she had a chance of gaining prestige and tightening social bonds. Who would and who would not receive meat would be an important social statement. By distributing the sacrificial animal, its bones would have been dispersed and ended up among everyday consumption refuse.

The cost of the offering may have been related to the severity of the situation and the size of the favour asked. Cost could be reflected in the size, age, economic value and health of the animal. An unneeded dog or aged horse could have been spared more easily than a fertile cow. Special deposits consisting of a complete animal or two individuals may have been made in times of crisis. The burial of a complete animal from a species that was normally eaten represents a loss of meat to the owner and his household. When the need was felt to either placate the gods or beseech them for a major request, burying a complete animal and foregoing a large amount of meat may have been appropriate. Although the rituals that took place within the settlement could have been religious, this is not necessarily the case. Offering in the ground was perhaps believed to increase or maintain fertility without intervention from superhuman entities.

We know from ethnographic studies that the human lifecycle is marked by rites of passage accompanying or allowing major transitions from one phase of life to the next. It does not seem far-fetched to imagine similar rites of passage connected to the lifecycle of a house or farmyard. In fact, rites of passage for farmhouses have been described by Gerritsen.[230] Just as the rites of passage in a human life, the rites of passage in the life of a building could have been marked by rituals. These rituals involved depositing pottery or animal bones in some of the farmhouse features. Derks described the important emotional

229 Grant 1984a, 543.

230 Gerritsen 2003, 38-39, 63-65, 79-84, 97-102.

bond between man and livestock in the Lower Rhine Area.[231] Rooted in the economic value of animals, this bond was strengthened by the stabling of animals under the same roof as humans. It is not surprising, therefore, that animals played an important role in settlements rituals.

3.6.3 FEASTING: RITUAL MEALS

The concentrations of disarticulated bones found in Passewaaijse Hogeweg result from the slaughter of several animals at one point in time. It is possible that bone concentrations represent the remains of ritual meals. Similar bone concentrations have been found at other settlements, such as Oude Tielseweg and Heeten. In all cases, they are characterised by the slaughter of a large number of animals at once, providing an enormous amount of meat, much more than could be consumed by the people in the settlement. It seems as if a large gathering of people was involved, perhaps consisting of relatives from other settlements, in order to celebrate a feast or discuss important subjects. Three of the bone concentrations contained horse bones with butchery marks that imply that horse meat was consumed. The evidence among the normal bone refuse for eating horse meat is inconclusive for Passewaaijse Hogeweg. Perhaps horse meat was eaten only on ritual occasions, strengthening the relationship between man and horse. A deposit of horse remains from Houten-Tiellandt seems to point to a ritual meal involving horse meat.[232]

3.6.4 FURTHER RESEARCH

The ritual animal deposits from Passewaaijse Hogeweg do not exist in isolation. Similar deposits must have occurred in the same numbers in other rural settlements. Excavations in Midden-Delfland and Noord-Holland have demonstrated that ritual animal deposits were also common in this area during the Roman period. Evidence from other areas in the Netherlands is fragmentary, but finds from several settlements demonstrate that animal deposits do occur. In the Eastern Dutch River Area, complete animal burials were reported for several sites. Other deposit types such as articulated bones and bone concentrations have rarely been reported. Hill suggested that many complete skulls may have been fragmented due to the weight of overlying fills, and as a result are not recognised by archaeologists. Skull deposits may therefore be seriously underrepresented.[233] Of course, the other problem with skulls is that they are all too often interpreted as primary butchery refuse rather than as ritual deposits.

What is needed is structural research into ritual animal deposits within settlements. In order to recognise these deposits, it is necessary that archaeologists know what they are looking for. All information on possible ritual deposits should be recorded, and photographs or detailed drawings made. Furthermore, the expertise of a zooarchaeologist should be sought in doubtful cases. Merrifield already emphasised the importance of recognising ritual deposits during excavation, when the manner of deposition can still be studied.[234] This is the only way in which a comprehensive picture of ritual animal deposits in the Netherlands can be reached.

Once ritual animal deposits have been recognised and carefully excavated, it is important that they are analysed and studied not by themselves, but in combination with ritual deposits of other find categories. The distinction between ritual deposits with animal bones and ritual deposits with pottery is a modern one, dictated by the pragmatic fact that these find categories are studied by different people. To the people who were responsible for the ritual deposits in Passewaaijse Hogeweg, this distinction may have been irrelevant. Even ritual animal deposits sometimes contain other finds, and they should be included in the

[231] Derks 1998, 65-66.

[232] Lauwerier 1999, 109-110.

[233] Hill 1995, 50.

[234] Merrifield 1987, 2-3.

analysis. Unfortunately, time constraints and the absence of any kind of systematic study of the pottery, metal and other finds made it unrealistic to include other find categories in the present study. Also, a statistical analysis of the ritual deposits from Passewaaijse Hogeweg has not been performed. Finally, ritual deposits of any kind of material should be widely published, and not just in obscure site reports, which are often unavailable to a wider public.

Hill's study of structured deposition in the British Iron Age has raised awareness of the ubiquity of ritual activities in this period, as well as the possibility that 'rubbish' was used for ritual deposition. In Roman Tiel-Passewaaij, ritual deposits of skulls, by themselves or in combination with lower limbs, demonstrate that conventionally interpreted "slaughter waste" was used for deposition. Furthermore, the fact that large sherds of pottery have been found associated with complete skeletons in at least two cases is a reminder that not all broken pottery is necessarily rubbish.

2. Animals and the economy of a rural community

2.1 INTRODUCTION

In archaeological literature, much emphasis has been placed on the martial aspects of Batavian communities.[1] However, a typical Batavian settlement was basically a farming community. In a small rural community such as Tiel-Passewaaij, farming was the economic base. The year was punctuated by the different tasks that had to be performed at the right time. For animal husbandry, these tasks included controlling the mating of animals, tending to animals during the birthing season, winter feeding, shearing of sheep, milking, moving animals between different grazing grounds, and training animals to perform various tasks. For agriculture, the most important tasks were ploughing, sowing, growing and collecting animal fodder, harvesting and processing grain.

In the byre houses of Tiel-Passewaaij, man and animal lived under the same roof. This reflects not just practical concerns but ideological ones as well.[2] During the times when animals were housed in the byres, man's living space must have been filled with the smell of the animals, and the animals' sounds accompanied indoor life. Farming and farm animals dominated life not just in practical ways, but ideologically as well. The dependence on farm animals must have been reflected in symbology. In the next chapter we will see that domestic animals played an important part in local rituals. This chapter will be concerned with the role of animals in the local economy. It is difficult to determine the relative importance of livestock and arable agriculture on the basis of archaeological sources. What is important to keep in mind is that they interacted closely and in a mixed farming regime supported each other. While domestic animals provided traction for ploughing and manure that could be used to fertilise the fields, arable agriculture provided food for livestock. Furthermore, fields were seldom used exclusively to grow arable crops, but were used for grazing as well, both after the crops had been harvested and in fallow years.[3]

When Tiel-Passewaaij is placed within a wider geographical context, the proximity of the Roman frontier along the river Rhine is the most striking aspect (fig. 1.1). The only town in the area of any significance is Nijmegen. The military forts, urban Nijmegen and the major rural temple sites all depended on the surrounding area for food. This food was almost certainly produced locally, in rural settlements such as those in Tiel-Passewaaij. It is not just the location of Tiel that this idea is based on, but also the presence of mass-produced imported materials such as pottery, coins and all kinds of metal objects in rural settlements.[4] Although perhaps they should not be considered as 'luxury items', these goods were imported into the settlement. This means that the inhabitants must have had some means of acquiring them. The presence of imported goods points to exchange networks and a market system. Their presence also proves that Tiel-Passewaaij was not just a subsistence ecomony, but that the inhabitants produced a surplus to sell at market. This surplus could consist of arable products or products from livestock, including dairy products, hides, horn, living animals and meat.

An important consequence of a market system for our reconstruction of the local economy is that a large part of our evidence is missing. The most practical way of transporting meat is on the hoof. This

1 Roymans 1996, 13-41; Roymans 2004, 7, 221-229, 242-249, 255-258; Nicolay 2007.

2 Roymans 1996, 54.

3 Fowler 2002, 131, 206, 226.

4 Heeren 2006, 103, 167; Van Kerckhove 2006, 137-8; Van Lith 2007; Verhelst 2006.

means that the remains of the animals that were produced as a surplus for meat are not found in the settlement where they were raised, but in the location where they were consumed, i.e. towns, forts or rural temples. If we only base our reconstruction of the livestock economy in Tiel-Passewaaij on the animal bones that were actually found there, we overlook what is arguably the most important part of the herd: the animals that were sold as a surplus. This problem has so far been underestimated or overlooked altogether in zooarchaeological studies in the Netherlands. Animals that produce dairy products which were sold as a surplus are found where they were raised, but it remains to be seen whether dairy was an important surplus product during the Roman period. Occasionally, livestock may have been brought in to add new breeding stock to ensure the population stayed healthy. This small-scale acquisition of animals would have been overshadowed by the number of animals that were sold as surplus.

Another complicating factor is that a small rural settlement such as Passewaaijse Hogeweg or Oude Tielseweg would not only produce for a market, but also had to grow and raise its own food. This means that the animal bones we find may represent both local consumption and small-scale production. Distinguishing between the two categories is difficult; indeed, they will overlap to a large extent. However, we must attempt to determine to what extent these two settlements produced specifically for a market. It is vital that we learn to understand the way in which the market systems in the Roman Netherlands functioned, and the analysis of animal bones is one way of approaching this problem.

In this chapter, I will first describe the animal bone assemblages from Tiel-Passewaaij, some of the problems associated with them, and the research questions that I will try to answer. Next, the results from the two settlements will be discussed for each phase separately, with some conclusions on livestock management. As these paragraphs will mainly be concerned with the main "economic" species cattle, sheep/goat, pig and horse, a separate paragraph will discuss the contributions of dog, chicken and wild animals to the economy. In 2.4, I will discuss livestock management and specialised production during the Roman period for the settlement Passewaaijse Hogeweg. The final paragraph will consider the interaction of Tiel-Passewaaij with urban and military markets.

The emphasis in this chapter will be on Passewaaijse Hogeweg. Passewaaijse Hogeweg has a longer chronology, without the third century hiatus of Oude Tielseweg. Furthermore, the number of animal bones for Passewaaijse Hogeweg is higher. The quality of the data collected is also better than that for Oude Tielseweg. Data from Oude Tielseweg will be used to point out similarities and differences between the two settlements.

2.1.1 THE ANIMAL BONES

Table 2.1 lists the total number of bone fragments available for each phase as well as the number of identified fragments. Obviously, higher numbers of identified fragments will lead to more solid conclusions. In Passewaaijse Hogeweg, phases 2, 3 and 7 are represented by over a thousand to almost two thousand identified fragments. Phase 1 is the only phase with less than 500 fragments, while phases 4 and 5-6 both contain 500-1000 fragments. For Oude Tielseweg, the numbers are slightly lower. Only two phases are represented by over a 1000 fragments: phases 2 and 7. Between 500 and 1000 fragments were recovered for phase 4, while the numbers of fragments for phases 1 and 3 are less than 500.

Fragmentation

The fragmentation of bones occurs as a result of several processes. First, during the butchery of a carcass bones are often chopped into pieces, especially in large animals such as cattle. A second cause of fragmentation is trampling by man or animal. This happens when bones are left on the ground surface. Finally, bones left unburied are vulnerable to weathering. Bones that are buried in a fresh state will suffer less from weathering and not at all from trampling.

Phase		TNF	NIF	%
PHW	1	729	312	42.8
PHW	2	4869	1762	36.2
PHW	3	3160	1096	34.7
PHW	4	2036	719	35.3
PHW	5-6	1699	604	35.6
PHW	7	4439	1861	41.9
Total		**16932**	**6354**	**37.5**
OTW	1	933	271	29.0
OTW	2	4075	1053	25.8
OTW	3	984	285	29.0
OTW	4	2148	579	27.0
OTW	7	3273	1474	45.0
Total		**11414**	**3663**	**32.1**

Table 2.1. Numbers of animal bones per phase for the settlements Passewaaijse Hogeweg (PHW) and Oude Tielseweg (OTW). TNF=Total number of fragments per phase, NIF=Number of identified fragments per phase, %=% of identified fragments.

Phase	<25 %	25 %	50 %	75 %	100 %	% loose teeth
PHW 1	23.1	20.5	12.7	16.9	26.7	17.3
PHW 2	22.9	23.3	14.2	14.4	25.2	19.8
PHW 3	19.8	16.9	10.1	13.6	39.7	25.1
PHW 4	22.7	16.4	13.7	15.9	31.3	28.9
PHW 5-6	18.6	20.2	13.7	15.9	33.2	16.3
PHW 7	22.7	17.9	13.6	17.3	28.4	16.2
OTW 1	31.6	23.0	12.6	12.3	20.4	25.7
OTW 2	32.7	19.4	9.7	23.3	15.0	38.3
OTW 3	33.7	15.8	14.0	20.4	16.1	43.0
OTW 4	30.5	13.9	13.8	20.6	21.2	36.1
OTW 7	23.9	25.4	9.0	13.4	28.4	29.1[5]

Table 2.2. Fragmentation of identified bones (cattle, sheep/goat, pig and horse) and the percentage of loose teeth. <25 % means that less than 25 % of the complete bone is present; 25 %: around a quarter of the bone is present; etc.

Fragmentation is closely related to the preservation of animal bones. Most complete bones were found in deeper features. Preservation seems to have been slightly better in Passewaaijse Hogeweg than in Oude Tielseweg. More fragments are found in the less fragmented categories (table 2.2). However, this could be related to a different butchery system, or a different way of disposing of animal bone waste.

5 The percentage of loose teeth has only been calculated for part of the material from phase 7 in Oude Tielseweg. Most of the bones dating to this phase were identified by another zooarchaeologist, using a fragmentation system that is incompatible with the one used here.

The percentage of loose teeth is a more useful indication of both the degree of fragmentation and the care with which animal bones were collected by archaeologists. The percentage of loose teeth is higher in the assemblage from Oude Tielseweg than in that from Passewaaijse Hogeweg.

Special deposits and associated elements

Complete skeletons, partial skeletons and bone concentrations were found in both settlements. Counting all identified bones from a complete skeleton would result in an overrepresentation of this species. Not counting skeletons at all would ignore the presence of the animal altogether. In most cases, a skeleton or group of bones from one individual was counted as a single bone, and is represented in the tables in this study as one fragment. Animals that were buried complete have not been used for food. In the case of the special deposit category of "bone concentration" (see chapter 3) all bones were counted, because it is suspected that the meat from these animals was consumed. All the individual bones from bone concentrations are represented in the tables in this study. Furthermore, bone concentrations typically consisted of unassociated or partially associated bones from more than one individual. Finally, the bone concentrations consisted mostly of cattle and horse bones, the dominant animals in the period to which the bone concentrations are dated. Therefore, counting all bones did not result in overrepresentation of minor species, which would be the case if all bones from, for example, dog skeletons had been counted separately.

2.1.2 RESEARCH QUESTIONS

This chapter will address several research questions. First, we want to know on what the economy of the settlements in Tiel-Passewaaij is based. This means finding out what the inhabitants ate, and on what their livelihood depended. A second important question is whether the presence of the Roman army and the development of the Batavian capital in Nijmegen resulted in changes in the rural economy of settlements such as Passewaaijse Hogeweg. Can we find evidence for the production of a surplus, either for payment of taxes or for a market? A question that is closely related to this is whether specialisation in livestock management occurred. The settlements may have aimed to raise certain species or age categories, or produced certain animal products. A third question is whether the two settlements developed in the same way. Passewaaijse Hogeweg and Oude Tielseweg are different in size. There may also have been differences in the local economies of the two settlements. Next, we want to find out how livestock was managed. Were the animals kept in or close to the settlement throughout the year, or were they grazing further away from the settlement? This would have implications for the amount of fodder needed, as animals kept in the settlement would need feeding. A question closely related to this one is how the landscape was utilised. Finally, the detailed chronology of the settlements will allow us to look for changes through time.

2.2 DOMESTIC MAMMALS: CATTLE, SHEEP/GOAT, PIG AND HORSE

Every study is based on a number of assumptions; this one is no exception. A first basic assumption is that the ratios of animal bones found reflect the ratios of livestock present in the settlements in the past. Already, we have seen that an important part of our data is missing, because it was traded as surplus. There can be several reasons for changes in livestock management as we find them in archaeology. Some may have been reactions to changes in landscape or microclimate or other external, non-human factors. Others may reflect a change in ethnic composition of the community, for instance when people migrated and settled in an existing settlement. Changes can also be a reaction to the imposition of taxes by the Roman state. The Iron Age phases in Tiel-Passewaaij will be used as a baseline against which to compare changes in the following period.

Below, the main results will be presented for each phase separately. This will not be done exhaustively. Due to restraints of space, this chapter will focus on those factors that will be of most importance to answer the research questions: changes in species distribution and changes in age distribution. Withers height will be discussed in 2.4.5. Other data from the animal bone analysis will be presented in appendix A. The following paragraphs (2.2.2 to 2.2.7) focus on cattle, sheep/goat, horse and pig because it is believed that these are the species that were most important to the local economy. Other species are present in very small numbers and would not have had a significant influence on the economy. In almost all cases where the species of sheep/goat could be established, the bones are from sheep. [6] Only one fragment was identified as goat, and a second one as possibly goat. Therefore, it is assumed that the majority of sheep/goat bones are from sheep. To improve readability, sheep/goat fragments will be referred to as sheep in the text. The near absence of goat is interesting and a recurring pattern in Roman sites in the Netherlands.[7] The wild ancestors of the domestic goat were adapted to living in rocky, steep and above all, dry terrain. It is possible that in the Roman period, a type of goat suitable for the damp climate of the Netherlands had not yet been developed. Another reason for the small numbers of goat can perhaps be found in the importance of wool. When only a limited number of animals can be kept, preference may have been given to sheep because they were able to provide meat, milk and wool. Before we move on to the results from the animal bone analysis, it is necessary to discuss certain aspects of the interpretation of mortality profiles.

2.2.1 INTERPRETATION OF MORTALITY PROFILES

Although it is relatively straightforward to produce mortality profiles, the interpretation of these profiles is problematic. Payne published models that show the sex and age structure of herds of sheep that are exploited for just one product: milk, wool or meat.[8] In reality, most ancient economies exploited herds for several products simultaneously. Furthermore, efficiency was not always the dominant factor in deciding when to kill animals. Social and ritual practice may have guided slaughter decisions as well. Despite this, the production models are a useful tool to help us in understanding ancient animal husbandry. These models are mainly used for cattle and sheep. Pigs are almost always exploited for meat and fat only, whereas in the case of horses, meat is rarely the main product.

A herd of cattle or sheep that is managed mainly for the production of meat will show slaughter peaks in the age category when the animals reach their "optimum slaughter weight".[9] At this point in their lives, the rapid growth of the juvenile phase slows down and any gain in meat weight will not exceed the cost in fodder. This point occurs at the stage when the animal reaches early adulthood. Both males and females will be raised for meat, but females are more likely to be kept alive for longer, so they can provide new additions to the herd. It has been suggested that a strong representation of adult cows could indicate meat production, as cows are believed to reach their optimum slaughter weight at a younger age than bulls or steers.[10] A sheep herd exploited for wool will be composed of adult animals and show little killing of young animals. Males are present in the same numbers or more as females, because the quality of wool from male sheep is better than that from females. The quality of wool declines with age, so most animals will be killed between 6 to 10 years.[11]

6 72 out of a total of 1619 sheep/goat bones from Passewaaijse Hogeweg are from sheep. For Oude Tielseweg, 16 out of a total of 673 sheep/goat bones were identified as sheep.

7 Lauwerier 1988, 131.

8 Payne 1973, 281-284.

9 Payne 1973, 281, 282 fig.1.

10 McCormick 1992, 204.

11 Payne 1973, 281, 284 fig. 3.

Zooarchaeologists seem to agree on the production models for both meat and wool, but there has been some discussion on the production model for milk. Traditionally, the culling of infant animals was seen as an indicator of milk production.[12] Cows and sheep only produce milk after they have given birth, and in primitive breeds only until the calf or lamb is weaned. Only a small number of the calves or lambs is needed to replace older females, so most of the calves and lambs, and especially the males, are surplus to requirement. Killing young animals also results in a larger supply of milk for people.[13] However, this theory goes against the fact that primitive breeds of cattle and sheep only let down their milk in the presence of their young. Documentary evidence from early Christian Ireland shows both the dominance of dairying and the necessity of the presence of calves for milking.[14]

So how should we interpret the mortality profiles from Tiel-Passewaaij, confronted with these conflicting theories? In the case of dairying, we can expect to find at least some young calves, representing natural mortalities. Because cows need to calf each year to produce milk, relatively more calves will be born than would be the case when all calves were reared for beef. Even when the presence of calves is needed for the cows' milk to be exploited, the milk yield will diminish and finally stop between 6 and 9 months after birth, so that is the age at which we can expect calves to be culled. Dairy may be the primary production aim, but the meat from the calves would still have been consumed. Although McCormick argues that a high incidence of young calves should be seen as proof against milking,[15] I believe that all killing of calves below 12 months old should be interpreted as a probable indication of milk exploitation. This way, we avoid the discussion of whether Roman-period cows needed their calves to be present during milking.

A complicating factor has already been mentioned above. Any study of a settlement trading a surplus of animals must take into account that a major part of the evidence is missing. When mortality profiles are based only on the animal bones found in the settlement, we ignore the animals that were traded as a surplus. However, these are the only data available for which it is certain that they relate to the settlement. Age data from possible consumption sites are useful for a comparison and vital in developing a regional model of production and consumption, but the animals derive from a number of settlements that could theoretically have had different livestock management systems. Because the situation is so complex, it is important to consider the data from Passewaaijse Hogeweg before comparing it to that from possible consumption sites.

An additional source of information is formed by literary evidence. Roman sources describe the use of dairy products. However, it is clear that in the Mediterranean area, it was milk from sheep and goat and not cattle that was made into cheese.[16] Cattle were mainly used as plough animals in Roman Italy.[17] Roman sources mention that people in northwestern Europe, in contrast to the Mediterranean, consumed milk.[18]

2.2.2 Phase I: Later Iron Age (450-175 BC)

Although the focus of this study is limited to the Roman period, it is important to have a basic understanding of animal husbandry in the preceding period in order to understand any changes or continuity in livestock management in the early Roman period. If we want to find out how the arrival of the Romans changed animal husbandry, we need to understand the situation before the Roman period.

12 Legge 1981, 170, 172, 180; Payne 1973, 281, 283 fig.2.

13 Legge 1992, 42.

14 McCormick 1992, 202; Lucas 1989, 4, 25.

15 McCormick 1992, 203.

16 McCormick 1992, 206-207; White 1970, 277.

17 MacKinnon 2004, 90.

18 Legge 1992, 29; Caesar, de Bello Gallico, 4,1; 6,22.

Unfortunately, the number of animal bones from the Iron Age is small for both settlements. Layers dating to the Iron Age have been only partially excavated; no house plans were found dating to this period. Another problem is that the Iron Age habitation in Tiel-Passewaaij is not continuous; there is a hiatus between 175 and 60 BC. Nevertheless, we will take phase 1 as our starting point.

species	fragments	%	weight (g)	%
cattle	153	49.8	5768	67.4
sheep/goat	91	29.6	998	11.7
pig	45	14.7	752	8.8
horse	18	5.9	1041	12.2
subtotal	**307**	**100.0**	**8559**	**100.1**
dog	4		66	
red deer (*Cervus elaphus*)	1		201	
beaver (*Castor fiber*)	1		3	
medium mammal	137		545	
large mammal	199		2571	
mammal indet.	81		124	
total	**730**		**12069**	

Table 2.3. Number, percentage and weight of animal bone fragments. Passewaaijse Hogeweg phase 1 (Iron Age, 450-175 BC).

The number of fragments for this phase is low, only 313 identified fragments for Passewaaijse Hogeweg and 271 for Oude Tielseweg. As a result of this low number, there is very little information available on the slaughter age of animals. This means that it will be hard to draw any conclusions on livestock management, apart from the ratios of animals present. The Middle/Late Iron Age livestock in both settlements was dominated by cattle and sheep/goat, with smaller numbers of pig and horse (tables 2.3 and 2.4). Cattle were the most abundant species in both settlements, followed by sheep (fig. 2.1a and 2.2a). The cattle-sheep ratio is somewhat different between the two sites, with sheep being relatively more numerous in Passewaaijse Hogeweg. The third species is pig in Passewaaijse Hogeweg and horse in Oude Tielseweg. This difference could point to a certain specialisation or division of tasks between the two settlements, assuming there were already close ties between the two communities. Alternatively, the difference could simply be a result of the small sample size. Another explanation is that animal bone ratios vary among different contexts.[19]

Although the data on age for Passewaaijse Hogeweg are limited, it is possible to note some trends.[20] Age data based on tooth eruption and wear show that sheep were mostly killed at a relatively young age, although not in the first six months of life. More than half were killed between 6 and 12 months after birth (fig. 2.3). Very few sheep reached adulthood. In cattle, the preferred age of slaughter seems to have

[19] Maltby 1985, 41-43, 56.

[20] For the methodology used for ageing and the problems associated with it see paragraph 1.6.4.

species	fragments	%	weight (g)	%
cattle	156	58.2	6446	68.6
sheep/goat	54	20.1	488	5.2
pig	24	9.0	406	4.3
horse	34	12.7	2054	21.9
subtotal	**268**	**100.0**	**9394**	**100.0**
dog	3		16	
medium mammal	59		216	
large mammal	369		3972	
mammal indet.	234		265	
total	**933**		**13863**	

Table 2.4. Number, percentage and weight of animal bone fragments. Oude Tielseweg phase 1 (Iron Age, 300-175 BC).

been during the third year of life (4-5 mandibles, n=10), although some cattle were killed (or died of natural causes) in each age category. Unlike sheep, some cattle were killed during the first months of life (2 mandibles). Over half of all pigs were killed at an age between 14 and 21 months old (4-5 mandibles, n=7); few survived to adulthood.

The mortality profiles based on epiphyseal fusion show that sheep were killed mainly during the first two years of life; 63 % did not survive beyond the second year (table A15). Some cattle were killed in their first year, and more during the third year. Nearly half survived to adulthood (table A16). Epiphyseal fusion confirms that pigs were killed before reaching adulthood (table A18). The fusion data for sheep and cattle are different from the tooth wear data. This problem has already been pointed out in paragraph 1.6.4. The tooth wear data are probably a better indication of the real mortality profiles. A humerus from a newborn pig proves that pigs were bred on site, as trade in newborn animals would be unlikely. An unfused horse acetabulum points to the presence of non-adult horses in Passewaaijse Hogeweg.

Very little information on age is available for phase 1 in Oude Tielseweg. Three cattle mandibles are from individuals in O'Connor's adult category, which could correlate with the slaughter peak in the third year found at Passewaaijse Hogeweg, but the animals could also have been older at time of death. Four out of five sheep mandibles are from young adults (2-4 years old). The fifth mandible is from a sheep between 6 and 12 months old. All horse bones and teeth are from adult individuals. No pig mandibles were available for ageing.

Conclusions on livestock management in phase 1

The evidence from the Iron Age phase points to a system where animals were raised for meat and milk. Cattle were killed at their optimum slaughter age, in their third year. In Passewaaijse Hogeweg, sheep were killed earlier, in the second half of their first year. Possible reasons for this will be discussed in paragraph 2.2.3. The diet of beef and lamb was supplemented by some pork. The presence of young calves at Passewaaijse Hogeweg suggests that cattle were also exploited for milk, which would have been made into different dairy products. Sheep's milk formed another contribution to the diet. Sheep were more numerous in Passewaaijse Hogeweg, whereas Oude Tielseweg relied more on cattle. We will see that this trend continued in later phases.

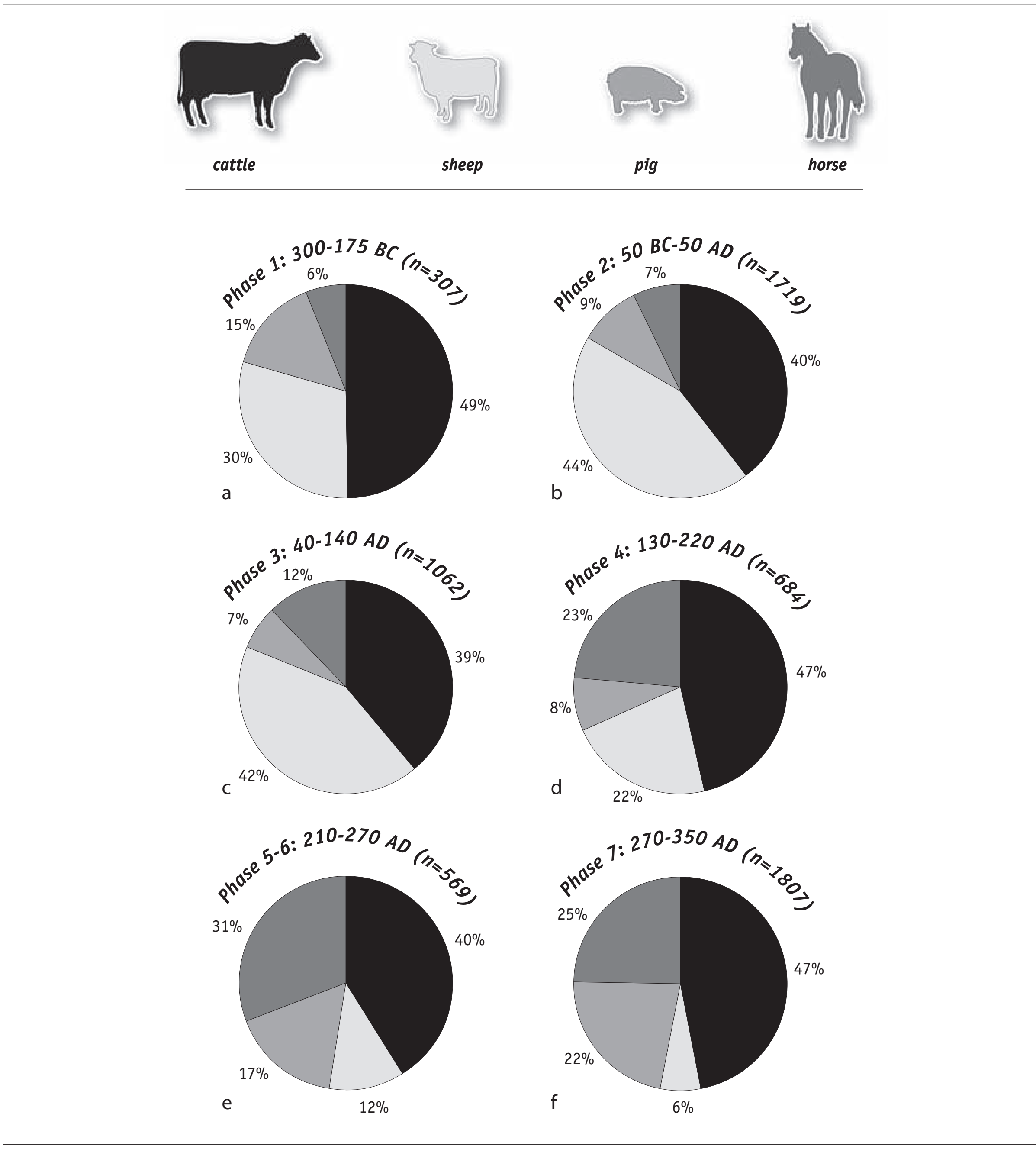

Fig. 2.1 a-f. Proportions of the four main animal species per phase in Passewaaijse Hogeweg, out of the total number of identified fragments for those four species.

2.2.3 Phase 2: 60 BC – AD 50 (Passewaaijse Hogeweg) and AD 25-70 (Oude Tielseweg)

Unfortunately, in the settlement Passewaaijse Hogeweg no distinction could be made between the habitation and the animal bones from the Late Iron Age (La Tène D2) and the earliest Roman period (first half of 1st century AD). Apparently, the arrival of the Roman army in the region did not result in immediate changes in habitation or building styles. We must assume that it also did not affect animal husbandry.

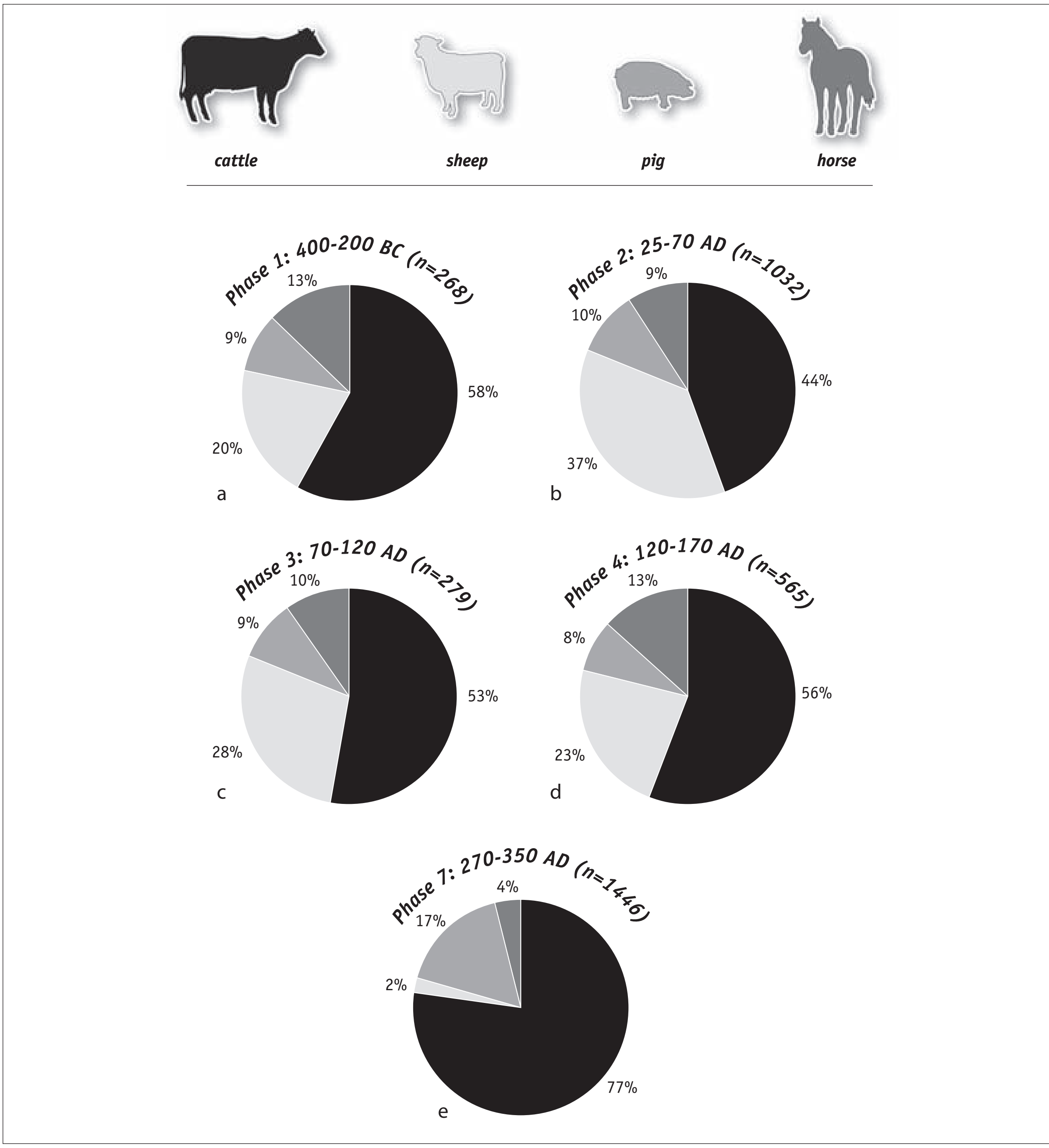

Fig. 2.2 a-e. Proportions of the four main animal species per phase in Oude Tielseweg, out of the total number of identified fragments for those four species.

In Passewaaijse Hogeweg, cattle and sheep were present in similar numbers, with sheep as the most commonly occurring species (table 2.5, fig. 2.1b). Pig and horse both have percentages of less than 10 %. The livestock economy in this phase was based on cattle and sheep. Although cattle and sheep were the main sources of meat, one cow will produce a much larger amount of meat than one sheep. So while the numbers of cattle and sheep are similar, beef would have dominated the menu. The presence of chicken in this early-Roman phase is interesting. Chicken will be discussed in paragraph 2.3.1.

The age distribution of sheep based on tooth eruption and wear shows a very clear peak between 6 and 12 months (fig. 2.4). More than half of all sheep were killed at this age. There is a complete absence of sheep younger than 6 months. In older age categories, 5-16 % were killed each year between 1 and 6 years. Very few sheep reached an age greater than 6 years.

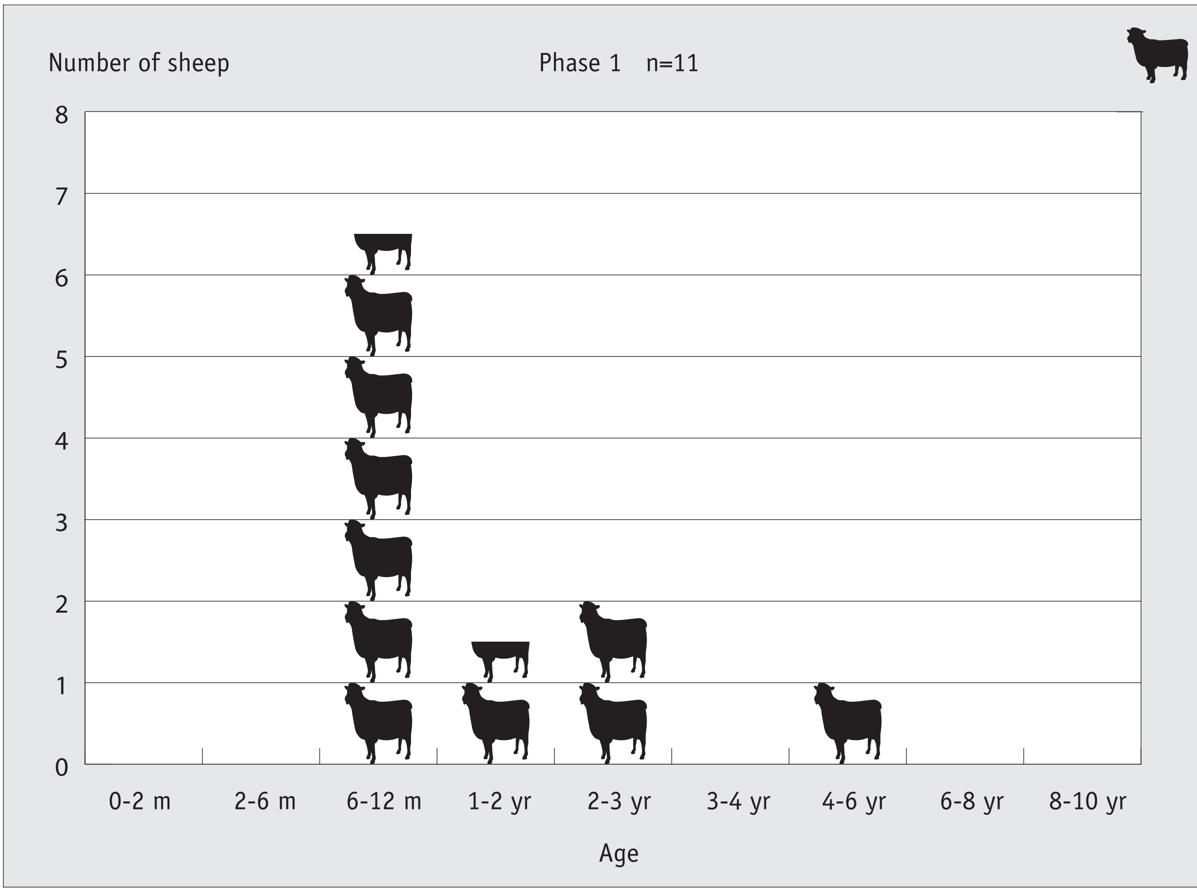

Fig. 2.3. Age distribution of sheep, phase 1 Passewaaijse Hogeweg. Based on Grant's Mandible Wear Stages and Payne's age categories.

The age profile for sheep in Passewaaijse Hogeweg based on epiphyseal fusion differs from that based on the mandibles. Only 20 % were killed in the first year (table A19). A third of all sheep were killed in the first two years of life. For the mortality profile based on tooth wear, this percentage is 70 %. Two thirds of sheep survived to adulthood.

In the mortality profile for cattle based on tooth eruption and wear, we can see a peak between 18 and 30 months (fig. 2.5). Twenty-two percent of cattle were killed during this period. About a third of cattle reached adulthood, and 20 % reached old age. There is also evidence for the culling of juvenile cattle. Almost 20 % were killed during the first eight months of life. These young animals could represent natural deaths, but the percentage is very high for that to be a plausible explanation. It is more likely that these deaths reflect a deliberate strategy.

In the mortality profile based on epiphyseal fusion, 32 % of cattle were killed during the first three years of life (table A20). 40 % was killed during the fourth year. Only 28 percent of cattle grew to adulthood or older (over three years).

Half of all pigs were killed at an age between 14 and 21 months (n=20). There is no evidence for the killing of suckling pigs. Few or no pigs survived beyond two years of age. Epiphyseal fusion data support this view: most pigs were killed between one and 2.5 years (table A22).

The ratios of domestic animals in Oude Tielseweg are very similar to those in Passewaaijse Hogeweg (table 2.6, fig. 2.2b). Sheep and cattle account for 80 % of all fragments, but the highest percentage in Oude Tielseweg is that of cattle. Percentages of pig and horse are both less than 10 %. Sheep mandibles show that sheep were killed at relatively young ages. More than half were killed during the first year of

species	fragments	%	weight (g)	%
cattle	682	39.7	32278	58.6
sheep/goat	753	43.8	6624	12.0
pig	161	9.4	3405	6.2
horse	123	7.1	12731	23.1
subtotal	**1719**	**100.0**	**55038**	**99.9**
dog	28		519	
domestic fowl	6		15	
red deer (*Cervus elaphus*)	3		170	
goose (*Anser spec.*)	1		7	
crow (*Corvus corone*)	4		2	
common snipe (*Gallinago gallinago*)	1		1	
pike (*Esox lucius*)	3		-	
medium mammal	1323		3386	
large mammal	1321		15785	
mammal indet.	457		650	
bird indet.	6		11	
fish indet.	1		-	
total	**4873**		**75584**	

Table 2.5. Number, percentage and weight of animal bone fragments. Passewaaijse Hogeweg phase 2 (60 BC – AD 50).

life, whereas 38 % reached adulthood.[21] An interesting point is that the peak of slaughter for sheep is between birth and 6 months, which is earlier than in Passewaaijse Hogeweg. Only six cattle mandibles were available for ageing; of these, half were killed between 8 and 30 months.

Conclusions on livestock management in phase 2

There seems to be a high degree of continuity between livestock management in the Middle and Late Iron Age (phase 1) and the early Roman period (phase 2). The main difference is the increase in the proportion of sheep, and the slightly younger slaughter age of cattle.

When we find such a clear slaughter peak as we do for sheep in Passewaaijse Hogeweg in this phase, we can ask ourselves at what time of the year the young sheep were killed. We can assume that lambs were born in spring, probably March or April, when there would be less chance of frost, and the adult sheep could feed on new growth. Spring births are most likely for the Roman period.[22] Spring births mean that lambs in Passewaaijse Hogeweg were killed between September and April. The mortality

21 O'Connor 1989, 161. Thirteen out of 24 sheep are killed in the juvenile and immature categories. Absolute ages are based on a comparative analysis of different methods for the Passewaaijse Hogeweg bones. See paragraph 1.6.4.

22 Legge 1985, 131-132; Legge 2000, 152-153.

species	fragments	%	weight (g)	%
cattle	460	44.6	12818	58.1
sheep/goat	379	36.7	2781	12.6
pig	101	9.8	1122	5.1
horse	92	8.9	5328	24.2
subtotal	**1032**	**100.0**	**22049**	**100.0**
dog	21		128	
medium mammal	697		1815	
large mammal	873		8250	
small mammal	6		4	
mammal indet.	1446		1910	
total	**4075**		**34156**	

Table 2.6. Number, percentage and weight of animal bone fragments. Oude Tielseweg Phase 2 (AD 25-70).

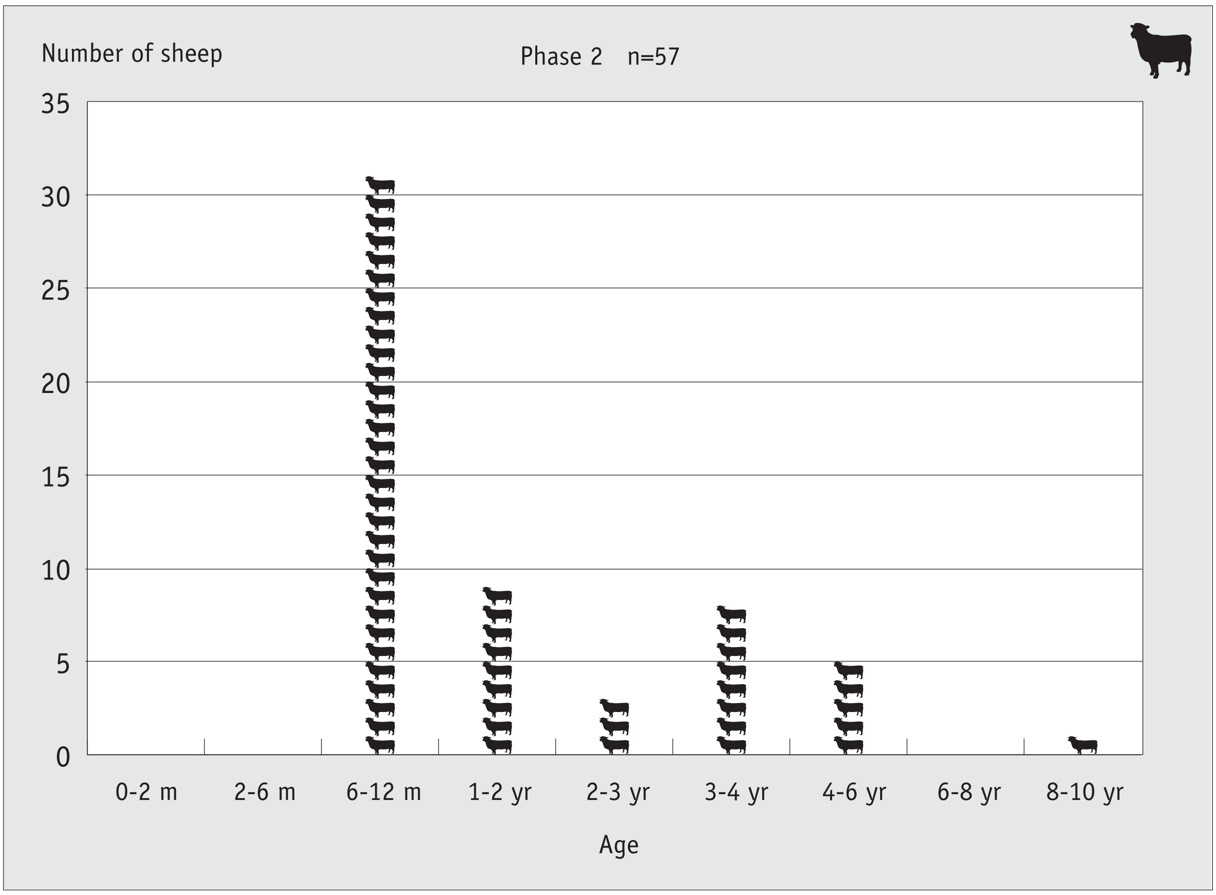

Fig. 2.4. Age distribution of sheep, phase 2 Passewaaijse Hogeweg. Based on Grant's Mandible Wear Stages and Payne's age categories.

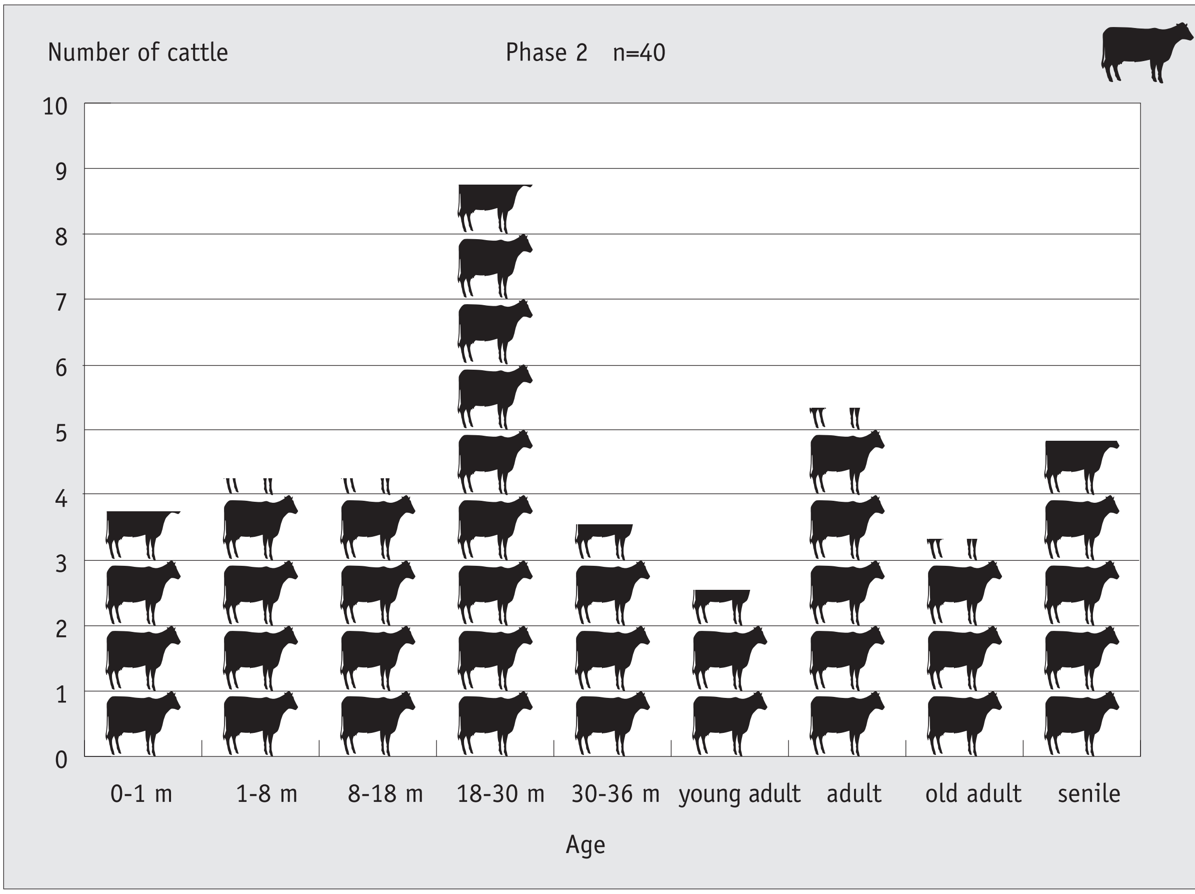

Fig. 2.5. Age distribution of cattle, phase 2 Passewaaijse Hogeweg. Based on Grant's Mandible Wear Stages and Halstead's age categories.

curve of sheep in phase 2 in Passewaaijse Hogeweg resembles that of medieval Aşvan in Turkey, described in Payne's classical study on the ageing of sheep and the interpretation of mortality profiles.[23] This pattern was still found in Aşvan at the time of Payne's research, when sheep were kept for meat and milk.[24] Payne suggests that surplus lambs will be killed at 6-9 months when milk is important and winter feed is scarce or expensive. When meat is more important and winter feeding presents no difficulty, sheep are killed at an age of 2-3 years.[25] From this, we can conclude for Passewaaijse Hogeweg that the choice to kill lambs at an age where they have not yet reached their maximum weight could reflect a shortage of winter feed. The weaker individuals would have been culled from late autumn throughout the winter, to provide food and give the rest of the herd a better chance of survival. Males were probably selected over females for culling. Females would be needed to maintain the herd, whereas only a few males would be enough for breeding. The mortality profile for Passewaaijse Hogeweg is very similar to Payne's model for milk production. Milk was clearly an important product of sheep in this period.

The absence of neonatal to six-month-old sheep in Passewaaijse Hogeweg is interesting. This could mean that sheep were not bred locally, but this does not seem likely. One explanation for the absence of neonatal sheep bones is the feeding of stillborn lambs to dogs or pigs. However, the teeth from neonatal lambs should survive digestion but have not been found. A more plausible explanation for the absence of

23 Payne 1973, 300, fig. 15.

24 Payne 1973, 301.

25 Payne 1973, 282.

neonatal mortality is that the sheep were not kept at the settlement during the lambing season, but were left to graze away from the settlement. Lambing would take place at the grazing grounds, and not in the settlements. It is possible that some form of shelter was provided for the sheep to protect the newborn lambs, or alternatively the type of sheep kept in Passewaaijse Hogeweg may have been hardy enough to cope by themselves. Sheep may have been brought closer to the settlement during the winter months, when they needed extra feeding.

20 % of cattle in Passewaaijse Hogeweg were killed as young calves (younger than 8 months). It is possible that weak individuals or surplus males were killed at young ages for meat, although this would not be the most efficient way of producing meat. However, shortage of winter feed and the focus on milk could have resulted in this strategy. The peak between 18 and 30 months reflects killing of animals that are nearing their optimum slaughter weight. The killing of adult individuals could also have occurred for meat, although in this case the animals would already have been utilized for other products for several years. The old animals represent animals that were used for non-meat products such as milk, manure and labour, as well as individuals needed for reproduction.

In Oude Tielseweg, the age distribution of sheep differs from that found in Passewaaijse Hogeweg. A peak is found in the first six months of life, a category which is absent in Passewaaijse Hogeweg. Sheep are also killed between 6 and 12 months, but not to the same extent as in Passewaaijse Hogeweg. The presence of young lambs suggests that in Oude Tielseweg, sheep were kept inside or close to the settlement throughout the year. Milk was an important, if not the most important product, of sheep, although meat and wool would undoubtedly have been used as well. Cattle were exploited for meat, labour, manure and possibly milk.

2.2.4 Phase 3: AD 40-140 (Passewaaijse Hogeweg) and AD 70-120 (Oude Tielseweg)

Phase 3 in Passewaaijse Hogeweg shows similar percentages of sheep and cattle as found in phase 2. Again, sheep and cattle make up around 80 % of all fragments (table 2.7, fig. 2.1c). The percentage of pig bones has fallen slightly, whereas the percentage of horse bones shows an increase.

Archaeologically, phase 3 could be divided into two sub-phases: 3.1 (AD 40-100) and 3.2 (AD 100-140). The problem with assigning the animal bones to sub-phases is that some of the material could only be dated as phase 3. This means that the sample sizes for phase 3.1 and 3.2 are small. However, some trends are visible in the data. For phase 3.1, the percentage of sheep bones is much higher than that of cattle bones (table 2.8, fig. 2.6). In phase 3.2, the percentage of sheep bones dropped, suggesting that high percentages of sheep were mainly a 1st-century phenomenon. The decline of sheep started in the early 2nd century and continued during the following phases. The percentage of horse bones started to increase slightly during phase 3.1 (from 7 % in phase 2 to 10 % in phase 3.1), and continued to do so in phase 3.2 (from 10 % in phase 3.1 to 17 % in phase 3.2). There is no significant change in the proportion of pig bones.

Mortality profiles will only be discussed for phase 3 as a whole; there are insufficient data available for each sub-phase. The mortality profile for sheep in phase 3 in Passewaaijse Hogeweg is very different from that for phase 2. In phase 3, we no longer find a peak at 6-12 months (fig. 2.7). Sheep were now killed in roughly equal numbers per year, from the age of six months to six years. A small peak is visible between three and four years. Very few sheep survived beyond six years. Compared to phase 2, many more sheep survived to adulthood. Epiphyseal fusion shows that 22 % of sheep were killed during the first year (table A23). Few or no animals were killed between 1 and 3.5 years. Three quarters of sheep survived to adulthood. Again, the epiphyseal data are different from the mandible data, although both data sets show the lack of a clear slaughter peak.

species	fragments	%	weight (g)	%
cattle	415	39.1	20883	54.2
sheep/goat	448	42.2	4051	10.5
pig	70	6.6	873	2.3
horse	129	12.1	12686	33.0
subtotal	**1062**	**100.0**	**38493**	**100.0**
dog	22		634	
domestic fowl	3		3	
stoat (*Mustela erminea*)	1		4	
duck (*Anas* spec.)	5		6	
crow (*Corvus corone*)	1		-	
grey heron (*Ardea cinerea*)	1		11	
crane (*Grus grus*)	1		12	
sturgeon (*Acipenser sturio*)	1		-	
common bream (*Abramis brama*)	1		-	
medium mammal	473		1345	
large mammal	860		10907	
mammal indet.	726		926	
bird indet.	5		5	
fish indet.	1		-	
total	**3163**		**52345**	

Table 2.7. Number, percentage and weight of animal bone fragments. Passewaaijse Hogeweg phase 3 (AD 40-150).

The mortality profile for cattle for phase 3 is not very different from that for phase 2. Again, we find a peak between 18 and 30 months (fig. 2.8). 30 % of cattle were killed in this age category. Fewer cattle were killed during the first eight months of life (3 %), but more between eight and eighteen months (18 %). 43 % of all cattle survived to adulthood. In the mortality profile based on epiphyseal fusion, 25 % of cattle were killed during the first year of life (table A24). 75 % survived to adulthood (over three years).

Two pig mandibles are from pigs killed in their first year, and two from pigs killed during their second year. Most of the nine available horse mandibles are from young horses. Six are from horses younger than 2.5 years and one is from a horse between 2.5 and 3.5 years. One mandible is from an animal older than 2 years, and one from a horse older than 3.5 years.[26] The epiphyseal fusion data do not agree with the tooth eruption data. Only 12.5 % of horses were killed before the age of two years (table A25).

[26] Silver 1969, 291, table C.

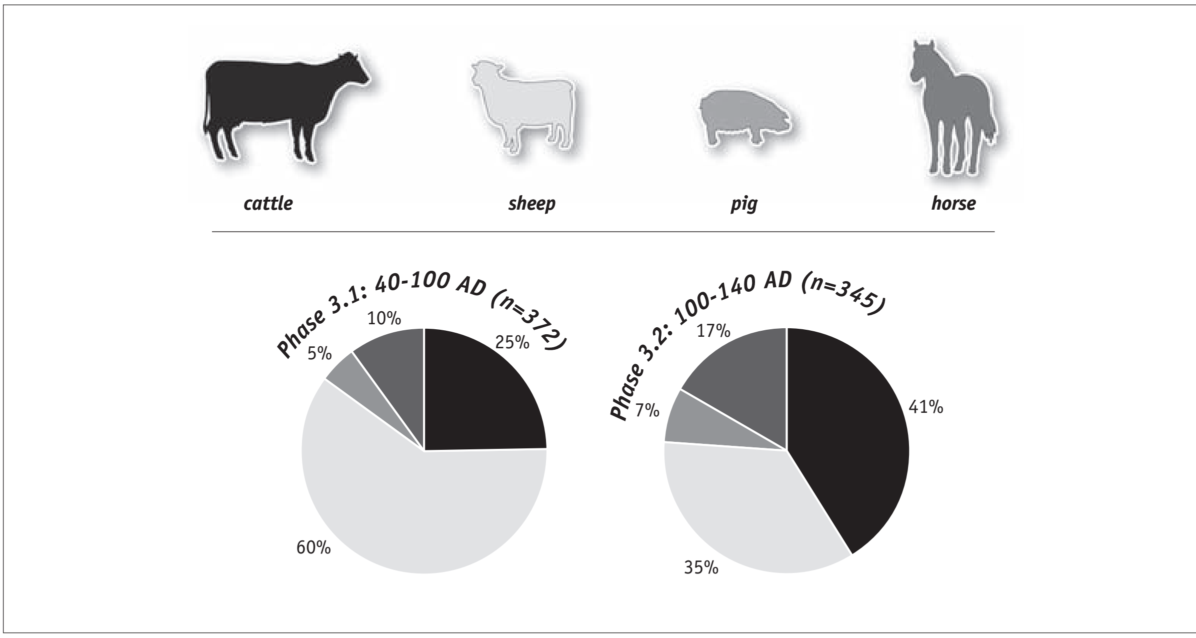

Fig. 2.6. Proportions of the four main animal species for sub-phases 3.1 and 3.2 in Passewaaijse Hogeweg, out of the total number of identified fragments for those four species.

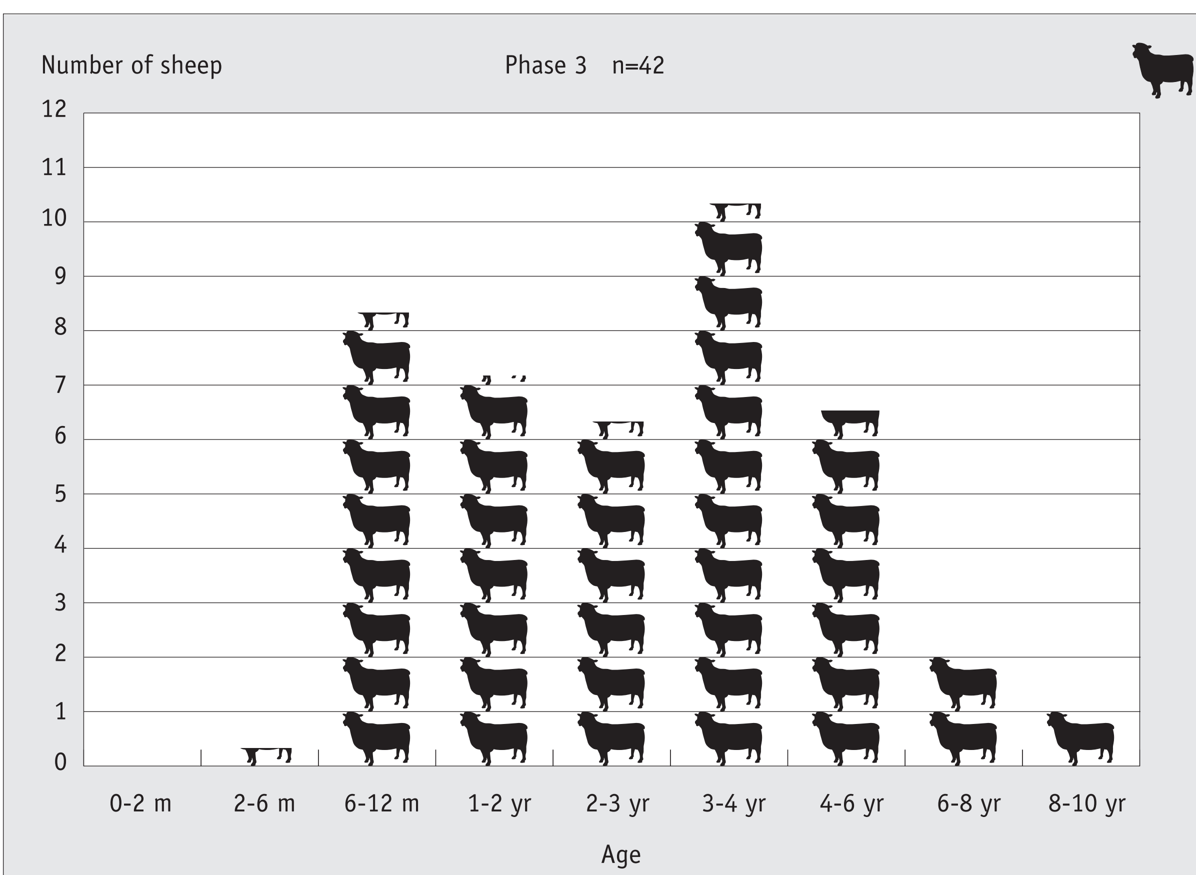

Fig. 2.7. Age distribution of sheep, phase 3 Passewaaijse Hogeweg. Based on Grant's Mandible Wear Stages and Payne's age categories.

species	fragments	%	weight (g)	%
phase 3.1: AD 40-100				
cattle	92	24.7	4048	43.8
sheep/goat	225	60.5	1514	16.4
pig	18	4.8	196	2.1
horse	37	9.9	3480	37.7
total	**372**	**99.9**	**9238**	**100.0**
phase 3.2: AD 100-140				
cattle	142	41.2	8731	56.0
sheep/goat	121	35.1	951	6.1
pig	25	7.2	226	1.5
horse	57	16.5	5671	36.4
total	**345**	**100.0**	**15579**	**100.0**

Table 2.8. Number, percentage and weight of animal bone fragments. Passewaaijse Hogeweg phases 3.1 (AD 40-100) and 3.2 (AD 100-140).

species	fragments	%	weight (g)	%
cattle	148	53.0	5477	73.6
sheep/goat	79	28.3	613	8.2
pig	25	9.0	325	4.4
horse	27	9.7	1025	13.8
subtotal	**279**	**100.0**	**7440**	**100.0**
dog	5		59	
otter (*Lutra lutra*)	1		12	
medium mammal	114		302	
large mammal	312		2835	
mammal indet.	273		388	
total	**984**		**11557**	

Table 2.9 Number, percentage and weight of animal bone fragments. Oude Tielseweg Phase 3 (AD 70-120).

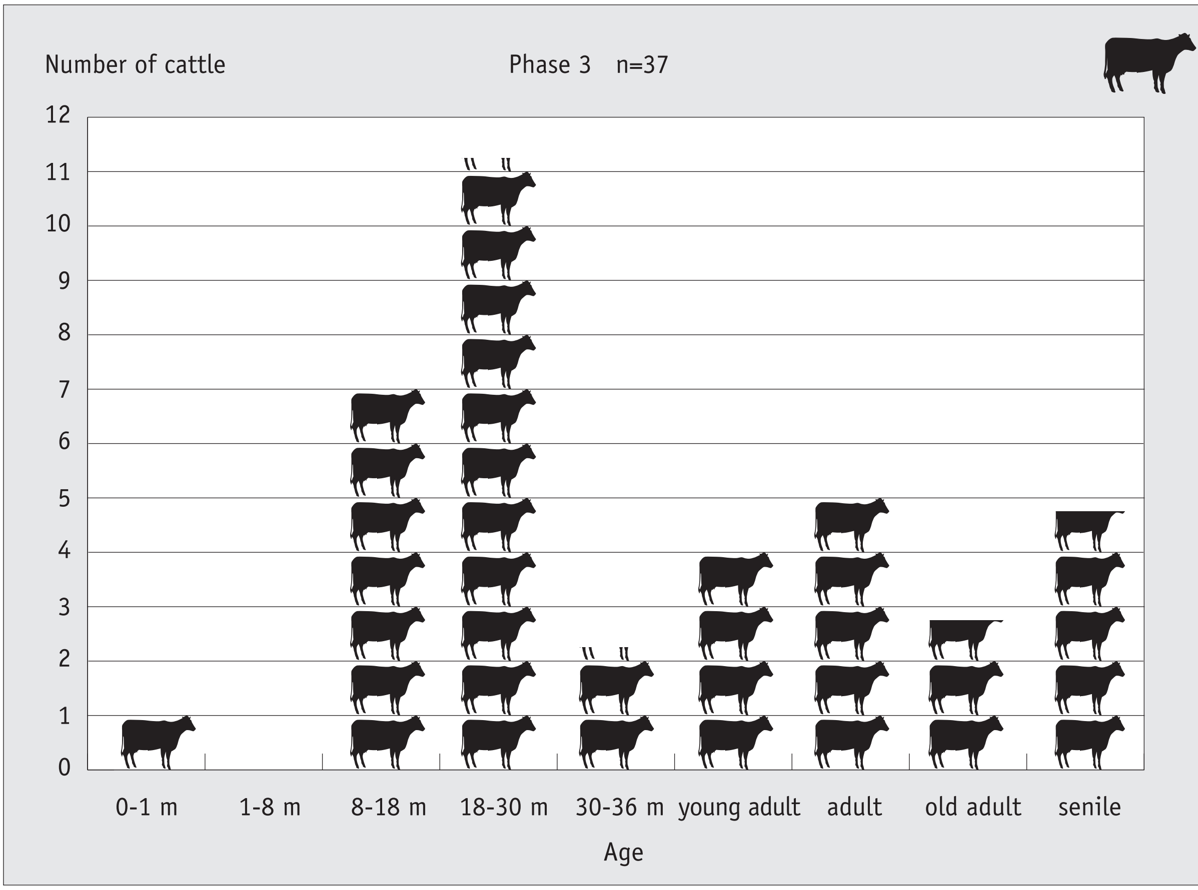

Fig. 2.8. Age distribution of cattle, phase 3 Passewaaijse Hogeweg. Based on Grant's Mandible Wear Stages and Halstead's age categories.

Phase 3 in Oude Tielseweg has a narrower time span than phase 3 in Passewaaijse Hogeweg. Unfortunately, the sample size for this phase in Oude Tielseweg is small: only 285 identified fragments. During phase 3, the percentage of sheep in Oude Tielseweg dropped, whereas the percentage of cattle bones increased (table 2.9; fig. 2.2c). Percentages of pig and horse remained stable.

Due to the small sample size, very little information on age is available for Oude Tielseweg phase 3. Two cattle mandibles are from animals with an age of 8 to 30 months and 18 to 30 months respectively. Four sheep mandibles are from sheep older than two years. Two of the four mandibles can be aged more accurately between 2 and 4 years. Epiphyseal fusion data suggest high survival into adulthood for both sheep and cattle. A single pig mandible is from an animal killed in the second year of life.

Conclusions on livestock management in phase 3

Although the economy in phase 3 was still based on sheep and cattle, the exploitation of sheep changed when compared to phase 2. Instead of killing most animals between 6 and 12 months, sheep were now killed between birth and six years, in almost equal numbers for each year of life. Sheep were now mainly exploited for meat and wool. Milk lost the importance it had during the previous phase, but the 20 % mortality between 6 and 12 months does suggest that sheep milk was still considered a useful product. If production was exclusively focused on meat, we would expect to find a peak at 18-30 months.[27] Ani-

[27] Payne 1973, 282.

species	fragments	%	weight (g)	%
cattle	318	46.5	19897	49.0
sheep/goat	150	21.9	1343	3.3
pig	56	8.2	809	2.0
horse	160	23.4	18561	45.7
subtotal	**684**	**100.0**	**40610**	**100.0**
dog	16		259	
domestic fowl	6		14	
red deer (*Cervus elaphus*)	1		64	
goose (*Anser spec.*)	8		19	
duck (*Anas spec.*)	3		4	
grey heron (*Ardea cinerea*)	1		1	
medium mammal	399		1136	
large mammal	794		10298	
mammal indet.	117		188	
bird indet.	7		8	
total	**2036**		**52601**	

Table 2.10. Number, percentage and weight of animal bone fragments. Passewaaijse Hogeweg phase 4 (AD 140-220).

mals were clearly not all killed at the optimum age for slaughter, but rather when meat was needed or wanted. Survival to ages beyond the optimum slaughter age indicates that wool had become an important product. Of the sheep killed at 3-6 years old, several fleeces were harvested. The killing of sheep during the second, third and fourth year (in contrast to the peak in the first year in phase 2) suggests that winter feeding was not a problem during this period. Granaries in Passewaaijse Hogeweg found in this phase could have been used for storage of animal feed.

Meat, milk, labour and manure were the most important products of cattle in this phase. Most cattle were killed between 8 and 30 months old. The calves killed in their first year suggest an exploitation of cows' milk. Although the cattle killed between 18 and 30 months would not yet have reached their optimum slaughter weight, they would have provided a large amount of meat. The older animals provided products such as manure and labour, and in the case of cows, calves.

In Passewaaijse Hogeweg, what little information we have for horse seems to point to an overrepresentation of young horses. Three quarters of the mandibles are from non-adult horses.

The limited information for Oude Tielseweg supports the conclusions for Passewaaijse Hogeweg. Sheep were killed at a later age; instead of milk, meat and wool were the main products in this phase. Cattle were mainly raised for meat. The older animals supplied manure and traction.

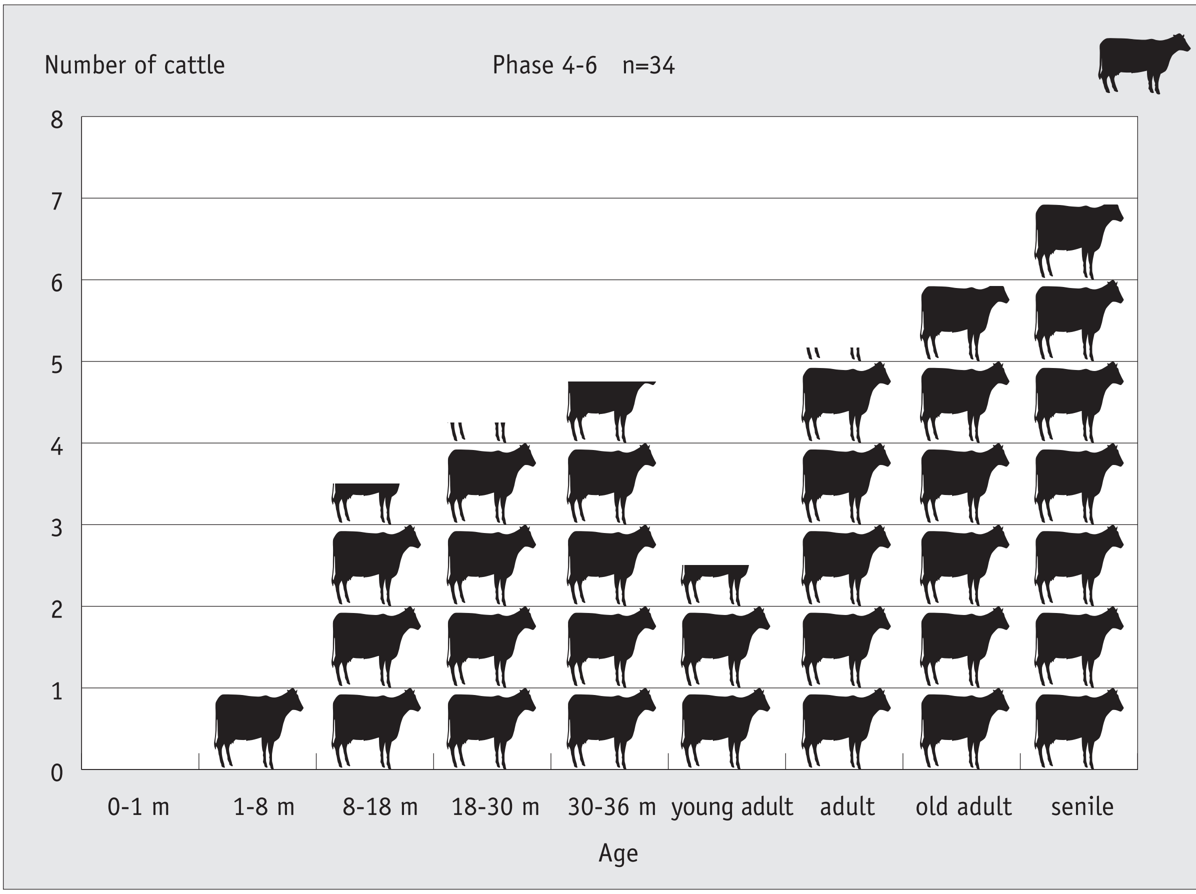

Fig. 2.9. Age distribution of cattle, phases 4-6 Passewaaijse Hogeweg. Based on Grant's Mandible Wear Stage and Halstead's age categories.

2.2.5 Phase 4: AD 140-220 (Passewaaijse Hogeweg) and AD 120-170 (Oude Tielseweg)

Phase 4 shows some strong changes in the livestock composition of Passewaaijse Hogeweg. The percentage of sheep dropped to 22 %, while the percentage of cattle bones rose slightly (table 2.10, fig. 2.1d). The percentage of horse bones rose further to 23 %. The percentage of pig bones remained less than 10 %.

The total number of fragments is lower than that for the previous two phases. As a result, we have less information on ageing. The few data we have for sheep show little change to the mortality profile for phase 3. There is not one clear slaughter peak; instead, sheep were killed in equal numbers per year for the first four years of life (n=8). There are not enough data on epiphyseal fusion of sheep for this phase to draw conclusions on the exploitation of sheep.

The exploitation of cattle shows a change from that in the previous phase. Whereas phase 3 showed a peak between 18 and 30 months, in phase 4 we find several peaks. The first one is found between 30 and 36 months (22 %), and then more peaks occur in the different categories of fully-grown cattle. Nearly two thirds of cattle survived to adulthood. Epiphyseal fusion data show a similar mortality profile, with a third of cattle being killed in their third year, and nearly two thirds surviving to adulthood (3 years or older) (table A28). The number of cattle mandibles for phases 4 and 5-6 is low, but the mortality profiles for cattle are similar. Therefore, the results for these two phases are combined in one graph. An advantage is that some mandibles that could not be accurately dated to either phase 4 or 5-6 can now also be taken

species	fragments	%	weight (g)	%
cattle	316	55.9	12883	59.6
sheep/goat	130	23.0	952	4.4
pig	45	8.0	548	2.5
horse	74	13.1	7217	33.4
subtotal	**565**	**100.0**	**21600**	**99.9**
dog	10		167	
red deer (*Cervus elaphus*)	1		12	
wild boar (*Sus scrofa*)	1		25	
wild cat (*Felis silvestris*)	1		5	
crow/rook (*Corvus spec.*)	1		1	
medium mammal	225		683	
large mammal	781		7245	
mammal indet.	561		612	
bird indet.	2		8	
total	**2148**		**30358**	

Table 2.11. Number, percentage and weight of animal bone fragments. Oude Tielseweg phase 4 (AD 120-170).

into account. The mortality profile shows a peak at the prime ages for beef (18-36 months) and an over-representation of adult and older cattle (fig. 2.9).

Two pig mandibles are both from pigs killed before the age of two years. Two horse mandibles are from animals older than 3.5 years, while a third mandible is from a horse between 2 and 2.5 years old. Epiphyseal fusion data for horse show that a third of all horses were killed during or before their second year (table A29). Of the remaining two thirds almost all survived to adulthood.

In Oude Tielseweg, the percentages for both cattle and horse bones increased slightly during this phase (table 2.11, fig. 2.2d). The percentage of sheep bones continued to drop. The relative number of pig bones remained the same.

Apart from the youngest age category (0-8 months), cattle were killed in all age categories. Half were killed between 8 and 30 months, while the rest lived to an older age (n=8). Epiphyseal fusion shows a peak between 18 and 36 months (24 %), but more than two thirds of cattle survived to over 4 years. No sheep were killed before the age of two years. Five out of 8 mandibles could be aged between 2 and 4 years.

Conclusions on livestock management in phase 4

The decline of sheep that started in phase 3.2 continued in this phase. Most sheep were killed during the first four years of life. Meat must have been the most important product. The decline in the proportion of sheep suggests that wool was a less important product in this phase.

For cattle, the peak between 30 and 36 months represents cattle killed for meat, at the time when they had reached their optimum weight. Two thirds of cattle survived to adulthood. This suggests that the

species	fragments	%	weight (g)	%
cattle	234	41.1	27977	49.7
sheep/goat	66	11.6	955	1.7
pig	95	16.7	2373	4.2
horse	174	30.6	25036	44.4
subtotal	**569**	**100.0**	**56341**	**100.0**
dog	24		423	
domestic fowl	1		1	
roe deer (*Capreolus capreolus*)	1		26	
wild boar (*Sus scrofa*)	2		77	
wild cat (*Felis silvestris*)	1		4	
goose (*Anser spec.*)	2		4	
duck (*Anas spec.*)	2		3	
crow (*Corvus corone*)	1		1	
raven (*Corvus corax*)	1		2	
medium mammal	167		761	
large mammal	785		12660	
mammal indet.	137		341	
bird indet.	6		7	
total	**1699**		**70651**	

Table 2.12. Number, percentage and weight of animal bone fragments. Passewaaijse Hogeweg phase 5-6 (AD 210-270).

products of living cattle were the most important. Although milk could have been taken from cows with calves, the lack of calves killed in their first year shows that milk was not an important product. However, milk could still have been produced if calves were not killed locally but sold outside the settlement. The calves could then have been sold either in the first year or raised until they had acquired more weight and thus more meat, at a few years old. However, zooarchaeological evidence from consumption sites does not show a high number of cattle in the first few years of life; instead, the mortality profiles are very similar to those for rural settlements, the supposed production sites.[28] Manure and labour were probably the main products of cattle during this phase. Both products were of enormous importance to agriculture. The change in exploitation of cattle from meat in phases 2 and 3 to manure and labour in phase 4 is an indication of an intensification of agriculture.

Horse became even more important in phase 4, especially in Passewaaijse Hogeweg. This settlement seems to have specialised in keeping and breeding horses. A third of all horses did not live beyond two years. These horses could represent natural deaths of young animals, or animals unfit for breeding or selling that were culled.

28 Lauwerier 1988, 134. See also paragraph 2.4.3.

species	fragments	%	weight (g)	%
cattle	1120	77.4	48400	83.2
sheep/goat	31	2.1	242	0.4
pig	243	16.8	5173	8.9
horse	53	3.7	4387	7.5
subtotal	**1447**	**100.0**	**58202**	**100.0**
dog	5		129	
red deer (*Cervus elaphus*)	17		842	
wild boar (*Sus scrofa*)	4		381	
otter (*Lutra lutra*)	1		5	
medium mammal	79		176	
large mammal	1510		5216	
mammal indet.	210		273	
total	**3273**		**65224**	

Table 2.14. Number, percentage and weight of animal bone fragments. Oude Tielseweg phase 7 (AD 270-350).

species	fragments	%	weight (g)	%
cattle	74	55.2	4736	79.8
sheep/goat	22	16.4	142	2.4
pig	29	21.6	781	13.2
horse	9	6.7	274	4.6
subtotal	**134**	**99.9**	**5933**	**100.0**
dog	1		4	
red deer (*Cervus elaphus*)	1		38	
otter (*Lutra lutra*)	1		5	
medium mammal	74		176	
large mammal	180		1647	
mammal indet.	210		273	
total	**601**		**8076**	

Table 2.15. Number, percentage and weight of animal bone fragments. Oude Tielseweg phase 7 (AD 270-350), excluding bone concentration S618.

In Oude Tielseweg, cattle were killed for meat at a younger age than in Passewaaijse Hogeweg: 8-30 months instead of 30-36 months. More than half of all sheep were killed between 2 and 4 years. By that age, they would have reached their optimum slaughter weight and produced several fleeces. Meat and wool were the main products of sheep in Oude Tielseweg. Horse shows a slight increase, from 10 % in phase 3 to 13 % in this phase. Although horses were not as important as they are in Passewaaijse Hogeweg in phase 4, the increase shows that Oude Tielseweg may have participated in horse breeding on a smaller scale.

2.2.6 PHASE 5-6: AD 210-270

In phase 5-6, sheep continued to drop in numbers and was the least numerous of the four main animal species (table 2.12, fig. 2.1e). The percentage of cattle bones shows a slight decline. The relative number of horse bones increased again, from 23 % in phase 4 to 31 % in this phase. The percentage of pig bones also shows a remarkable increase; the percentage has doubled from 8 to 17 %.

Unfortunately, the amount of data on age is small, which means that any conclusions will be tentative. The mortality profile for cattle shows the absence of clear peaks. No cattle were killed during the first month of life. 56 % of cattle survived to adulthood. When we look at epiphyseal fusion data, 69 % of cattle survived to 3 years or older (table A32). Two sheep mandibles are from animals between 4 and 6 years old.

Pigs were mostly killed between 14 and 21 months old (4-5 mandibles, n=8). Epiphyseal fusion supports the finding that pigs were not killed until the second year (table A34). Three horse mandibles are from animals younger than 2.5 years. From the epiphyseal fusion data, we can see that about a third of horses were killed during the first two years of life (table A33).

There is no habitation in Oude Tielseweg in this period.

Conclusions on livestock management in phase 5-6

The livestock economy of Passewaaijse Hogeweg was now firmly based on cattle and horse, with pig and sheep contributing to a lesser degree. Pig increased in proportion. Phase 5-6 shows a continuation of the trends in phase 4: cattle supplied manure and traction for agriculture, as well as meat. Sheep, although few in number, supplied additional meat and wool.

2.2.7 PHASE 7: AD 270-350

Phase 7 once again shows habitation in both settlements. The bone sample from Oude Tielseweg consists mainly of fragments from one feature. In Passewaaijse Hogeweg, the proportion of sheep continued to decline (table 2.13, fig. 2.1f). The percentage of horse bones shows a slight decrease, but is still high. The percentage of pig bones increased to 22 %. Cattle remained the most numerous species.

The mortality profile for cattle shows peaks between 8 and 18 months and 18 and 30 months. More than a quarter of cattle reached old age. Epiphyseal fusion does not show these same peaks. 32 % of cattle were killed in the first year (table A38). A quarter of all cattle were killed between 1 and 4 years old.

Pigs were mainly killed between 14 and 21 months and between 21 and 27 months. 82 % were killed in these two age categories (n=25). Epiphyseal fusion data do not show such a clear peak. Nearly 60 % were killed between 1 and 3.5 years (table A40). Just over a third of pigs lived to adulthood.

Two thirds (n=21) of horse mandibles are from animals younger than 2.5 years. When we look at epiphyseal fusion, we see that some horses were killed during the first and second year, but nearly three quarters reached adulthood. Sheep were killed in all age categories, apart from the first six months of life.

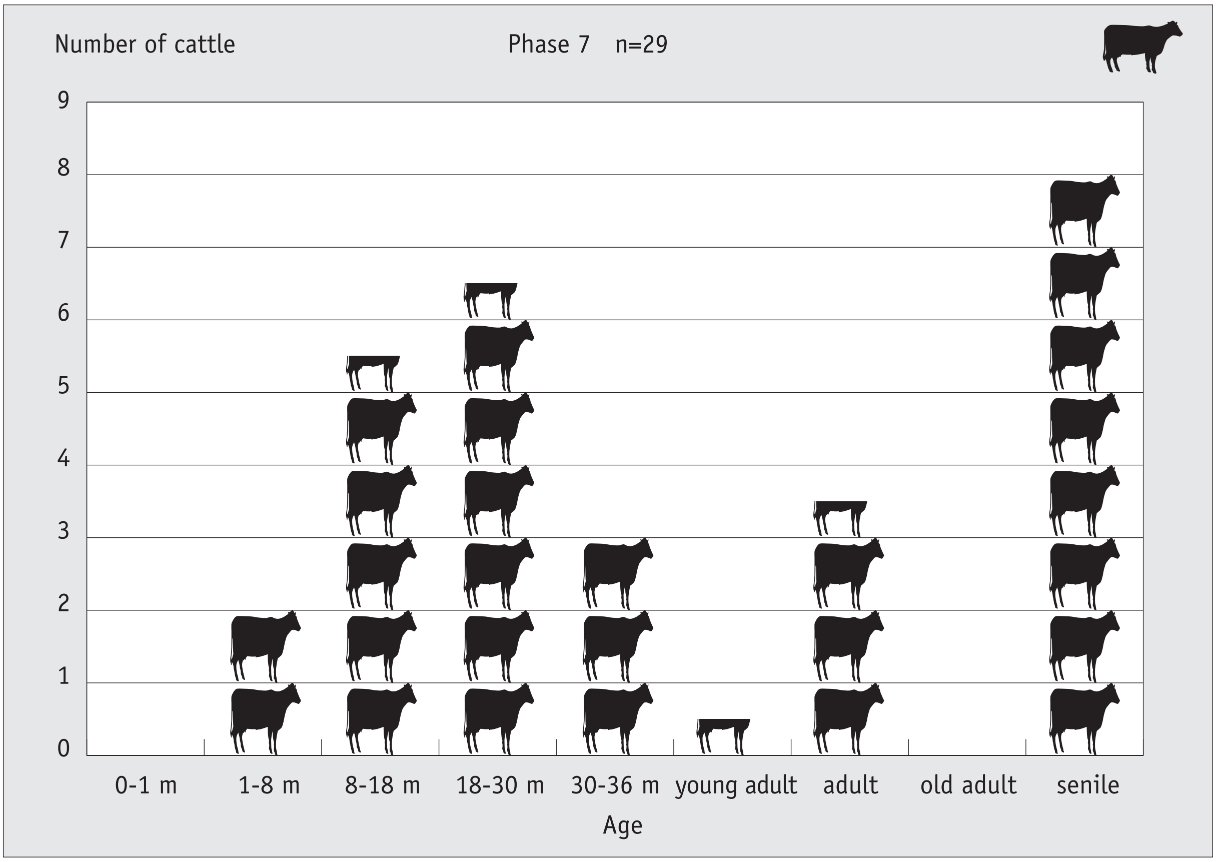

Fig. 2.10. Age distribution of cattle, phase 7 Passewaaijse Hogeweg. Based on Grant's Mandible Wear Stages and Halstead's age categories.

In Oude Tielseweg, cattle accounted for three quarters of all animal bones (table 2.14, fig. 2.2e). The only other species of any significance is pig, with a percentage of 17 %. However, the problem with this phase in Oude Tielseweg is that most of the animal bones were found in one context. This context, the upper fill of a well, seems to represent a single occasion where a number of cattle and pigs were slaughtered and at least partly consumed. As such, it is similar to the special animal deposit category of bone concentrations, which will be discussed in chapter 3. The relative proportions of animals in this context may not be representative for the whole phase. When this context is not included in the assemblage for phase 7, the proportions of cattle and pig are comparable to those in Passewaaijse Hogeweg (table 2.15). Compared to Passewaaijse Hogeweg, more sheep bones were found in Oude Tielseweg and fewer horse bones.

Half of the 8 cattle mandibles are from animals killed either between 18 and 30 months or as young adults, whereas the other half are from adult cattle. Epiphyseal fusion shows that most cattle survived to adulthood (78 %).

Conclusions on livestock management in phase 7

Cattle were still the most numerous species in Passewaaijse Hogeweg, followed by horse and pig in roughly equal numbers. Sheep no longer had a significant role in the economy. Cattle were killed between 8 and 30 months for their meat. The relatively large number of cattle that reached old age could have been used as breeding stock or for traction. Manure would have been another important product. Pigs were killed for meat in their second year. In Oude Tielseweg, cattle and pig account for 94 % of all bone fragments. The small assemblage from Oude Tielseweg that does not come from the large bone concentration shows percentages of cattle and pig similar to those in Passewaaijse Hogeweg. The difference lies in the percentages of horse and sheep.

species	fragments	%	weight (g)	%
cattle	851	47.1	84128	53.3
sheep/goat	111	6.1	1281	0.8
pig	399	22.1	13504	8.5
horse	446	24.7	59020	37.4
subtotal	**1807**	**100.0**	**157933**	**100.0**
dog	16		291	
domestic fowl	4		6	
red deer (*Cervus elaphus*)	12		1388	
wild boar (*Sus scrofa*)	7		406	
beaver (*Castor fiber*)	2		18	
brown bear (*Ursus arctos*)	1		4	
goose (*Anser spec.*)	2		3	
crow (*Corvus corone*)	2		2	
magpie (*Pica pica*)	3		3	
white-tailed eagle (*Haliaeetus albicilla*)	3		23	
cinereous vulture (*Aegypius monachus*)	2		14	
common bream (*Abramis brama*)	19		-	
houting (*Coregonus oxyrhynchus*)	1		-	
pike (*Esox lucius*)	128		-	
perch (*Perca fluviatilis*)	18		-	
wels catfish (*Silurus glanis*)	2		-	
cyprinidae	16		-	
salmonidae	1		-	
small mammal	1		1	
medium mammal	349		1857	
large mammal	1841		31473	
mammal indet.	379		684	
bird indet.	8		10	
fish indet.	434		-	
total	**5058**		**194116**	

Table 2.13. Number, percentage and weight of animal bone fragments. Passewaaijse Hogeweg phase 7 (AD 270-350).

The late Roman occupation in Nijmegen shows a similar bone spectrum as Passewaaijse Hogeweg: high percentages of cattle and horse, followed by pig. Sheep is represented by a low percentage of bones.[29]

[29] Lauwerier 1988, 65.

2.3 DOG, CHICKEN AND WILD ANIMALS

2.3.1 DOG AND CHICKEN

So far, we have focused only on the four main domestic species: sheep/goat, cattle, pig and horse. Two more domestic species were found in Tiel-Passewaaij: dog and domestic fowl. In this paragraph, these two species and their part in the local economy will be discussed briefly.

Chicken

No chicken bones were found in Oude Tielseweg. Although this could be partly due to excavation methods, it is unlikely that chicken would be completely overlooked by analysing only hand-collected material if it was present in a significant quantity.[30] In Passewaaijse Hogeweg, chicken was found in all phases except phase 1, the Iron Age phase. This is not surprising, since chicken was introduced in north-western Europe by the Romans. The earliest finds of chicken in the Netherlands date to the beginning of the 1st century AD.[31] Chicken is more common in military sites than in rural settlements. Large numbers of chicken were found in the early Roman castellum Velsen I.[32] They were raised inside the army camp and used for food, and the males possibly as fighting cocks.[33] In the late 1st-century legionary camp in Nijmegen, 5 % of all identified fragments were chicken bones.[34]

The earliest chicken bones in Passewaaijse Hogeweg date to between 15 BC and AD 40. In Passewaaijse Hogeweg, the percentage of chicken fragments is low in all phases: less than one percent. Chicken is found in such small quantities that it could not have formed a substantial part of the diet. In chapter 4, it will be suggested that in Passewaaijse Hogeweg, chickens were reserved for funerary ritual, and not consumed as everyday food. Chicken was found in the cemetery in much larger frequencies than in the settlements. Chicken played only a marginal role in the local economy, but was important in a symbolic way. However, it is important to remember that even food consumed as part of a ceremonial or ritual meal would have provided nourishment.

Dog

In all phases, dog accounts for a small percentage of the total number of fragments. This percentage varies from 0.3 to 4.0, but usually lies between 1 and 2 %. Although the number of dogs was small, they still contributed to the economy by fulfilling important tasks. Dogs may have been used for herding or guarding livestock, hunting, and guarding houses or farmyards. Three different size categories of dog can be distinguished in Tiel-Passewaaij: small dogs with a withers height of circa 30 cm, medium-sized dogs with a withers height of 56-64 cm, and large dogs with a withers height of more than 70 cm (table A11). The medium-sized dogs were most common in Tiel-Passewaaij, with a total of eight. Two small dogs were found and one large dog, with a withers height of 74 cm. Most of the dog bones for which withers height could be calculated date to phases 3-6. The two individuals from phases 2 and 7 are both medium-sized dogs.

In phases 2 and 3 in both settlements, cut marks were found on dog bones. There are no indications that dogs were ever eaten in this region; the cut marks probably result from skinning. The absence of cut marks in later phases could be coincidence as a result of the small total number of dog bones. However, it could also indicate a change in the perception of dogs over time. Chapter 3 will show that dog burials are relatively more common from phase 4 onwards.

30 See paragraph 1.5 for excavation methods.

31 Velsen I: AD 15-30, Prummel 1987, 183.

32 Prummel 1987, 185.

33 Prummel 1987, 186.

34 Lauwerier 1988, 142.

Fig. 2.11. A large pike. Remains from similar-sized pikes were found in Passewaaijse Hogeweg. Photo R. Gulin.

Although higher percentages of dog were seen as correlating with a high sheep percentage for some phases in Oude Tielseweg, the differences are not significant.[35] In Passewaaijse Hogeweg, no such correlation could be found. Although the percentage of dog fragments rose when the percentage of sheep increased (phase 2-3), it continued to rise when sheep numbers declined (phase 4-6). The percentage of dog bones was lowest in both Oude Tielseweg and Passewaaijse Hogeweg in phase 7, just when the percentage of wild animals was highest. This also rules out a correlation between dogs and wild animals. Sheep herding and hunting may not have been the main tasks of dogs.

2.3.2 THE CONTRIBUTION OF WILD ANIMALS TO THE ECONOMY

Wild animals in Tiel-Passewaaij

Apart from the domestic species, we also find remains of wild animals in Tiel-Passewaaij (table 2.16). Among the wild animals, we can distinguish mammals, birds and fish. The fish remains from Passewaaijse Hogeweg have been identified by Bob Beerenhout. Sieved samples, which would have been most likely to contain fish remains, were not included in the selection of animal bones from Oude Tielseweg that was analysed. The problem with the fish remains from Passewaaijse Hogeweg is that the sample is not representative. Many of the fish remains were found in one cluster of pits, dating to phase 7. Only a few fragments were dated to other periods: 4 fragments to phase 2 and 3 to phase 3. The absence of fish in

[35] Verhelst 2001, 50-51.

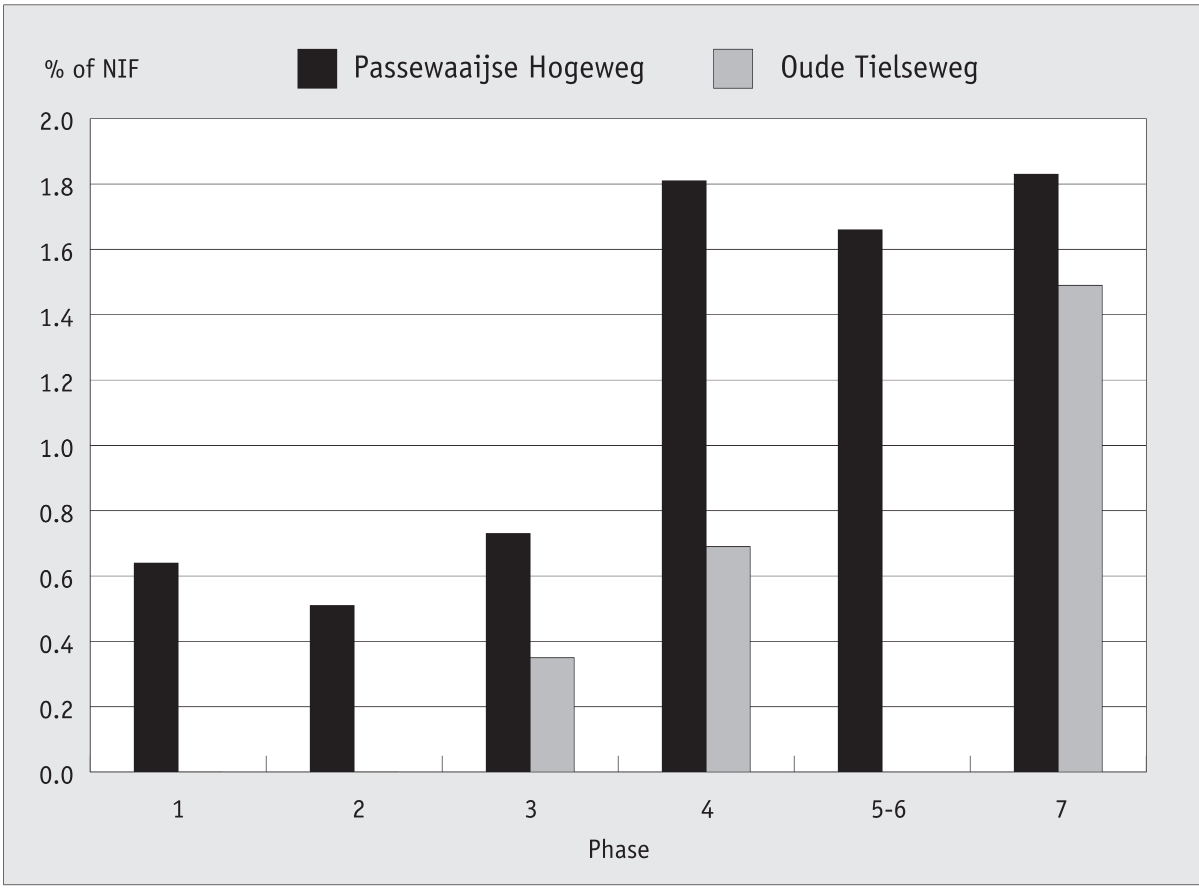

Fig. 2.12. Proportions of wild animals in Tiel-Passewaaij, out of the total number of identified fragments.

the other phases does not mean that fish was not being utilized, but only that no features suitable for sieving were found dating to those phases. Despite these limitations however, we can at least say something about the types of fish caught during the Late Roman period.

Two of the fish species are only found in rivers during the spawning season: sturgeon in late summer and houting in autumn.[36] All species prefer slow flowing or stagnant water, which means they were not caught in the main river stream but in smaller side channels or pools. Pike is found in much larger numbers than the other species, although this is partly due to the presence of loose teeth. Many of the pike remains are from very large individuals (fig. 2.11). A pike of this size would have provided food for several people. Although no cut marks were found on the fish bones, the presence of two charred fish fragments and the overrepresentation of large animals indicate that the fish bones are food refuse.[37]

In all phases, the percentage of wild animals is small. Nevertheless, this percentage shows some fluctuations and is worth a closer look. In Passewaaijse Hogeweg, the percentage of wild animal bones is stable in phases 1 to 3 (fig. 2.12). In phase 4, it shows an increase. This increased percentage remains stable during the later phases. In Oude Tielseweg, no wild animal bones were found in phases 1 and 2. Phase 4 has a higher percentage than phase 3, but both are smaller percentages than are found in Passewaaijse Hogeweg. In phase 7, the percentage has increased and is now only slightly lower than that for Passewaaijse Hogeweg.

The presence of two black vulture fragments in phase 7 is interesting (fig. 2.13). Nowadays, this bird is a very rare visitor to the Netherlands. The closest location where black vultures breed is in the Mediter-

36 Beerenhout 2003, 1.

37 Beerenhout 2003, 3.

species	PHW phase	TNF	OTW phase	TNF
mammals				
red deer	1, 2, 3-4, 4, 4-6, 4-7, 7	21 (incl. 7 antler)	4, 7	18 (incl. 3 antler)
roe deer	5-6	1	-	
wild boar	4-6, 5-6, 7	11	4, 7	5
wild cat[38]	5-6	1	4	1
stoat	3	1	-	
brown bear	7	1	-	
otter	-	-	3, 7	2
beaver	1, 7	3	-	
hare	3-4	1	-	
subtotal		**40**		**26**
birds				
goose	2, 2-3, 3-6, 4, 4-6, 5-6, 7	21	-	
duck	2-3, 3, 4, 5-6	10	-	
swan	3-6	1	-	
crow	2, 3, 5-6, 7	8	4	1
raven	5-6	1	-	
magpie	7	3	-	
common snipe	2	1	-	
water rail	3-4	1	-	
grey heron	3, 4	2	-	
crane	3	1	-	
white-tailed eagle	7	3	-	
black vulture	7	2	-	
subtotal		**54**		**1**
fish				
pike	2, 7	131	-	
sturgeon	3	1	-	
common bream	3, 7	20	-	
houting	7	1	-	
perch	7	18	-	
wels catfish	7	2	-	
cyprinidae	7	16	-	
salmonidae	7	1	-	
total		**190**		

Table 2.16. Wild mammals, birds and fish in Tiel-Passewaaij.

[38] It is possible that the two feline bone fragments are from domestic cat instead of wild cat. Domestic cat was introduced in the Netherlands in the Roman period. The small number of fragments (2 fragments compared to 155 fragments of dog) is seen as an indication that the cat fragments are more likely to be from wild cats.

Fig. 2.13a. Tarsometarsus from a black vulture, found in Passewaaijse Hogeweg.

Fig. 2.13b. Carmen, the black vulture that visited the Netherlands in 2005. Photo Martijn de Jonge.

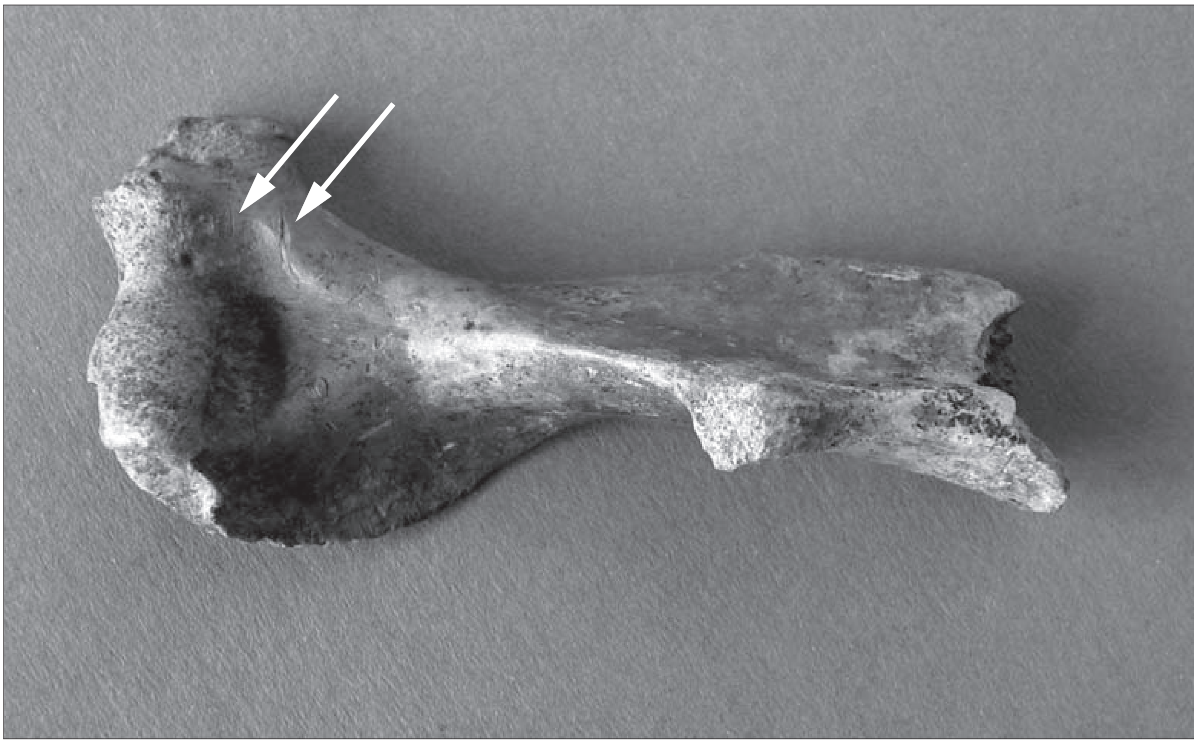

Fig. 2.14. Beaver humerus with cut marks, Passewaaijse Hogeweg.

ranean region, in France and Spain. The preferred habitat of the bird, the scarcity of archaeological finds and historical data suggests that it has always been rare in the Netherlands. Only one other archaeological find is known from the Netherlands: a beak from Roman Valkenburg.[39] Since 1800, black vultures have been seen in the Netherlands only three times: in 1948, 2000 and 2005.[40] The most recent visitor survived in the Netherlands for several months. This bird, a female named Carmen, was released from a rehabilitation centre in France in February; she reached the Netherlands in March. Unfortunately, she was hit by a train in August. The bird survived for five months in the Oostvaardersplassen, one of the few places in the Netherlands where carcasses of large animals (red deer) can be found. Black vultures are the largest birds in the Old World, with a wing span of 2.5-3 metres. It must have been a very impressive sight to the inhabitants of Tiel-Passewaaij. The bird may have been killed out of a fear that it would prey on lambs. The two fragments, a radius and a tarsometatarsus, were found in different features, but close together and dating to the same period: phase 7. Considering how rarely black vultures visit the Netherlands, we can assume that the bones are from the same individual.

It has been suggested that a higher percentage of wild animals in bone samples could reflect a higher population of wild animals in the area.[41] The higher percentage of wild animal bones in the Late Roman period could then be an indirect result of a decline in the human population. Fewer people would mean a less intensive use of the landscape, resulting in larger populations of wild animals. This explanation is too simple and does not account for human choices. It can also be claimed that an increase in hunting was necessitated by a bad agricultural year, or that it reflects a change in ideology.

Zvelebil distinguishes three different uses of wild resources in farming societies.[42] First, wild animals can be used as a buffer against bad harvests. Second, hunting can fulfill various social functions, mostly related to gender relations or an elite lifestyle. Wild animal symbolism is included in this type of hunting.

39 Verhagen 1991.

40 Van den Berg/Bosman 2001, 100.

41 Lauwerier 1988, 144.

42 Zvelebil 1992, 8-9.

Fig. 2.15. Perforated canine from a wild boar, Passewaaijse Hogeweg.

Finally, hunting can provide items of trade such as fur, hides and fat. The first and last types of hunting are similar, as both can be regarded as hunting for economic reasons. The next paragraphs will discuss the possible reasons for hunting in Tiel-Passewaaij, and the information that wild animals can provide for a reconstruction of the local landscape.

Economic role of wild animals

A first economic use of wild animals is as food. Not all animals are necessarily perceived as food; this depends on social classifications.[43] From the small numbers of wild animals we can conclude that wild animals could not have contributed substantially to the daily diet in Tiel-Passewaaij. However, some if not all wild animals that were caught were eaten. This is suggested by the presence of butchery marks and the fragmented state of the wild animal bones. Butchery marks are present on two red deer fragments (mandibula and scapula) and a beaver humerus (fig. 2.14). Butchery marks are present on only one bird bone: a goose scapula from phase 5-6. The small number of wild birds and their small size mean that they were never an important source of food. Wild birds are normally not an important source of food in farming communities.[44]

Besides meat, wild animals are a source of products that are not supplied by domestic livestock, such as antler and fur. Bones from large birds can be made into flutes or tools, and their feathers are often useful as well. Feathers serve a practical purpose as insulation and as part of arrows, but are also used for decoration and display.[45] Animals possibly hunted for their fur in Tiel-Passewaaij are wild cat, stoat, otter, beaver, hare and brown bear. Red deer were not necessarily hunted for their antler; at the right time of

43 Hamilakis 2003, 239; Tambiah 1969, 433, 440.

44 Serjeantson 1997, 256.

45 Serjeantson 1997, 257.

year, in late winter, shed antlers can be collected. That this was done in Tiel-Passewaaij is shown by two fragments of antler that were shed. Antler formed an important material for the production of tools and objects.

There is a third practical or economic reason to hunt animals in the direct surroundings of a settlement. Some mammals, such as deer and wild boar, form a threat to growing crops. Grazing mammals (and birds such as geese) are in direct competition for food with livestock. By hunting wild animals, the harvest and pasture are protected. Whether wild animals were hunted for this reason in Tiel-Passewaaij is impossible to prove.

Symbolic role of wild animals

Apart from the economic role of wild animals, they could also play a symbolic role. Hunting wild animals would not only have provided valuable raw materials and an additional food source, but also had various cognitive associations. Wild animals often represented the wilderness, marginality, the unfamiliar, as opposed to the domestic realm, the familiar.[46] Wild animals probably featured in local myths and stories. Ethnographic evidence shows that birds often have a symbolic role in society.[47] Hunting wild animals can be associated with masculinity and warriorship.[48] Hunters use their skill to kill wild and sometimes dangerous animals.[49] Hamilakis described how hunting can be an elite practice used to generate power.[50] In medieval Europe, for instance,serving wild birds at feasts demonstrated the status of the host.[51]

Zvelebil suggested that the social and ideological role of wild animals is apparent in representations of animals on objects or in unusual patterning of bones indicating ritual treatment.[52] Wild animals clearly had a symbolic significance to the people in Tiel-Passewaaij. This is demonstrated by their incorporation in special animal deposits,[53] and by the find of a perforated wild boar tusk used as a pendant (fig. 2.15). Images of wild animals on objects are rare, but include a wild boar on a bronze key. Amulets made of antler have been found mainly in military contexts, but one find from Wijk bij Duurstede indicates that they can be found in rural settlements as well.[54] They were supposed to protect against the evil eye. This protection was often ensured by the image of a phallus or vulva.[55] However, the fact that not all amulets have images indicates that the antler itself offered protection as well. Nicolay described amulets as being part of military horse gear.[56] Two types can be distinguished: the first type consists of the base of a red deer antler, while the second type is a *lunula* shape formed by two wild boar canines. Both amulets were probably worn on the breast of the horse. The perforated wild boar tusk from Passewaaijse Hogeweg may have been used in a similar fashion.

There are two species of bird I would like to discuss briefly here. First, the white-tailed eagle is regularly found in excavations. Eagle feathers may have been useful, but symbolism could also have played a part in hunting such a large, powerful bird of prey. The black vulture would probably have been hunted for the same reasons. The second bird is not strictly a species, but constitutes all the black birds of the crow family: crow, rook, raven and jackdaw. Crow bones were found in four phases in Passewaaijse Hogeweg and in one phase in Oude Tielseweg. Although the total number of fragments is low (9), it is high compared to numbers of other bird species (except geese and ducks). One bone of raven was found in Passewaaijse Hogeweg as well. Crow and jackdaw were also found at the temple site of Empel.[57] In a discussion of the animal bones from this temple, Seijnen referred to other finds of crow bones in cult sites,

46 Hamilakis 2003, 240-241.
47 Serjeantson 1997, 257.
48 Hamilakis 2003, 240.
49 Hamilakis 2003, 240, 243.
50 Hamilakis 2003.
51 Serjeantson 1997, 256.
52 Zvelebil 1992, 10.
53 Special animal deposits will be discussed extensively in chapter 3.
54 Hottentot/Van Lith 1990, 194-205.
55 Hottentot/Van Lith 1990, 187, 191.
56 Nicolay 2007, 58-59.
57 Seijnen 1994, 164.

and suggested that crows may have played a role in rituals.[58] This idea is confirmed by the find of a crow skeleton in a special animal deposit in Passewaaijse Hogeweg.[59] Other finds of black birds belonging to the crow family include a crow from Kesteren-De Woerd, a raven from Vlaardingen-Hoogstad 6.36 and a jackdaw from Castricum-Oosterbuurt.[60] An alternative explanation is that members of the crow family occur regularly in excavations because they are commensals, i.e. they live in close proximity to humans. However, so do many other bird species (sparrow, starling) which are not found frequently, although this could be related to their smaller body size. While geese and ducks are also found frequently, and in larger numbers, they were probably hunted for food and down.

Landscape

Wild animals can help us get an idea of the local landscape. However, we must beware of the effect of trade. In the absence of a local population of deer, for instance, antler could have been traded over long distances. It is important to realise that the wild animals found in Tiel-Passewaaij are not a direct reflection of the relative abundance of different species in the area. Some species may have been hunted preferentially, for different reasons. Some species may even have been illegal to hunt.

What can the wild animals found in Tiel-Passewaaij tell us about the landscape? First, that not all of the local landscape was cultivated. There must have been enough suitable uncultivated land in which large mammals lived. It has been assumed that the Eastern Dutch River Area was densely occupied, with all available land cultivated or used as pasture. Even then, wild animals would have found a suitable habitat in the marshy areas of the river landscape. The low-lying flood basins were covered in grassland and river forest. This kind of habitat will support red deer, roe deer, wild boar and wild cat. Stoats will live in almost any type of habitat. Hares can live on cultivated farmland. The presence of otter and beaver, as well as the bird species found in Tiel-Passewaaij, remind us of the importance of water in this river landscape. Goose, duck, swan, common snipe, water rail, grey heron and white-tailed eagle are all dependent on wetlands or open water. The single fragment of brown bear cannot be taken as an indicator of the local landscape. The fragment, a tooth, could have reached Tiel-Passewaaij as part of a pelt, since the skull and claws are often left attached to a pelt. Archaeological bear finds from the Roman period in the Netherlands are limited to a find from Valkenburg.[61]

Conclusion

The landscape of the Eastern Dutch River Area was used intensively by humans; this does not exclude that wild animals lived there as well. They would have found a place to live in the wooded areas on the river banks, the extensive reed beds and the grassy flood plains. The small numbers of wild animals found in Tiel-Passewaaij suggest that their contribution to the local economy must have been marginal. A low contribution of wild animals to the economy is typical for almost all rural settlements in the Roman period. Meat of wild animals was consumed, perhaps at special occasions or on special days, but never in large quantities. Antler was used to make artefacts. Although the contribution of wild animals to the diet and the local economy may have been negligible, this does not mean that wild animals were not important to the inhabitants of the two settlements. The symbolism of hunting and wild animals was important. That wild animals did indeed have a symbolic function can be seen from their presence in special animal deposits (chapter 3).

58 Seijnen 1994, 165.

59 Special Deposit 2, see 3.3.7.

60 Zeiler 2001, 268, table 9.6; Van Dijk/Robbers/De Ridder 2003, 8, table 2; Lauwerier/Laarman 1999, 231, table 8.7.

61 Verhagen 1990.

2.4 PRODUCTION OF A SURPLUS? INTERACTION WITH URBAN AND MILITARY MARKETS AND THE ROMAN ADMINISTRATION

Several factors should be considered when reconstructing the rural economy of a community such as that of Tiel-Passewaaij. The rural economy is determined by the size of the local population, the available technology and the landscape. External factors such as taxation or the availability of markets can provide a stimulus to produce a surplus. Cultural factors can play a role as well, explaining what seem to be non-rational decisions in animal husbandry. Examples of this are keeping alive surplus animals because they provide status and avoiding the consumption of certain types of meat.

Despite the fluctuations of the population of Tiel-Passewaaij, population size is not considered in interpreting the results from the animal bone analysis. The first reason for this is that the animal bones do not provide absolute data. Unlike the number of excavated house plans which can be assumed to be representative of the actual number of houses inhabited during a certain phase, the number of animal bones per phase is determined by refuse disposal practices and taphonomical processes. It does not reflect the actual number of animals slaughtered in a particular phase. Therefore, it is impossible to interpret a smaller number of animal bones in phase 3 compared to phase 2, for instance, as a decrease in the number of animals kept in Tiel-Passewaaij during that phase. A second reason is that the assumption is made that the population size did not exceed the maximum that can be supported by the local landscape. A further assumption is that for every phase, the local population needed to be fed first before a surplus can be produced. More people represented more mouths to feed, but also more labour to grow crops and tend to livestock. The relatively small changes in population size found in Tiel-Passewaaij may not have affected the agricultural economy to any large extent.

The most important technological change during the Roman period is that the size of cattle and horses increased. This size increase was a result of breeding larger, imported animals with the smaller, local stock. The stimulus behind the change to start breeding larger animals may have been provided by the Roman authorities. Paragraph 2.4.5 discusses the evidence for an increase in size of cattle and horses in Tiel-Passewaaij.

The local landscape obviously had an influence on the agricultural economy. All four common domestic species were found in Tiel-Passewaaij, which proves that they could all be raised successfully in this landscape. The flood basins provided plentiful grazing grounds for livestock, especially horses. If it were not for the need to collect manure for arable agriculture, cattle may have been kept in the flood basins year round. The continuity of the byre house during the Roman period leads to the conclusion that cattle were stabled for part of the day or part of the year. High or low percentages of pig have been related with the presence or absence of woodland suitable for mast feeding.[62] This type of deciduous woodland, containing oak and beech, was rare in the Eastern Dutch River Area. The absence of woodland where pigs could feed only put constraints on large-scale pig keeping. Small numbers of pigs could be kept in the settlements and fed with, amongst others, agricultural waste products. The landscape put more limitations on the types of crops that could be grown. Barley, emmer wheat, oats and rye were more suitable crops for the Eastern Dutch River Area than bread wheat and spelt wheat.[63] The limited area suitable for arable agriculture, in combination with the number of people available for labour, put restraints on the amount of produce.

Chapter 1 briefly outlined the main external factors that influenced the rural economy of Tiel-Passewaaij: taxation, the Roman army and markets. While the Batavians were probably exempt from taxation until the Batavian revolt in AD 69, they had to pay taxes for the rest of the Roman period. To

[62] Kooistra 1996, 124; Lauwerier 1988, 127.

[63] Kooistra 1996, 120.

distinguish between the production of a surplus for a market and production for taxation is very difficult. In the case of Tiel-Passewaaij, both factors influenced the rural economy from AD 69 onwards. Early imports of pottery indicate that surplus goods were already traded in the first half of the 1st century AD.

2.4.1 Later Iron Age and early Roman period

The economy in this period is not far from a subsistence economy, with grain and animal products being produced mainly for consumption within the settlement. Some goods were produced as a surplus. Exchange networks existed between different settlements and different tribes, often covering large distances. Cattle, with their cultural and practical values, played an important role in exchange systems and could also be the subject of raids.[64] Cattle and sheep formed the basis of the livestock economy in Tiel-Passewaaij. Meat was produced by sheep, cattle and pigs. Milk from cows and sheep was taken and made into cheese. Wool was taken from the older sheep and spun locally. Cattle were kept inside the house for at least part of the year. During this time, manure could have easily been collected to fertilise the arable fields. There is a high degree of continuity in livestock management between the Iron Age and the early Roman period.

Considering that during phase 2 a large number of soldiers were first stationed along the Rhine, at least some of the food they needed must have been produced locally. However, the mortality profiles for both sheep and cattle are very similar to the Iron Age profiles, indicating that no specialised production of animals for meat took place. This does not mean that surplus animals were not sold to or taken by the army as taxes, only that this did not affect local animal husbandry.

2.4.2 Wool production in the second half of the 1st century AD

In Passewaaijse Hogeweg, sheep increased in number in phase 3.1 (AD 40-100) compared to phase 2 (50 BC – AD 50). In phase 3.2 (AD 100-140), the proportion of sheep started to drop. Sheep were very important to the local economy during the second half of the 1st century, but this importance rapidly declined after around 100 AD. Apart from the rise in numbers, an important change in the exploitation of sheep can be found in phase 3: the age distribution is very different to that in the previous phase. Instead of a slaughter peak between 6-12 months, we now find equal numbers being killed per category between 6 months and 6 years. This reflects a new emphasis on wool. The presence of animals in the category 6-12 months shows that milk is still being used, but not to the same extent. The change in strategy could also reflect a change in the availability of winter fodder, with enough animal feed now available to keep on more animals.

Wool production: supply and demand

Although we can say nothing about absolute numbers, the increase in the percentage of sheep and the change in age distribution show that the production of wool gained in importance in phase 3. Assuming that the manner of exploitation in phase 2 supplied enough wool for the requirements of the household, an increased emphasis on wool suggests that surplus wool was produced specifically for a market. The assumption here is that a rural settlement such as Passewaaijse Hogeweg would have been largely self-sufficient in the Late Iron Age and early Roman period. A complementary source of evidence on wool

[64] Hiddink 1999, 174-177.

Fig. 2.16. Spindle-whorls found in Passewaaijse Hogeweg. Spindle-whorls are evidence for local woolworking, which is often absent when wool is produced specifically for a market.

is formed by spindle-whorls and loomweights (fig. 2.16). In Passewaaijse Hogeweg, this find category is overrepresented in phase 2.[65] There seems to be a contradiction here. The spindle-whorls suggest that wool-working had its peak in phase 2 and decreased in phase 3, while the bones indicate that wool production increased in phase 3. A third type of evidence is needed to explain this. We will return to this apparent contradiction in 2.5.

Tiel-Passewaaij is not the only rural settlement that shows specialisation in wool production. Several other settlements in the Eastern Dutch River Area also show a high percentage of sheep bones in the 1st century, whereas this is absent in other settlements. It seems that the settlements specialising in wool production already had a sizeable sheep population during the Late Iron Age and the beginning of the 1st century.

Apart from the settlements in Tiel-Passewaaij, those in Kesteren, Medel, and Rijs en Ooijen all have high sheep percentages in the 1st century AD (table 2.17). At Kesteren, three phases were distinguished for the period between AD 1 and 120. The percentage of sheep remained stable at 40 % throughout

65 Heeren 2006, 139, table 8.10. A word of caution is needed at this point. Although the absolute numbers of spindle-whorls and loomweights decreased after phase 2, it is by no means certain that the relative number (compared to the total number of pottery fragments) also decreased. Unfortunately, total numbers of pottery per phase were not available for Passewaaijse Hogeweg. The relation between the number of spindle-whorls and loomweights and the total number of pottery fragments has been analysed for Oude Tielseweg, however, where the percentage of these woolworking tools declined in phases 3 and 4. Verhelst 2001, 54, table 5.1

Site	Date/phase	% sheep	Total number of identified bones
Tiel-PHW	2: 50 BC-AD 50	43.8	1719
Tiel-PHW	3.1: AD 40-100	60.5	372
Tiel-OTW	2: AD 25-70	36.7	1032
Tiel-OTW	3: AD 70-120	28.3	279
Kesteren-De Woerd [66]	a-b: AD 1-80	39.9	1056
Medel [67]	AD 15-70	46.2	184
Rijs en Ooijen [68]	LIA-early Roman	31.7	167
Ewijk I [69]	LIA-early Roman	9.6	1102
Wijk bij Duurstede-DH [70]	LIA-early Roman	9.7	236
Heteren II [71]	AD 50-150	14.7	211

Table 2.17. Percentages of sheep bones out of totals for domestic mammal fragments for rural settlements in the Eastern Dutch River Area.

these phases, and only started to decline after AD 120.[72] Sites that do not show high percentages of sheep for this period include Wijk bij Duurstede-De Horden, Heteren and Ewijk. Druten shows a rather high percentage during the Late Iron Age/early Roman period (20 %), but this percentage decreased to 16 % around the start of the 2nd century.

In the second half of the 1st century, there was clearly a demand for wool in the region. Even before the arrival of the Roman army in the Eastern Dutch River Area, sheep were an important part of the local economy. Shifting the focus of production strategies could have been accomplished quickly and easily. Passewaaijse Hogeweg already had a sizable flock of sheep and could answer the demand for wool by changing the way they managed the flock. As the emphasis on horse increased in the 2nd century, the relative number of sheep, and thus the production of wool, dropped steadily. We can only speculate on the reason for the end of the specialised wool production in Tiel-Passewaaij. Was wool no longer a desirable commodity on the markets? Or was it more lucrative to concentrate on horses? If wool was mainly produced for the army, a decline in wool can possibly be associated with the establishment of new supply lines, or a decline in the demand for wool. It could even be connected with the leaving of the 10th legion from Nijmegen in AD 102/104.

Textile industry

When we find rural settlements specialising in wool production, we would expect the existence of a textile industry that was the buyer of the raw wool. It is possible that a textile industry existed in Nijmegen, although no indications have yet been found for this in Nijmegen itself. It is also possible that the wool produced in Tiel-Passewaaij (and other rural settlements) during the 1st century AD was transported much further, to textile production centres such as Trier or *Gallia Belgica*. On the other hand, wool may have been produced for the army.

The importance of the textile industry for the Roman empire is known from references in classical texts.[73] Jongman also emphasised the importance of the textile industry in antiquity. After food, clothing

66 Zeiler 2001, 268, 269.

67 Groot 2005, 58.

68 Groot 2003, 64.

69 Lauwerier 1988, 92.

70 Laarman 1996b, 379.

71 Lauwerier 1988, 90.

72 Zeiler 2001, 268-270, tables 9.6, 9.8 and 9.10.

73 Drinkwater 1977/78, 109, 112.

and housing were the main items on which money was spent.[74] Drinkwater described the nature of the textile industry in the Trier region.[75] The textile industry was a complicated business, with many different activities and people involved. After shearing the sheep, the wool had to be washed. The most sensible option was to wash the wool before transport, as this will have made a big difference in weight.[76] The wool was transported to a central place, where it was spun and woven into cloth.[77] Raw wool would probably have been bought from farmers by a middleman and sold on to professional textile merchants.[78] Drinkwater described several criteria necessary for the successful development of a textile industry. First, there is the presence of a local small-scale wool industry. A second factor is pressure from a growing population. Next, a stable government is needed. Finally, there has to be a market where the end product can be sold, and producers need to have access both to this market and to the raw materials.[79] We have already seen that sheep formed a major part of the Late Iron Age economy in some rural settlements in the Eastern Dutch River Area. The arrival of the Roman army satisfied the remaining criteria, providing peace and a potential market.[80]

Management of sheep in the Eastern Dutch River Area

The wet Eastern Dutch River Area does not seem the perfect setting for sheep-raising. Liver fluke is a common parasite of sheep and cattle. Affected animals show a low productivity: low weight gain and low milk production.[81] Because liver fluke is dependent on a type of aquatic snail as part of its life cycle, sheep raised in wet environments are at increased risk.[82] Sheep kept in humid conditions are also likely to develop hoof problems.

However, the relatively high percentage of sheep bones in the Iron Age phase at Tiel-Passewaaij (20-30 %) shows that sheep can be raised successfully in the area. Sheep could be grazed on the higher stream ridges and the fallow arable land. The flood basins would be relatively dry in summer. Sheep that grazed the flood basins throughout the year may have been susceptible to liver fluke and hoof rot, but that does not mean that sheep did not graze there. These sheep may have been less productive than sheep raised in better conditions, but they would still have satisfied the apparent need for wool. The choice for the local inhabitants was whether to raise sheep for a product in demand, or whether not to do so. Or perhaps there was no choice involved at all. The Roman administration may have imposed taxes in the form of wool, thus forcing a change in livestock strategy.

2.4.3 CATTLE AND ARABLE AGRICULTURE, OR THE PRODUCTION OF BEEF FOR A MARKET?

The biggest change in the exploitation of cattle is found with the transition from phase 3 to 4. In phases 4 to 6, more cattle lived to adulthood or even old age. This does not reflect a concentration on dairy products, because then we would expect to find more animals killed at young ages. There are two explanations for the overrepresentation of older animals. Either the older cattle were exploited for manure and labour, or the overrepresentation of older cattle is a result of younger cattle being sold as a surplus.

74 Jongman 1988, 155.
75 Drinkwater 1977/78.
76 Frayn in Jongman 1988, 169.
77 Drinkwater 1977/78, 115.
78 Drinkwater 1977/78, 115.
79 Drinkwater 1977/78, 123-124.
80 Drinkwater 1977/78, 124.
81 http://www.biosci.ohio-state.edu/~parasite/fasciola.html
82 http://au.merial.com/producers/sheep/disease/fasci.html

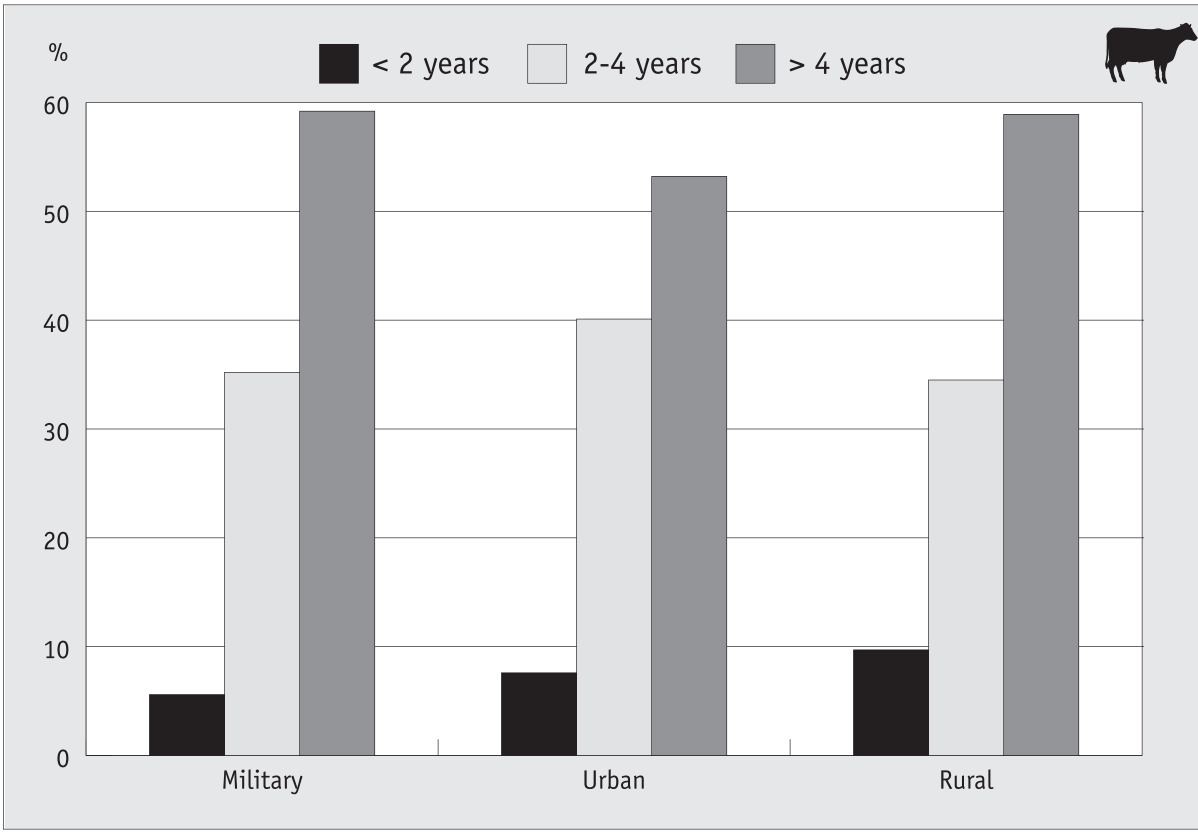

Fig. 2.17. Production-consumption model for cattle in the Eastern Dutch River Area in the Middle Roman period, based on a rural site (Passewaaijse Hogeweg), urban site (Nijmegen-Maasplein) and military sites (Nijmegen *castra* and *canabae*): percentage of cattle killed in three broad age categories. The similar age distribution suggests an absence of specialised beef production.

Intensification of arable agriculture

The first explanation would suggest an intensification of arable agriculture. Apart from calves, the main products of older cattle are manure and labour. Both are indispensable for arable agriculture. That arable agriculture gained in importance in this period is suggested by the appearance of large granaries in Passewaaijse Hogeweg.[83] If we could discover the sex ratio for cattle in this period, we might be able to say which explanation is more likely. If manure and labour were the main products, we would expect to find equal numbers of males and females. An overrepresentation of females would suggest breeding as a production strategy. Unfortunately, the number of bones that could be sexed is too small to say anything about the sex ratio of cattle. Only three pelvic fragments from phases 4 to 6 could be sexed and were from female cattle. For two metacarpals, the index of distal breadth against greatest length indicated that one was from a female animal while the other was from a male.[84]

Specialised production of beef for a market

The second explanation suggests an intensification of livestock breeding. Selling cattle at market as young adults would explain the relative scarcity of younger animals. Both cattle and sheep were best transported to the market on the hoof, as living animals rather than slabs of meat. Meat spoiled quickly, especially

[83] Heeren in prep.; Groot *et al.* in prep.

[84] Maltby 1994, 90.

in warmer weather, and required wagons or other means of transportation. Moving living animals only required some manpower to drive them to market. Instead of the inhabitants driving their own animals to market, it is also possible that a middleman visited the settlement, bought animals directly from the rural settlements and arranged for their transportation. Either way, selling young animals for meat would result in their under-representation in the animal bone assemblage from the settlements in Tiel-Passewaaij.

The problem is that the sale of live animals is not easily detectable. After all, the evidence is removed from the site: the cattle bones are deposited somewhere else. The only way to find out whether there was a market-oriented production of beef in rural settlements in the Eastern Dutch River Area is to look for the evidence in the consumption sites: towns, military sites and rural temples. There is much to learn from previous studies into urban-rural relationships. Maltby's study is particularly valuable because it compared data on animal bones from two Roman towns in southern Britain with data from rural settlements in the immediate vicinity.[85] The types of data used were age and measurements. For sheep, the ratio of hornless to horned sheep was also taken into account. The predominance of adult female cattle shows a clear selection of animals of a certain age and sex. These cattle may be the animals no longer required by rural settlements, or they may represent a dairy herd kept by inhabitants of the town. The presence of large, hornless sheep in Early Roman Winchester, a type of sheep not found in nearby rural settlements until the Late Roman period, indicates that animals were not just acquired from local settlements but derived from various sources.[86] What Maltby's study showed was that different supply systems may have existed for different species of animal. Although Maltby included metrical data, I will focus on age data for the Eastern Dutch River Area.

Towards a production-consumption model

If rural settlements produced cattle specifically to sell at market, they would be sold as young adults. That is the age category that would then be overrepresented on the consumption sites. If, on the other hand, the consumption sites show mainly older cattle, this would suggest that selling cattle was only a by-product. In that case, cattle were sold when they became less useful to the settlement (for instance old plough cattle). When cattle of all ages are found, this would point to a non-specialised system, where those cattle would be sold that were "surplus to requirement". In that case, cattle were not deliberately reared for a market.

Nijmegen is the best site to use for a comparison. Nijmegen is the urban as well as the military centre in the region, and various animal bone assemblages from Nijmegen have been analysed. The assemblages we will consider here are those from the *castra* and *canabae*, and that from the Maasplein.[87] However, a straightforward comparison of cattle mortality profiles is not possible. First, the chronologies of Passewaaijse Hogeweg and Nijmegen are different. However, Lauwerier's data for the different periods in Nijmegen show continuity of cattle mortality profiles.[88] This is a good sign: apparently, there were no drastic changes in the ages of cattle consumed in Nijmegen. This means that the fact that the assemblages used here have slightly different time frames is less of a problem. Second, the use of different ageing methods means that the results are not readily comparable. The discrepancy between tooth wear and epiphyseal fusion data has been mentioned earlier.

While Lauwerier's mortality profiles are based on epiphyseal fusion, Filean used the quadratic crown height method, although he also included data on epiphyseal fusion for the Maasplein assemblage. Despite these problems, the age data available for cattle from Nijmegen have been compared with the data from Passewaaijse Hogeweg and are presented in a consumption-production model. Lau-

85 Maltby 1994.

86 Maltby 1994, 90, 94, 100.

87 Lauwerier 1988; Filean 2006.

88 Lauwerier 1988, 134.

werier's data for the *castra* and *canabae* represent the army, while Filean's Maasplein data represent the urban market. For the rural side, the data from Passewaaijse Hogeweg phases 4-6 are taken. The model combines both tooth wear and epiphyseal fusion data for the urban and rural assemblages. No tooth wear data were available for the military sites in Nijmegen. To reduce the bias inherent to combining results from different ageing methods, very broad age categories were used: younger than 2 years, 2 to 4 years, and older than 4 years. Of course, this model is still only a very crude one, but it turned out to be more useful than expected.

Despite the fact that only four sites were included in the model, and that different ageing methods were used for the different assemblages, the model does show a clear pattern (fig. 2.17). The mortality profiles are very similar for the three categories: urban, military and rural. The amount of animals killed in the first two years of life is low: between 3 and 13 %. The percentage of animals killed between two and four years old varies between 34 and 42 %, while 51-65 % of cattle survived beyond four years. The similarity between the age profiles from Nijmegen and rural settlements shows that cattle were not specifically produced for this market. If that were the case, we would find cattle killed in the second and third year of life, instead of the adult animals that were found there. What the model shows is that rural settlements selected adult cattle to send to market, animals that had already been useful for several years and were no longer required. They were raised for the settlement's own use first; selling them for meat was a secondary use. There is no evidence in Passewaaijse Hogeweg for specialised rearing of cattle for beef. This model is only a first step in analysing the system of beef production in the Eastern Dutch River Area. Ideally, a model would include much more data from a number of sites. Metrical data could clarify the results and provide information on the sex ratios of cattle.

This lack of evidence for a specialised production of beef is contrary to expectations. However, the study of medieval York showed a similar absence of specialised production of meat.[89] Most of the cattle and sheep found in York were adult animals. This implies that the rural settlements supplying these animals to the town raised cattle for traction and sheep for wool. Surplus animals were not sent off to town until several years' worth of labour, wool or offspring had been taken by the rural settlement. York was one of the major cities in medieval Britain, and yet it did not have a supply of animals raised only for meat. Perhaps the assumption that the towns and army camps in the Eastern Dutch River Area in the Roman period required beef production is simply wrong.

One other category of consumption site needs to be be considered here. The three temples from which animal bones have been analysed are Elst-Grote Kerk, Elst-Westeraam and Empel. At all temples, most cattle were killed between 15 and 30 months.[90] These young cattle must have come from rural settlements in the area, as there are no indications that cattle were bred at the temple sites. This could be a destination for which rural settlements raised young cattle. However, the killing of cattle at these temples is unlikely to have been large-scale. Only a few settlements would be needed to fulfill the needs for young sacrificial animals.

Continuity in cattle raising

The proportion of cattle stayed fairly constant throughout the Roman period. Mortality profiles indicate that milk was mainly used in phases 1 and 2. While meat never lost its importance, the delay of slaughter in phases 4 to 6 indicates that the value of other products, such as manure and traction, increased. Although the main products for which cattle were exploited varied, the existence of the byre house in all phases in Tiel-Passewaaij indicates that cattle raising changed little in

[89] O' Connor 2000, 163.

[90] Robeerst 2005, 97; Seijnen 1994, 165-166; Lauwerier 1988, 116-117, 134.

practice.[91] While the animals almost certainly grazed in the flood basins, the need to collect manure meant they were stabled for part of the year, or part of the day. The value of manure cannot be overestimated. How valuable a product it could be is demonstrated by the example of a 19th-century farm not far from Tiel-Passewaaij, where the dunghill was valued to the price of two milk cows.[92] A consequence of stabling cattle is the need to provide fodder. Agricultural waste products such as cereal chaff and straw could be fed to animals, but hay was probably grown as well.[93] Grazing cattle on fallow fields or after crops were harvested had the advantage of feeding cattle on waste products while they fertilised the fields at the same time. It is of course possible that only part of the cattle herd was stabled, while the rest were kept in the flood basins. This is what makes estimates of herd size based on stable size unreliable.

2.4.4 HORSE BREEDING AS A SPECIALISATION

A high percentage of horse bones is found in many rural settlements in the Dutch River Area. Although horse meat may have been consumed, this does not seem to have been the main product of horses in this region. Horses were used for riding and light traction, but not for heavy traction.[94] The assumption is that many communities in the Eastern Dutch River Area specialised in breeding and/or training horses for the Roman army.[95] Lauwerier and Robeerst's article on horses in the Netherlands in the Roman period suggested that only some of the horses needed by the army were supplied by local rural settlements.[96]

The horse breeding hypothesis is mainly based on literary sources in combination with a high percentage of horse bones in rural settlements. It has been readily accepted because it ties in so nicely with the reputation of the Batavians' horsemanship. However, there is a problem related with the theory. Laarman mentioned this for Houten-Tiellandt, where the percentage of horse bones was rather high but foals were almost absent.[97] The situation is similar in Passewaaijse Hogeweg. By taking the local landscape, the nature of horse breeding, and the hardiness of the native horses into account, an explanation can be found for this apparent problem. I will start off by making two important assumptions: first, that the Roman army based in the Lower Rhine Area had a need for horses; and second, that they acquired at least some of these horses locally.

It was not just the Roman cavalry units that used horses. Every legion had a number of horses that were used by officers and for transport of goods.[98] The system by which horses were approved and their military career was organised was complex. There is no evidence for a central supply of military horses.[99] Horses could be requisitioned in times of war, and were purchased from civilians or taken as taxes in times of peace. In the Later Roman Empire, imperial stud farms existed in Spain, Thrace and Asia Minor.

91 Although there is little proof that cattle were stabled in the byre houses, their occurrence throughout the Roman period correlates with the dominance of cattle in most settlements. If byre houses were mainly used for other species, for instance sheep, we would expect their numbers in Passewaaijse Hogeweg to decline along with the decrease in the proportion of sheep. While cattle are assumed to be the main species stabled in byre houses, other animals may have been stabled along them. A second argument for placing cattle in byre houses are the stables found from phase 3 onwards in Passewaaijse Hogeweg, when the specialisation in horse breeding started.

92 Brusse 2002, 24.

93 Evidence for hay in the Roman period is found in a military context in Dormagen. Knörzer 1979, 131.

94 The horse collar, which enabled horses to use their full power for traction, was not introduced in Europe until the early Middle Ages.

95 Hessing 2001, 162; Laarman 1996b, 377; Roymans 1996, 82.

96 Lauwerier/Robeerst 2001, 278-279.

97 Laarman 1996a, 356.

98 Davies 1969, 429-430; Hyland 1990, 71.

99 Davies 1969, 434-435.

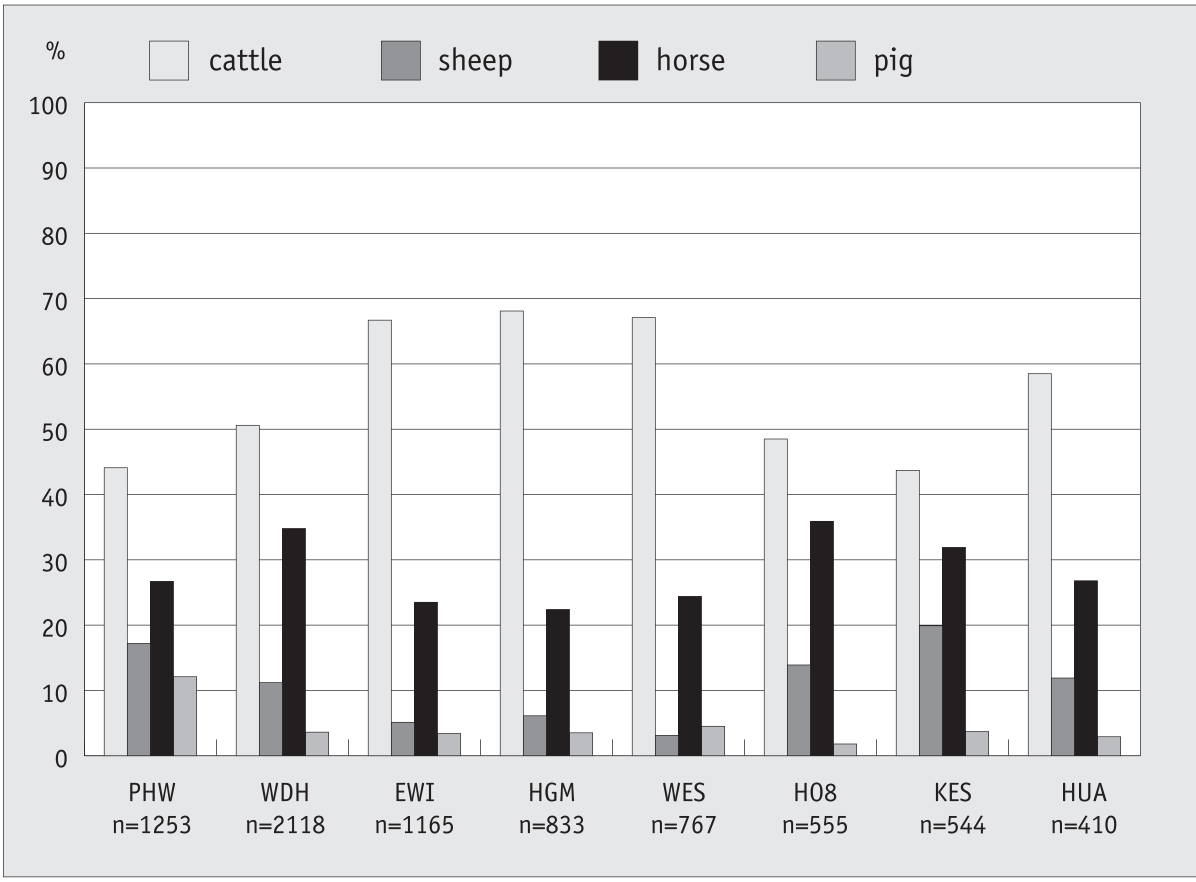

Fig. 2.18. Species composition in 2nd-century rural settlements in the Eastern Dutch River Area with a high percentage of horse bones. PHW: Tiel Passewaaij (Passewaaijse Hogeweg); WDH: Wijk bij Duurstede-De Horden, Laarman 1996b; EWI: Ewijk, Lauwerier 1988; HGM: Geldermalsen-Hondsgemet, Groot in prep. b; WES: Oss-Ussen Westerveld, Lauwerier and IJzereef 1998; HO8: Houten site 8A, De Vries and Laarman 2000; KES: Kesteren-De Woerd, Zeiler 2001; HUA: Huissen-Loostraat site A, Groot in prep. c.

The horses found in the Roman fort at Newstead, Scotland, showed that various breeds of horses were used by the army.[100] Hyland states that "throughout the Empire production of sufficient stock must have been a constant burden and all sources must have been tapped."[101] In the selection of cavalry horses, temperament may have been more important than size.[102]

In the next paragraphs, I will discuss the evidence for horse breeding in Tiel-Passewaaij. First, we must find out whether horse meat was eaten in Tiel-Passewaaij. Next, we will discuss our expectations for a bone sample from a horse breeding site. We will then look at the results from Tiel-Passewaaij and establish whether horse breeding was an important part of the local economy. After briefly discussing non-osteological evidence for horse breeding and training, we will look at the local landscape and see how horse breeding fitted in there.

Consumption of horse meat

The Roman taboo on the consumption of horse meat is too readily taken as an indication that the local inhabitants of the Eastern Dutch River Area had similar inhibitions.[103] In reality, there are indications

[100] Davies 1969, 453, 456.

[101] Hyland 1990, 77.

[102] Hyland 1990, 78-80.

[103] Hessing 2001, 162.

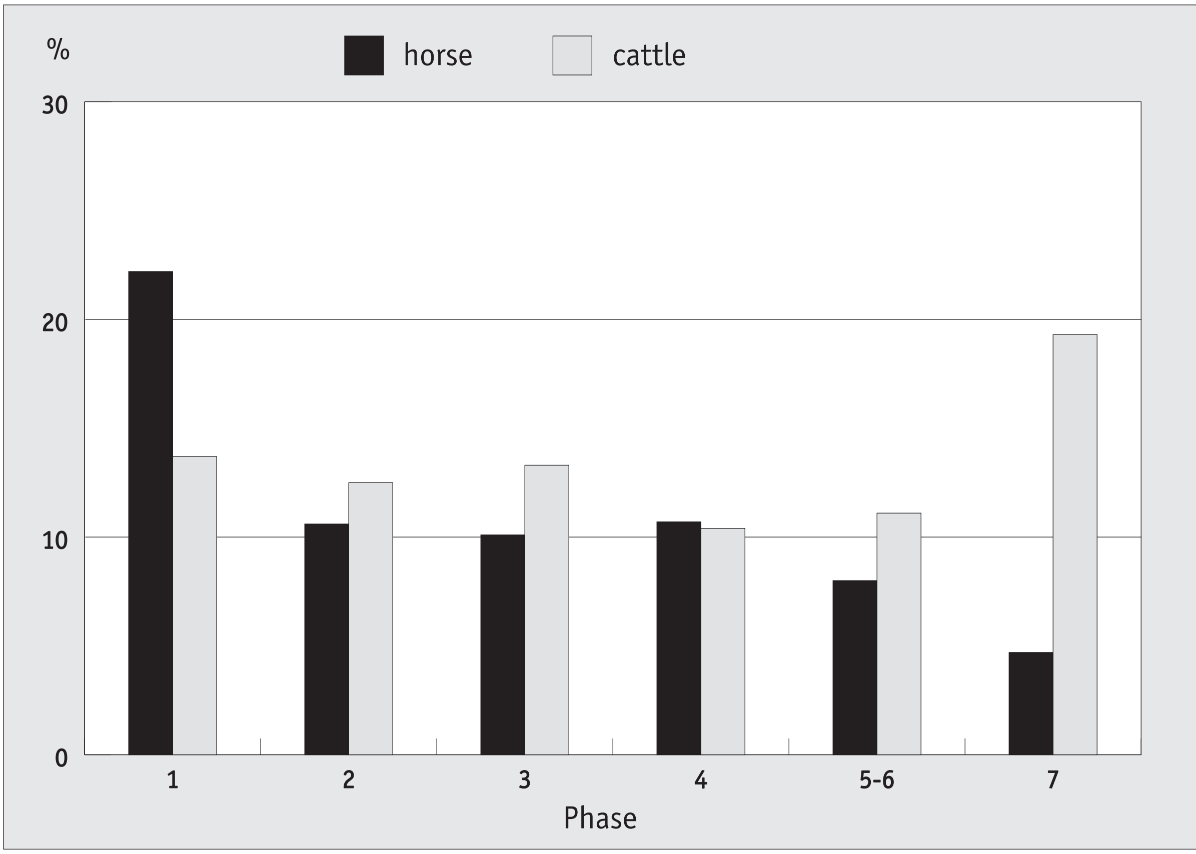

Fig. 2.19. Proportions of horse and cattle bones with butchery marks per phase for Passewaaijse Hogeweg, out of the total number of fragments for that species.

that horse meat was consumed, at least in some settlements and at certain times. To establish whether horse meat was consumed, three different aspects can be used. First, there is the occurrence of butchery marks, and the frequency with which they are found on horse bones compared to cattle bones. Second, the fragmentation of horse bones can provide information about the way a horse carcass was treated. Again, fragmentation of horse bones is best compared with that for cattle bones. The presence of articulated horse remains is used as an argument against the consumption of horse meat.[104] Next, the presence and frequency of gnawing marks provides information on the disposal of horse remains. It is important to take gnawing marks into account in this discussion, because segmentation of horse carcasses and the removal of meat from the bones to provide dog food has been used as an argument to explain the presence of butchery marks on horse bones.[105] Again, we look for differences between horse and cattle. Because these two species are roughly the same size, a similar way of butchery is expected. Finally, the precise location of butchery marks can clarify what happened to the animal. Skinning, segmentation and the removal of meat all leave distinctive butchery marks.

In Tiel-Passewaaij, butchery marks were found on horse bones from all phases. In both Passewaaijse Hogeweg and Oude Tielseweg, the percentage of horse bones with butchery marks was markedly higher for phase 1 than for the subsequent phases (fig. 2.19). For phases 2 to 4 in Passewaaijse Hogeweg, the percentage of bones with butchery marks was stable. It declined slightly in phase 5-6 and further in phase 7. Only in phase 1 and 7 did the percentage of horse bones with butchery marks differ substantially

[104] Lauwerier 1999, 107.

[105] Laarman 1996a, 356.

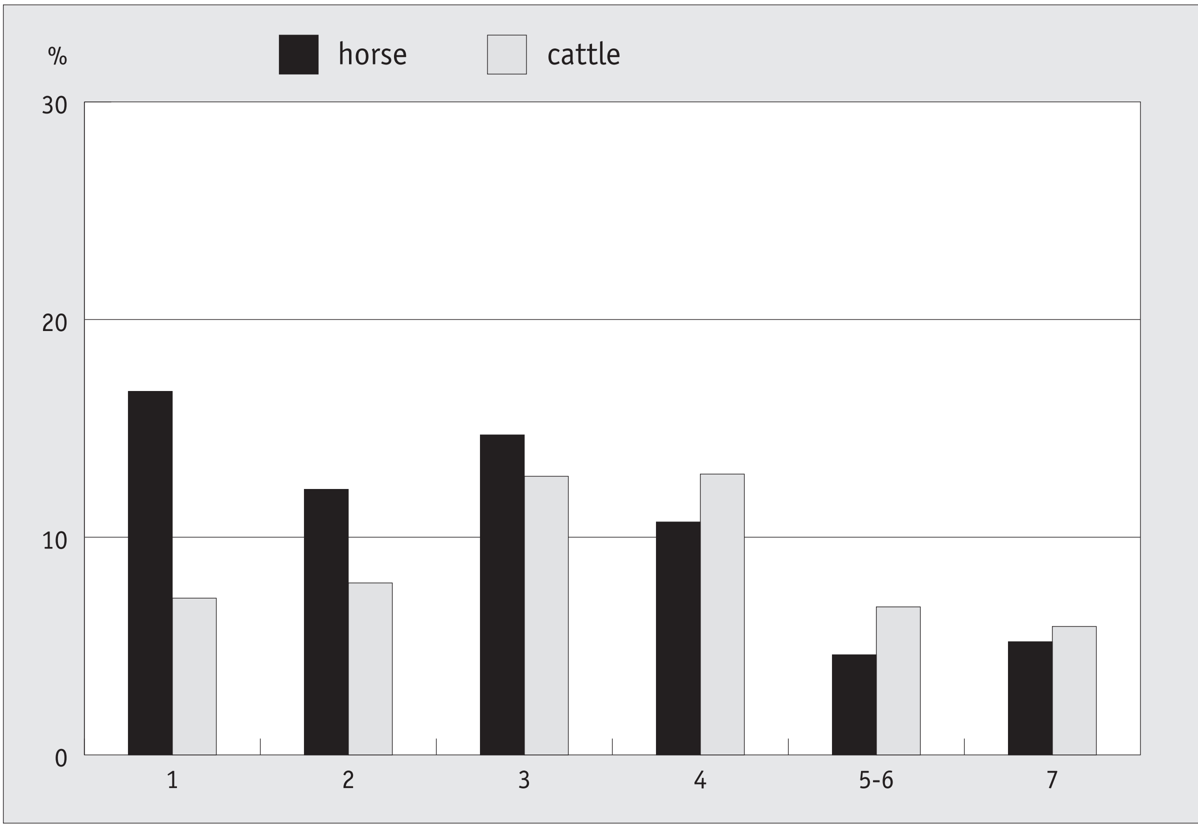

Fig. 2.20. Proportions of gnawed horse and cattle bones per phase for Passewaaijse Hogeweg, out of the total number of fragments for that species.

from that for cattle. In Oude Tielseweg, the percentage of bones with butchery marks declined steadily from phase 1 to phase 7. In phases 1 to 3, the percentage for horse was significantly higher than that for cattle, while for phase 4 we find the opposite. When we look at the fragmentation of horse bones in Passewaaijse Hogeweg, we find that horse bones from phase 1 were less fragmented than cattle bones. For phases 2 to 4, horse and cattle bones showed similar degrees of fragmentation, although this began to change for phase 4. For phases 5-6 and 7, horse bones were again less fragmented than cattle bones. In Oude Tielseweg, horse bones were less fragmented than cattle bones in all phases, but the difference between the two species was not pronounced.

Articulated horse remains were found in Passewaaijse Hogeweg, but these should be seen in a ritual context and not as refuse. In Passewaaijse Hogeweg, gnawing marks were found in significantly higher percentages on horse bones from phase 1 and 2 (fig. 2.20). For phases 3 to 7, the percentages of gnawed bones for horse and cattle were roughly similar. In Oude Tielseweg, gnawing marks were found significantly more often on horse bones in phases 2, 4 and 7. For phase 1, the percentages were similar for horse and cattle, and for phase 3, gnawing was not observed on horse bones.[106]

The location of butchery marks on horse bones from Passewaaijse Hogeweg indicates that horses were skinned and segmented and that meat was removed from some of the bones. The number of horse bones that have butchery marks indicative of meat removal is small but they were found for almost all phases. All the evidence points to one conclusion: horse meat was eaten in Tiel-Passewaaij. However, that does not say anything about the scale at which this occurred. Differences in fragmentation could mean

[106] This is a result of the low number of horse bones for phase 3: 27.

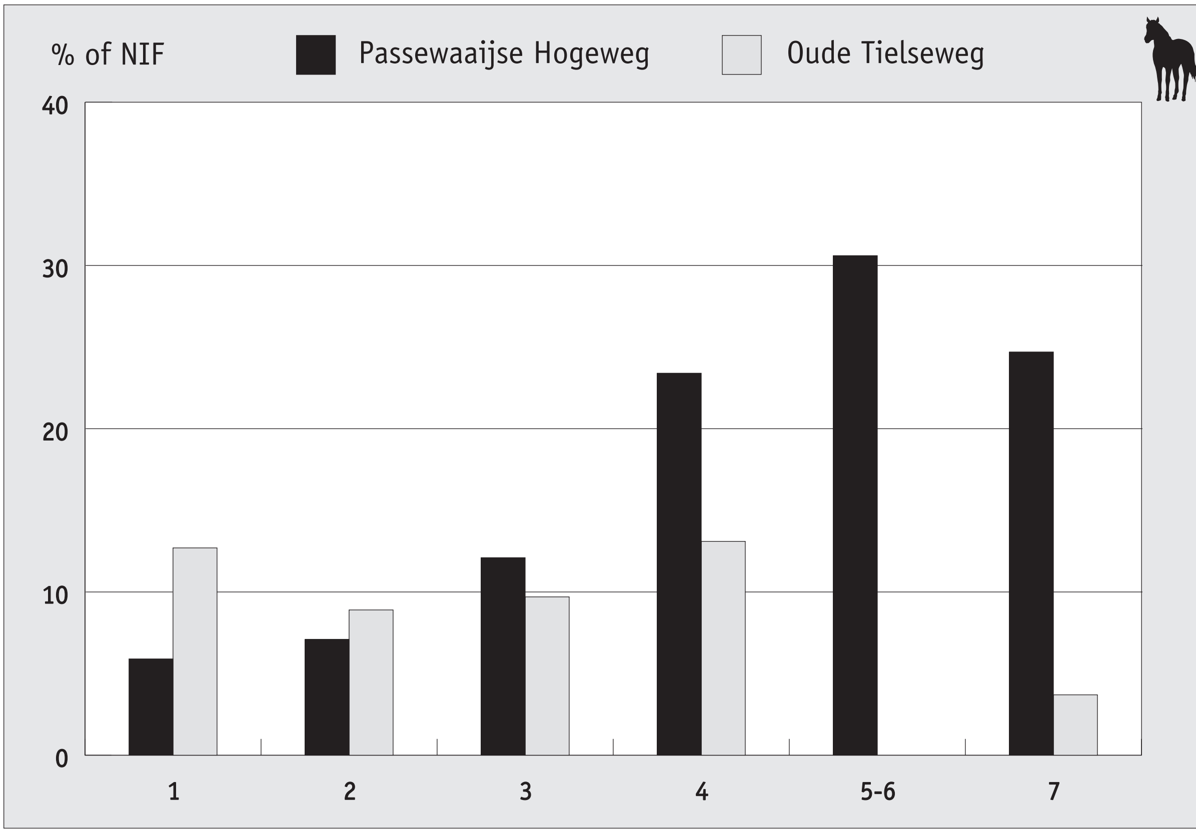

Fig. 2.21. Proportions of horse bones per phase in Tiel-Passewaaij, out of the total number of identified fragments for cattle, sheep/goat, pig and horse.

that some horses were consumed, and others were not. The high percentage of butchery marks on Iron Age horse bones seems to indicate that consumption of horse meat was more common during the Iron Age and declined with the transition to the Roman period. However, the overall number of bones for the Iron Age phase is small, so we must be cautious with our interpretations.

Evidence for horse breeding

What would we expect to find at a specialised horse breeding site? First, we can expect a relatively high percentage of horse bones, or at least a percentage that is higher than that in a non-horse-breeding site. Second, the age distribution should show a clear pattern. Not only should there be evidence for newborn and juvenile animals, which represent natural deaths and culled animals, but we would also expect to find the breeding stock: older adults, as well as some animals in all age categories (natural deaths). Young adults should be underrepresented, as it is at this age that horses were sold outside the settlement. Finally, we can use non-osteological sources, such as horse gear and stables, as indicators for horse breeding or training.

Horses in Tiel-Passewaaij

The percentages of horse bones in Passewaaijse Hogeweg and Oude Tielseweg show a remarkable change over time. In Passewaaijse Hogeweg, the percentage of horse bones increases over time (from 6 % in phase 1 to 31 % in phase 5-6), whereas no such increase is observed in Oude Tielseweg (fig. 2.21). In Oude Tielseweg, the percentage of horse bones is much lower overall, with a maximum of 13 % in phase 4. This could be an indication of differential specialisation between the two settlements, with Passewaaijse Hogeweg breeding horses and Oude Tielseweg not.

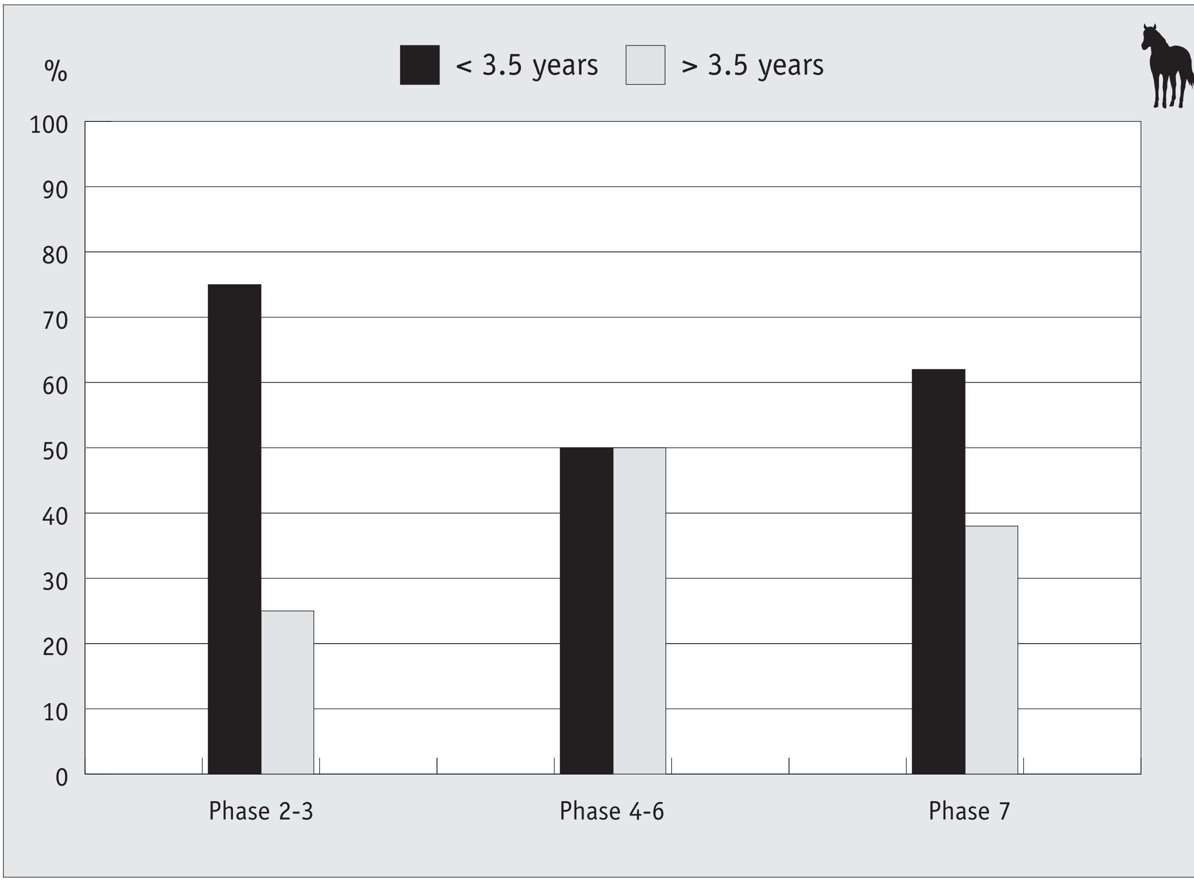

Fig. 2.22. Age distribution of horses per phase, Passewaaijse Hogeweg.

In the analysis of the age distribution of horses in Passewaaijse Hogeweg, there are a few problems. First, Grant's method for sheep, pig and cattle cannot be applied to horse teeth. Second, Levine's method, developed especially to age horse teeth, is suitable only for permanent teeth, while it is the ratio of non-adult to adult horses that is important here. Epiphyseal fusion data could be used, and indeed we do have epiphyseal fusion data for horse, but we have already seen the problems associated with ageing based on epiphyseal fusion. Because of the differential survival of early and late-fusing epiphyses, these data are not as reliable as data based on teeth. Indeed, we have already seen the discrepancy between the two types of data for other animal species. There is a way to overcome this problem, and that is to simplify our data. What we are really interested in here is the ratio of non-adult to adult horses, and not the exact ages. Therefore, it was decided to look at mandibles and maxillae and distinguish between those of adult and non-adult horses. Jaws with deciduous premolars are from horses younger than 2.5 (dp2 and dp3) or 3.5 years (dp4) old.[107] Horses with permanent fourth premolars or third molars are from horses older than 3.5 years.

There is no strong representation of young horses in phase 4 to 6, as would be expected for a specialised horse breeding site (fig. 2.22). However, this strong representation of non-adults is found in phases 2-3. At first glance, this seems to go against the idea of horse breeding in the 2nd century. However, we cannot overlook the increase in percentage of horse bones, which undeniably points to an intensification of horse keeping. Perhaps we should adjust our expectations, or rather, regard our material from a

[107] Silver 1969.

different perspective. Our bone sample consists of animal bones found inside the settlement, and this has consequences for what we find.

In the small-scale horse keeping of the Early Roman community in Tiel-Passewaaij, the few horses owned by the inhabitants would be kept close to or inside the settlement, where they would be available for riding or transport when needed. Horses kept within the settlement, in stables or paddocks, would have to be fed cereals or hay. The number of horses kept in the settlement would therefore be kept to a minimum. Because the horses lived inside the settlement, any animals that died would have had a good chance of ending up in our bone sample. With the intensification of horse keeping in phase 4, it was no longer efficient to keep them inside the settlement, as this would require too much food. It would make sense to keep only those horses in the settlement that were needed for work or that were undergoing training. The main herd would stay at pasture away from the settlement permanently. I am not suggesting a system where livestock travels a long distance from the settlement; keeping horses at grazing grounds only a few hundred metres away would ensure that any animals dying there would not be found in our bone sample.

If we accept that the most efficient way of keeping larger numbers of horses is to leave them at pasture year round, then instead of finding an overrepresentation of young horses, we would expect young horses to be underrepresented. This is certainly the case for Passewaaijse Hogeweg in phases 4 to 6, when compared to the age distribution for phases 2-3 and phase 7. This could be an explanation for the apparent paradox of intensification of horse keeping, but absence of foals.

The age data from crown height measurements should be mentioned at this point. Not enough data was available for the separate phases, but the results for phases 2-3 and 4-6 are similar enough to be added together. What this shows is that most of the adult horses (76 %, n=37) died between 6 and 15 years (table A41). This is not surprising for a breeding population. These horses represent animals that have produced several foals. In phase 7, more horses are killed before the age of 6 compared to the previous phases.

Non-zooarchaeological evidence for horse breeding or training

A first indicator for the training of horses is horse gear (fig. 2.23). Nicolay's study into the distribution of militaria on non-military sites in the area has provided us with a good idea on the prevalence of horse gear in rural settlements. Horse gear is commonly found in both the 1st and 2nd century, but nearly absent in the Late Iron Age and the 4th century AD.[108] Nicolay explained this in two ways. Some of the horse gear would have been brought to the settlements by veterans, especially during the 1st century, but most would have been used in a non-military context.[109] Horse gear is sometimes interpreted as being used in training young, locally bred horses before they were sold to the army. However, Nicolay believed that only the functional items such as iron bits would have been used in the initial training of young horses, and not the decorative horse gear that is mainly found in the 2nd and 3rd centuries AD.[110] He believed the horse gear was used for riding animals in a civilian context. The decorative elements have a symbolic function; they would have protected horse and rider against danger or evil on a journey or during the hunt.[111]

A second possible indicator for horse breeding or training is the presence of stables in rural settlements. Stables were probably not necessary for the hardy type of horse of the Roman period, but would have been useful to contain and control animals for breeding or training purposes. In phase 3.2 and later phases in Passewaaijse Hogeweg, we find buildings that can be interpreted as stables (fig. 2.24).[112] These buildings are clearly different from the "normal" byre houses. The presence of phosphate staining indicates that livestock was kept in these buildings. In the same period, and even on the same farmstead,

[108] Nicolay 2007, 70-71.

[109] Nicolay 2007, 217.

[110] Nicolay 2007, 220.

[111] Nicolay 2007, 236.

[112] Heeren in prep.; Groot *et al.* in prep.

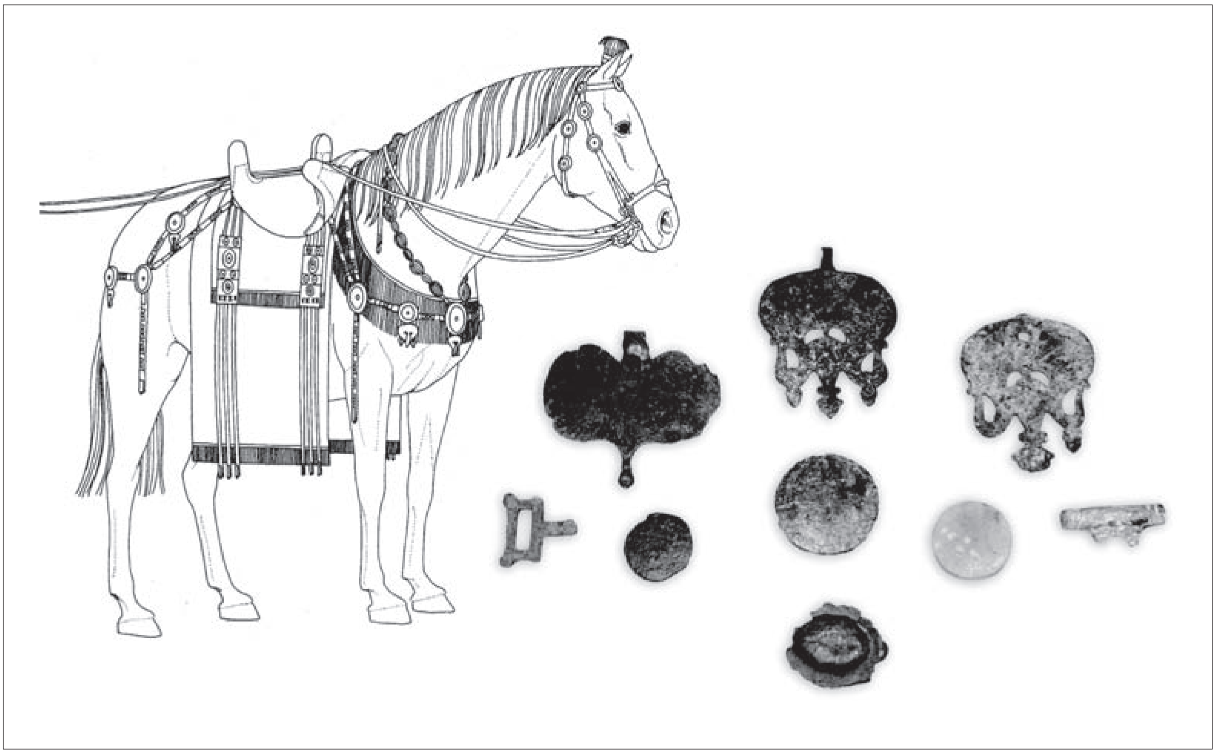

Fig. 2.23. Horse gear found in Passewaaijse Hogeweg, and a reconstruction of a horse with full military equipment. Horse reconstruction after Bishop 1988, fig. 31.

we find byre houses. These would almost certainly have housed cattle. It is not unreasonable to assume that the separate stables would have housed a different species of animal. As the occurrence of stables coincided with the rise in horse bones, it is not far-fetched to think that the stables were built to house horses. Paddocks in or near the settlement could also indicate horse training.

The role of the flood basins in horse breeding

We have already established that the only efficient way to keep larger numbers of horses is to leave them at pasture year round. The best places for grazing in this region are the flood basins, low-lying grassy land which would be likely to flood in winter (fig. 2.25). The river sedimentation left behind after floods made this into fertile land, which would have provided good grazing for livestock. One question is whether horses are able to live outdoors in conditions like this (rich grazing in summer, less food and flooding in winter) year round. That this is the case is proven by modern herds of Konik horses living in nature reserves in the Dutch River Area (fig. 2.26).[113] The horses are left to fend for themselves year round. The nature reserves are so rich in food that even at the end of winter the horses can find enough to eat.[114] Apart from grass, the horses eat herbs and leaves and bark from shrubs and trees.[115] A bit further away, in a marshy nature reserve in Flevoland (the Oostvaardersplassen), Koniks thrive. The introduced population has grown exponentially: from 18 animals in 1984 to 670 in 2002.[116] This herd is now the largest in Europe. Before the introduction of large herbivores to the area, there were certain expectations of the number of animals the area could support. Interestingly, the populations of horses, Heck cattle

113 Markerink 2002.

114 Markerink 2002, 62.

115 Markerink 2002, 63.

116 Cornelissen/Vulink 1996, 58, 134. Between 1986 and 1995, 25 new animals were introduced, while 16 animals were removed from the herd; Markerink 2002, 158.

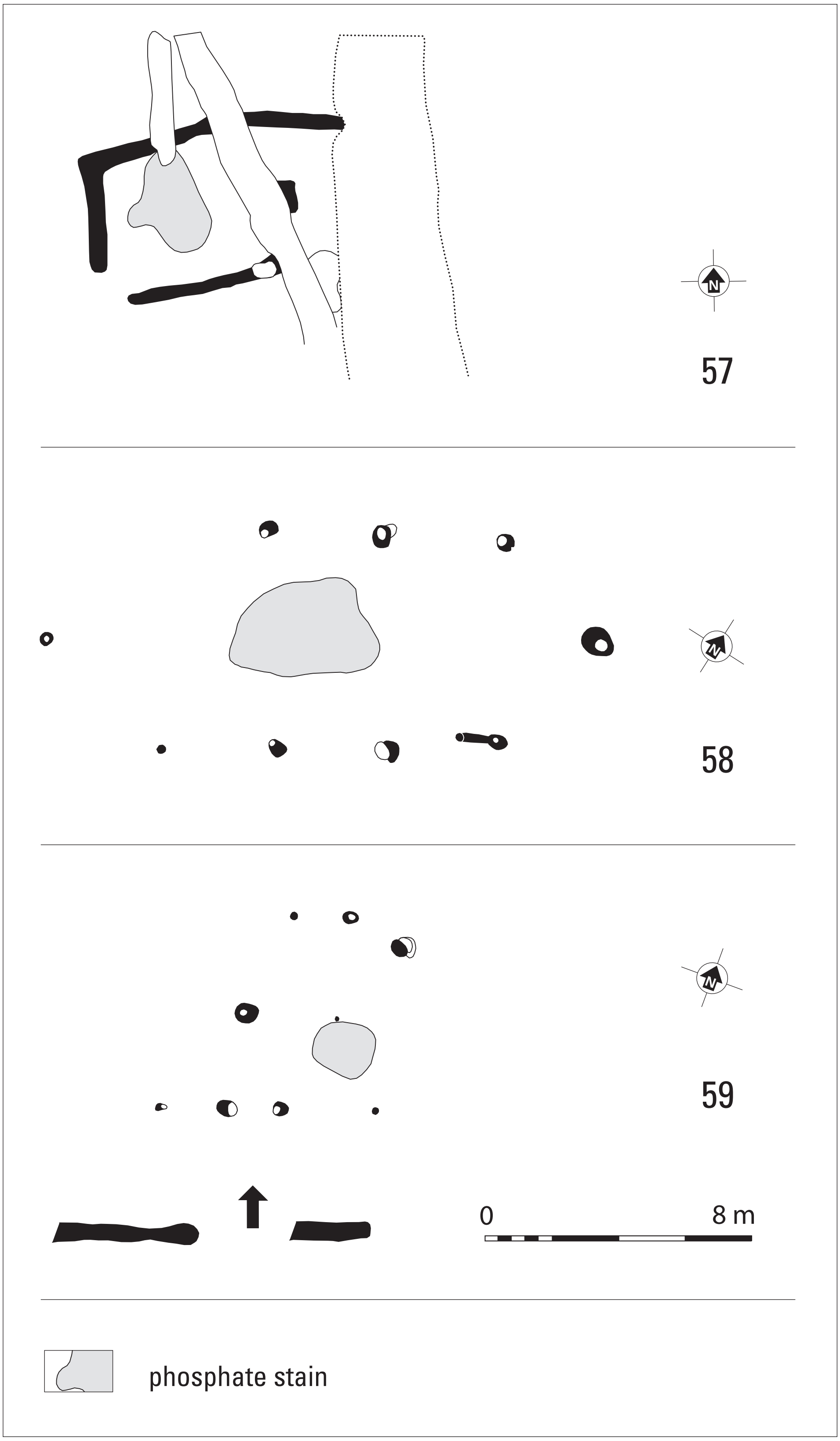

Fig. 2.24. Three buildings from Passewaaijse Hogeweg that are interpreted as horse stables (outbuildings 57, 58 and 59).

Fig. 2.25. Modern flood basin in the Millingerwaard near Nijmegen. This area is grazed by Konik horses and Galloway cattle.

and red deer have grown far beyond those expectations, demonstrating that wet grasslands can support a high number of grazers. In October 2005, it was estimated that the 2,000 hectares supported a total of 3,000 large herbivores.[117] These animals do not receive any additional food during winter. Every winter, a number of animals die from starvation, but what is more important is that most survive.[118]

How can we translate this information to the Eastern Dutch River Area in the Roman period? The modern situation demonstrates that wetlands are rich in food and can support large numbers of large herbivores. In the Roman period, both habitation and arable agriculture in the Eastern Dutch River Area were located on the drier and sandier stream ridges. The flood basins may have been used as meadows,

[117] Pers. comm. Hans Breeveld, Staatsbosbeheer, *boswachter* in the Oostvaardersplassen.

[118] The management of the large herbivores in the Oostvaardersplassen has been the centre of a controversy in recent years. Animal welfare organisations claimed that not feeding what are essentially still domestic animals constitutes cruelty, while *Staatsbosbeheer*, the organisation that manages the Oostvaardersplassen, insisted that the area is large enough for herds to be self-regulating. An international committee investigated the issue, and a judge ruled that *Staatsbosbeheer* was not required to feed the animals. Feeding in winter would artificially increase the population, resulting in more animals that the area can support. By the way, weakened animals are not left to starve, but are shot by the *boswachters*, who in this sense fulfil the role of the predators who are missing in this habitat. The success of another controversial strategy, leaving red deer carcasses on the ground, was proven both by the visit of the black vulture mentioned in 2.3.2 and the first successful breeding of white-tailed eagles in the Netherlands in modern times, in 2006.

Fig. 2.26. Konik horses in the Oostvaardersplassen, the Netherlands. Photo Martijn de Jonge.

to produce hay to feed stabled cattle during winter. The remaining land was available for horse keeping. Of course, the horses needed to be able to move around freely, both in order to find enough grazing in winter, but also to find drier ground in winter, when part of the flood basins would be flooded occasionally or permanently. As long as the horses were able to build up enough fat reserves during summer, they would survive the winter even when there was little food available.

Foals would be born in the flood basins. Foals that were born in late spring would be strong enough to survive the next winter. Care would be taken to ensure that foals would not be born too early in the year. Although we do not know exactly what type of horses the Tiel-Passewaaij horses were, they were almost certainly strong and hardy, and able to survive outdoors throughout the year.

Demography of horses

The wild-living Konik horses in the Netherlands have high fertility rates. 75 % of mares have their first foal at three years. From the age of four years onwards, 90 % of mares produce a healthy foal each year. However, the Konik herds are mainly composed of young mares, which means that the fertility rate may be inflated. Most foals in herds in the modern Dutch River Area are born in April or May.[119] This peak in births ensures that foals can take advantage of the new growth in vegetation, which starts to grow again in May.[120] In the Oostvaardersplassen, foals are born throughout the year, but 75 % of foals are born between March and September, with a peak in June.[121] Mortality rates are highest for foals: 15-25 %.[122] Among adult horses, mortality rates are very low: 1 %.[123] This is a result of the young age of the herd

119 Markerink 2002, 107.

120 Markerink 2002, 108.

121 Cornelissen/Vulink 1996, 64.

122 Markerink 2002, 131; Cornelissen/Vulink 1996, 62-3.

123 Cornelissen/Vulink 1996, 64.

overall. Koniks were first released in the Oostvaardersplassen in 1984, so that at the time these data were published, the proportion of older animals in the herd was still low.[124]

Koniks are modern horses and not related in any way to the Batavian horses. However, their size, hardiness and semi-wild state in areas similar to the flood basins of the Eastern Dutch River Area make it possible to use demographic data on Koniks to create a hypothetical herd of horses for Tiel-Passewaaij. This exercise is only intended to give a rough idea on the possibilities of productiveness of horses in this area and should not be taken too literally.

In order to fulfill the need for horses, the best strategy for the inhabitants of Tiel-Passewaaij would be to sell the surplus stock: most of the young males and perhaps some of the females, depending on whether growth of the herd was desirable or not. Some females would be kept on to replace older mares whose reproduction had stopped or slowed down. If our Roman horses had similar fertility rates combined with low mortality, a surplus of young horses could be produced each year. Of course, we have no idea about the absolute numbers of horses in Tiel-Passewaaij, but just to give an idea of the kind of surplus that could be produced we can apply some calculations to a hypothetical herd. This hypothetical herd consists of 100 mares and 10 stallions. Our herd is controlled by humans, so we would not expect a 1:1 sex ratio. In the Oostvaardersplassen herd, 90 % of mares produced a foal each year. However, our herd also contains older mares as well as young mares not yet reproducing, so a lower figure of 75 % would be more appropriate. This means 75 foals are born. If we take the high end of the mortality rate for foals, 25 % of foals did not survive their first year. This leaves us with 56 healthy yearlings. At the same time, a number of the adult animals will have died from old age, disease or culling. The 1 % mortality rate in the Oostvaardersplassen is too low for our situation. Instead, we can take 10 %. This means that 10 mares and 1 stallion die each year. Assuming that these animals are replaced by yearlings to maintain the size of the herd, this leaves 45 yearlings that could be sold at market. Although our herd is hypothetical and some assumptions are made, it leaves us with the following conclusion: that for every two mares, one yearling could be produced as surplus each year.

But what about the area of land our hypothetical herd would need for grazing? Again, we can base this on the Oostvaardersplassen, where every two hectares support three large grazers. This number is probably too high for our situation, considering that much of the grassland in the Oostvaardersplassen was originally sown with modern grass seeds. Instead, we can assume that every hectare supported just one horse. Estimating the amount of land in the flood basins available to the settlement Passewaaijse Hogeweg is difficult. Although it is possible to give a rough estimate of the flood basins near Passewaaijse Hogeweg, we are dealing with an unknown variable consisting of the number of other rural settlements that would have used parts of this land. Modern Tiel covers most of the Roman flood basins north of Passewaaijse Hogeweg, which explains the low number of rural settlements known for this area. The flood basins to the south of Passewaaijse Hogeweg covered over 400 hectares and were surrounded by 12-15 rural settlements, including Passewaaijse Hogeweg and Oude Tielseweg.[125] From the evidence from Oude Tielseweg, it seems likely that not every settlement was involved in horse breeding. However, other livestock would have grazed in the flood basins as well as horses. Also, parts of the flood basins may have flooded in winter. Therefore, it is impossible to conclude that 400 hectare of available land equals a Roman population of 400 horses. However, it does give us some idea of the possibilities of what has been considered marginal land.

There are several possibilities for the exploitation of the flood basins. Each settlement may have had its own grazing grounds. It is also possible that the flood basins were common land where animals from all surrounding settlements grazed. In either case, horses must have had access to a large area if they were to thrive. They needed different types of vegetation to support them throughout the year, as well as some

[124] Cornelissen/Vulink 1996, 58.

[125] Pers. comm. Ivo Vossen.

Fig. 2.27. New Forest ponies in the northern part of the New Forest, UK.

higher land in case of flooding. If the flood basins were used by more than one settlement, disputes over ownership of livestock or land use may have occurred. Marking or branding of animals to indicate ownership and adherence to a traditional use of certain areas by certain settlements may have prevented disputes. It seems unlikely that the flood basins were enclosed by fences or ditches. Boundaries would necessarily cover long distances, and building and maintaining them would be labour-intensive. It would make more sense to have boundaries around the arable fields only, to protect them from livestock, but not around the grazing grounds.

A modern parallel to this situation is easy to find. In the New Forest, UK, domestic horses are still kept outdoors year round (fig. 2.27). Every animal is owned by someone. At least once a year, in late summer or early autumn, horses are rounded up and some are sold. This is also the chance to brand animals and check their health. In the New Forest, approved stallions are turned out to ensure that foals of a good type are born. Stallions are moved every fourth year to avoid inbreeding. Many forest-bred foals grow into excellent riding ponies. The practice of keeping horses in semi-wild herds is also known from medieval Limburg, where the right to graze horses on common grounds was restricted to certain members of the elite.[126] The use of uncultivated grounds to graze livestock was an essential part of past agricultural systems.[127]

The surplus of horses in Tiel-Passewaaij could either be sold as yearlings, or they could be kept until they were young adults. In that case, they may have received some training before being sold. The inhabitants of Tiel-Passewaaij may have taken their horses to a local or larger market, or they may have sold them to a middleman.

[126] Renes 1999, 184.

[127] Vera 1997, 106.

Conclusion

From the above, we can conclude that horse breeding was an important part of the economy in Tiel-Passewaaij. The fertile flood basins were ideally suited for keeping and breeding relatively large numbers of hardy horses. This extensive way of horse breeding required little manpower, although one or two people may have herded the horses and prevented them from wandering outside the site territory or even being stolen. Predators would not have formed a problem, since there were very few large meat-eating mammals left in the area in the Roman period. A surplus of foals would have been produced each year, which could either be sold as yearlings or receive basic training first. Evidence that the army preferably acquired four-year-old horses could mean that the horses stayed in Passewaaijse Hogeweg for several years.[128]

The settlement of Passewaaijse Hogeweg may have specialised in breeding horses, but that of Oude Tielseweg did not. What this demonstrates is that two settlements that are situated close together and must have had strong links could differ in their animal husbandry. It is possible that it was not so much the settlement of Passewaaijse Hogeweg that did the horse breeding, but rather just one household. An analysis of the horse bones at house level instead of site level could clarify this. Due to the unfinished nature of the study of the settlement, it was not possible to produce distribution maps of horse bones at this point.

Passewaaijse Hogeweg is one of several sites in the Eastern Dutch River Area with a high percentage of horse bones. While the proportion of horse started to increase in Passewaaijse Hogeweg at the end of the 1st century, at Wijk bij Duurstede-De Horden the proportion of horse was already high in the Early Roman period.[129] This settlement seems to have concentrated on raising horses much earlier than Passewaaijse Hogeweg. The proximity to the border, and thus the army, is a possible explanation. In Kesteren-De Woerd, the proportion of horse increased in the first half of the 2nd century.[130] Ewijk II, Houten 8A and Houten-Doornkade are other sites with high percentages of horse bones in the Middle Roman period (fig. 2.18).[131]

One question that remains is where the horses were sold to. How many horses did the army in the region need on a yearly basis? A rough and very conservative estimate based on the number of army units stationed in the province of *Germania* shows that the number of horses in the whole province during the first three centuries AD ranged from around 3700 to 5300.[132] If horses really lasted on active duty for only three years, over a thousand horses were needed annually to replace retiring ones.[133]

It is also possible that horses from the Eastern Dutch River Area traveled much further than the local stretch of the *limes*. Roman sources indicate that horses were traded over large distances in the Roman Empire.[134] The province of *Germania* was not known for the quality of its horses, unlike, for instance, *Cappadocia*.[135] However, that is not an argument against horse breeding in the Eastern Dutch River Area. The Batavian horses may not have had the quality of some of the other types of horses in the Roman Empire, but they could still be valuable, even if it was only as pack animals.

An intriguing parallel to the practice of horse breeding in the Eastern Dutch River Area is the large-scale horse breeding in the Linge region, a part of the Eastern Dutch River Area that includes Tiel-Passewaaij, in the second half of the 19th century. Many of these horses were bought by traders and

128 Davies 1969, 445.

129 Laarman 1996b, 379, table 61.

130 Zeiler 2001, 223, 270-271, tables 9.10 and 9.12.

131 Lauwerier 1988, 93; De Vries/Laarman 2000, 3, table 3; Taayke 1984, table 9a.

132 These rough figures do not include horses used for transport of goods. Based on Bogaers/Rüger 1974 and Bechert/Willems 1995. Wouter Vos kindly compiled these data.

133 Hyland 1990, 86.

134 Hyland 1990, 71.

135 Davies 1969, 443; In Germania 6, Tacitus describes Germanian horses as unremarkable for build or speed.

destined for the army. The Dutch authorities even introduced a stallion in the region to improve the local horses.[136] In the early decades of the 20th century, horses were exported to Belgium, Germany, France and England.[137]

2.4.5 Stock improvement as an indicator for market-oriented production

The withers height of cattle and horse, especially, is an aspect of zooarchaeology that has received a lot of interest in zooarchaeological studies of the Roman period. The conclusion from previous research is that the average withers height of cattle increased with time, whereas the average withers height of horse was dependent more on type of site than on time period.[138] Lauwerier and Robeerst stated that the withers height of horses did not increase gradually during the Roman period, as was the case for cattle, but that the mean withers height varied according to the nature of the location where the horses are found.[139] Horses in settlements north of the *limes* were smallest, with a withers height of 132 cm. The mean withers height of horses in military sites was 142 cm, while that of horses in villa sites was 144 cm. The mean withers height of horses from rural settlements directly south of the *limes* fell somewhere between these extremes.

In Passewaaijse Hogeweg, however, the withers height of horse does show an increase over time. However, the number of bones for which the withers height could be calculated is very small for some phases. If we combine phases and add the data from Oude Tielseweg, we have more information. The mean withers height increased from 134 cm in phases 2 and 3 to 141 cm in phases 4 to 6 (fig. 2.28). Phase 7 shows another, smaller increase to 143 cm. It is possible that an increase in withers height over time was not found in previous studies because of the limited number of sites that have both a detailed chronology and a large number of complete horse bones. Many of the sites used by Lauwerier and Robeerst covered long time periods or produced a small number of horse bones.[140] The mean withers height for villa type settlements was based on just one site. The methodology used to calculate withers height was not the same for all sites. It is possible that, when more data from large excavations become available, the increase in withers height over time seen in Tiel-Passewaaij will be seen in more rural settlements.

The Roman army probably played a large role in the size increase of horses. The Roman army needed horses of a minimum size and the fastest way of acquiring these locally would have been to distribute large stallions and thus directly influence the size of foals born in the area.

The mean withers height of cattle in Passewaaijse Hogeweg shows an increase starting in phase 2 and reaching a maximum in phase 7. However, the number of bones for which the withers height could be calculated is small for most phases. Combining phases and data from both settlements gives a more solid impression of changes in withers height. The transition between phases 2-3 and 4-6 shows the largest increase, from 112 to 120 cm (fig. 2.29). This increase probably started earlier, but more information is needed to substantiate this. Withers height of cattle changed little in phase 7.

Although the small size of the pre-Roman cattle may have been related to cultural ideals, the spread of large, imported cattle in the Eastern Dutch River Area provided an opportunity to ' improve' the native cattle. Changes in withers height of cattle have been taken as an indicator for intensification of production of beef.[141] An increase in withers height is a sign of stock improvement. Larger animals are desirable when

[136] Brusse 2002, 22-23.

[137] Brusse 2002, 62.

[138] Lauwerier 1988, 167; Lauwerier/Robeerst 2001, 277.

[139] Lauwerier/Robeerst 2001, 277-279.

[140] Lauwerier/Robeerst 2001, 276, table 1.

[141] Robeerst 2004, 88.

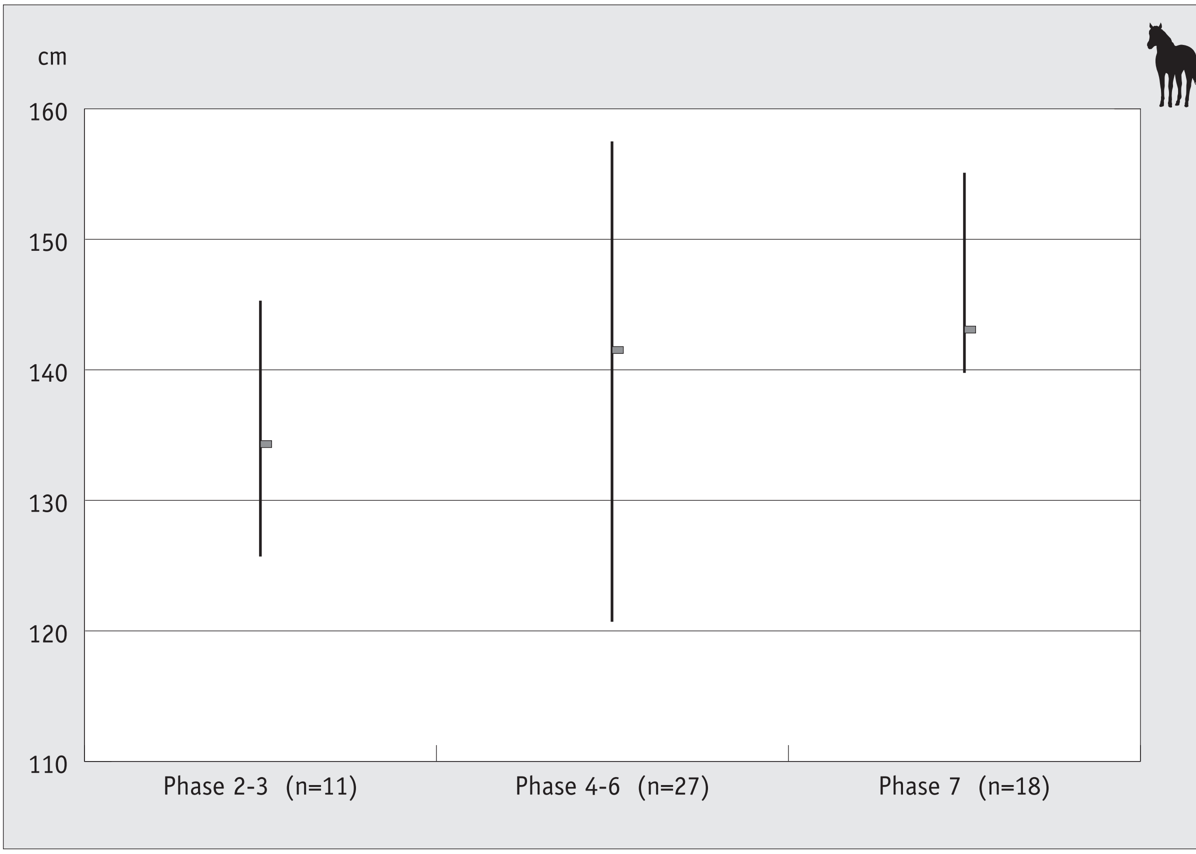

Fig. 2.28. Withers height for horse in Tiel-Passewaaij: range and mean.

meat production is the primary aim. This is why it is important to know when the withers height started to increase in rural settlements, because it could mean the settlements were reacting to market demands by breeding larger cattle. However, an increase in withers height can also reflect a desire for larger animals for other purposes. Larger cattle may have been more useful as traction animals.

In the case of sheep, phases 1 and 2 are compared with phases 3 to 6, because the production strategy changed in phase 3. An increase in mean withers height of 3 cm is observed (table A8). Since wool was the main product of sheep in phase 3, the increase in withers height could reflect a demand for larger fleeces.

2.4.6 PIGS

No evidence was found in Tiel-Passewaaij for the production of a surplus of pork. Neither was there any evidence for the consumption of suckling pig, which is regarded as a typical Roman food. Most pigs were killed in their second year, when they had reached a good weight. Very few pigs reached adulthood. It may look as if this could not be a sustainable population of pigs, because some older individuals are needed to breed from. However, pigs produce large litters. Very few breeding animals were needed to produce a steady supply of pork.

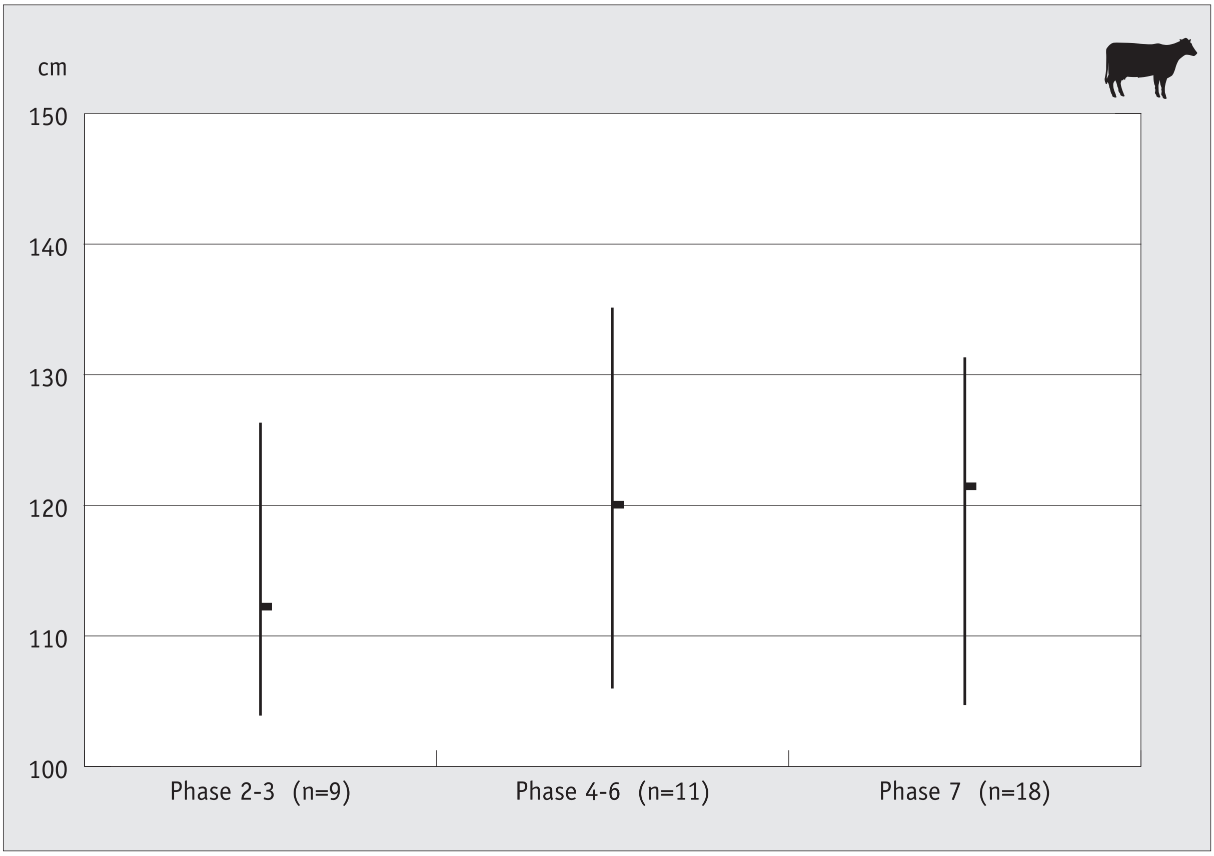

Fig. 2.29. Withers height for cattle in Tiel-Passewaaij: range and mean.

2.4.7 LIVESTOCK PRODUCTION FOR CEREMONIAL NEEDS

The production of animal products was not just guided by economic concerns or needs. Animals were also needed for ceremonies such as funerals and rituals within the settlement. The next two chapters will discuss these two topics, but we should briefly look at the possible influence this could have had on the economy. Some species of animals may have been kept specifically for ceremonial needs. However, ceremonial needs are intertwined with economic needs. Food consumed within a ceremonial context provides energy and sustenance just as much as food consumed in everyday meals. Chapter 3 will discuss animals that were used in rituals within the settlement. Animals buried whole would not have added to the food economy, but where partial animals were used in special deposits, the rest of the animal would certainly have been consumed. Chapter 4 will show that pig and chicken are the species most used for funerary rituals. Compared to the other domestic animals, these two species were not as important to the economy. Rituals involving animals did not occur on a daily basis. The use of the meat from some of those animals would have ensured that the effect on the economy was negligible.[142]

Temples formed a rural consumption site, although in practice consumption may have been limited to seasonal festivals and would probably not have put a major strain on the local economy. If the meat from sacrificial animals was consumed by their owners, or taken back to the settlement for consumption at home, then the rural temples may even have functioned within the local economy.

142 Lauwerier 2004, 71.

2.4.8 Differential development of the rural economy in Oude Tielseweg and Passewaaijse Hogeweg

The two settlements in Tiel-Passewaaij show some differences in animal husbandry. Oude Tielseweg does not exhibit the degree of specialisation in animal husbandry found in Passewaaijse Hogeweg. The percentage of sheep bones in Oude Tielseweg in phase 3 is much lower than that in Passewaaijse Hogeweg. Like Passewaaijse Hogeweg, Oude Tielseweg specialised in wool production, but to a much more limited extent. Again, although the percentage of horse bones increased in phase 4, it did not reach the high percentages found in Passewaaijse Hogeweg.[143] The large granaries found in Passewaaijse Hogeweg in phases 3 and 4 were absent in Oude Tielseweg, which is an argument against a substantial surplus production of cereals in this settlement. One explanation of the different degree of specialisation is that Oude Tielseweg may have been subservient to the larger settlement Passewaaijse Hogeweg, providing labour and perhaps some produce to the benefit of the larger settlement.[144] The animal bones from Passewaaijse Hogeweg have not yet been analysed at farmyard level. Such an analysis may uncover differences in animal husbandry between different households. In that case, Oude Tielseweg may simply turn out to have been an outlying part of Passewaaijse Hogeweg, and not its poor neighbour.

2.5 Conclusion

One of the main research aims of this chapter, and indeed, this study, was to answer questions on the production of a surplus in Tiel-Passewaaij. A first question was whether it was possible to produce a surplus, and second, what products did the surplus consist of?

A major drawback of zooarchaeological studies in answering these kinds of questions is that quantification of bone fragments cannot be used to show changes in absolute numbers of animals. The number of fragments that are found in excavations is determined almost exclusively by taphonomy and excavation strategies, and does not reflect the number of animals that were originally kept at a site. To a large extent, it is still possible to study changes in agricultural production. Changes in the ratios of species indicate a possible increase in one species at the cost of another. Changes in mortality profiles for a species show a change to a different production strategy.

However, when determining the extent of a surplus, the absence of absolute numbers becomes more of a problem. Theoretically, it is possible that a rural settlement increased output of animals without significantly changing the ratios of species or the way in which the animals were exploited. However, it is more likely that changes in animal ratios or production strategy did occur.

One way of overcoming this problem is by combining results from both production and consumption sites, so that a complete population can be studied instead of just the productive herd (fig. 2.17). This will not provide us with absolute numbers, but it will give a better picture of the processes of production, trade and consumption. Another way to understand the changes observed in a production site is to use economic models in combination with the results from zooarchaeological studies.

De Vries described the two ways in which a largely self-sufficient rural society can change in response to population growth and limited trading opportunities.[145] Although his study is based on the 16th and

[143] However, the highest percentage of horse bones in Passewaaijse Hogeweg is found in phase 5-6, when Oude Tielseweg was not inhabited.

[144] If this explanation is correct, a difference in material culture should have been found. The material culture from Oude Tielseweg does seem to be poorer than that from Passewaaijse Hogeweg, but it must be remembered that Oude Tielseweg is a much smaller settlement and was not excavated completely.

[145] De Vries 1974, 4-9.

17th centuries, the models he described can be applied to any period or region with a largely self-sufficient rural economy. In a *peasant model*, small farmers are unable to produce a regular surplus; trade opportunities are monopolised by large landowners. This results in increased inequalities in society. Because small farmers are unable to produce a surplus to sell at market, they do not have the income to buy urban goods. In a *specialisation model,* a regular surplus is produced. Less labour is spent on producing non-agricultural goods; instead, these goods are bought on the market. Whereas previously, all goods were produced on the farm, now all effort is spent on agricultural products that can be sold. Part of the proceeds is used to buy products that are no longer made on the farm. There are several indications that the specialisation model is most appropriate for Tiel-Passewaaij:

- there is no pronounced social inequality in the settlements and cemetery of Tiel-Passewaaij.
- urban goods are found in the rural settlement, indicating that the means of acquiring these products existed.
- there are no large farms or landowners in the region (in comparison to the villa landscape).
- agricultural specialisation occurred, in the form of wool production and horse breeding.

Now we can solve the apparent contradiction between the rise in wool production in Passewaaijse Hogeweg in phase 3 and the decrease in finds of spindle-whorls and loomweights. De Vries's specialisation model provides an explanation. The production and the working of wool are two entirely different things. As the settlement specialised in wool production and sold this wool on the market, this left the inhabitants with the means to buy products they had previously made themselves. Spinning wool and weaving was abandoned in favour of buying finished wool products on the market.

A small rural settlement would have reacted to the demand of markets and perhaps the Roman army for certain products. On the other hand, supply of goods would have been limited by practical considerations, such as the amount of arable land and the availability of grazing. Clearly, in the late 1st century there was a demand for wool in the army and the growing town of Nijmegen. Although other products must have been in demand as well, sheep formed a large part of the livestock population in Tiel-Passewaaij, and an increase in wool production was easily managed by changing the main exploitation of the flock from milk and meat to wool.

Of course, instead of producing for a market, it is likely that part of the agricultural surplus was produced to satisfy tax demands. The presence of imported products means that at least part of the surplus was sold or exchanged. The Roman administration may have exerted their influence by demanding certain products, but even they would realise what could realistically be achieved by the rural settlements in the Eastern Dutch River Area.

1. Introduction

In this study, the animal bone assemblage from excavations in Tiel-Passewaaij is used to explore the various roles of animals in a rural community in the Eastern Dutch River Area during the Roman period. The focus will be on the roles of animals in economy and ritual. This study will focus on just one rural community, consisting of two settlements and the cemetery in which the inhabitants buried their dead.

One of the strengths of the data set is that Tiel-Passewaaij provides information from different contexts for one community, instead of comparing results from different communities. The focus on different contexts such as settlement and cemetery, and within the cemetery on the different features that were created during the funerary ritual, is an important research strategy. Another is the study of this community within the market networks it functioned in. The production of an agricultural surplus by rural settlements in the Eastern Dutch River Area is an important theme in Roman archaeology in the Netherlands.

Animal bones can answer questions that are of interest not just to zooarchaeologists but to general archaeologists and historians as well. This study aims to rise above traditional zooarchaeological studies and contribute to a wider archaeological debate on the Eastern Dutch River Area in the Roman period.

Before discussing the assemblage from Tiel-Passewaaij, it is necessary to know a little about the results of the excavations (1.1), about the people who inhabited the settlements in Tiel-Passewaaij, and about the historical and geographical context (1.2). Previous zooarchaeological research and the main research themes of the last two decades will be described in 1.3. The next paragraph introduces the concepts of production and consumption sites, the various agents that were involved, and the influence of markets and taxation on agricultural production in rural settlements in the Eastern Dutch River Area. Possibilities and limitations of the animal bone assemblage from Tiel-Passewaaij are discussed in 1.5, as is some information related to the chronology of the sites. Paragraph 1.6 describes the zooarchaeological methods used in recording and analysing the animal bones, including aspects related to identification, taphonomy and ageing. The research questions and the outline of this study are described in 1.7.

1.1 THE EXCAVATIONS IN TIEL-PASSEWAAIJ: A BRIEF HISTORY AND RESULTS

1.1.1 HISTORY OF THE EXCAVATIONS IN TIEL-PASSEWAAIJ

Passewaaij is a new housing estate which is part of the city of Tiel. Tiel-Passewaaij is located in the Eastern Dutch River Area, on the northern side of the river Waal, and within what used to be the Roman Empire (fig. 1.1). During the 1980s, surface finds from fields in Tiel-Passewaaij were recorded by amateur archaeologists. A more systematic survey in 1986, in combination with chance finds from 1990 and later surveys, resulted in the suspicion that Tiel-Passewaaij was the location of a settlement and a cemetery, both dating to the Roman period. When it became known that Tiel-Passewaaij was the proposed site for a new housing development, the area was inspected for archaeological remains. The three sites that will be discussed in this study are the settlement Oude Tielseweg, a second and larger settlement Passewaaijse Hogeweg, and a cemetery which is located between the two settlements (fig. 1.2). Together with a stream and enclosure ditches, they form a complete settlement landscape.

Fig. 1.1. Map of the Netherlands with the location of Tiel-Passewaaij and sites mentioned in the text. The selected area is the *civitas Batavorum* or Eastern Dutch River Area. For a detailed map, and the sites located in this area, see fig. 1.11.

The settlement of Oude Tielseweg was thought to be badly disturbed, but during the building development in the area, preservation turned out to be better than expected. Amateur archaeologists from BATO closely monitored the development and were able to save much archaeological information.[1] Roughly half the site (2.5 hectares) was subsequently excavated in several campaigns between 1994 and 1997. Oude Tielseweg was a small rural settlement, with probably only one farmhouse being inhabited at any time. This settlement was inhabited during the Middle Iron Age, and from the Early to Late Roman period.[2] Habitation was not continuous; there are gaps in the Late Iron Age and between 170 and 270 AD. Habitation in the Late Iron Age may not have been possible because the stream was active at this time, resulting in frequent flooding of the area. Four house plans were discovered, as well as a large number of other settlement features. For some of the phases, no house plans were excavated, although other features could be assigned to those phases.

The second settlement, Passewaaijse Hogeweg, was excavated by the VU University Amsterdam between 1999 and 2004. Passewaaijse Hogeweg is located about 300 metres from Oude Tielseweg. This settlement is larger than Oude Tielseweg, with two to four contemporary farmhouses. Occupation levels from the Middle to Late Iron Age were found. A gap in occupation occurred in the middle of the Late Iron Age, after which occupation was resumed around 60 BC. The site was continually occupied until around the early 4th century AD, but a new group of people inhabited the site from the second half of the 3rd century.[3] Apart from house plans, numerous ditches, small outbuildings, pits and wells were found; all are features typical of a rural settlement.

The cemetery was first discovered in 1990, when remains of cremation graves disturbed by ploughing were observed on the surface. Excavation started in 1995 and most of the cemetery was excavated in the years before 2000. In 2003, the last part of the cemetery was excavated. The first two campaigns were executed by the State Service for Archaeology (ROB), while the five other campaigns were led by the VU University Amsterdam. About 80 % of the cemetery has been excavated. The remaining 20 % is covered by modern buildings and a road and was therefore not accessible. In total, 392 graves were excavated. The cemetery was in use from circa 60 to 270 AD.[4]

A final important aspect of this area is a stream running around the cemetery and through the settlement Passewaaijse Hogeweg. After an active phase during the Middle Iron Age and renewed activity in the Late Iron Age, the stream partially silted up and continued as a small residual channel in the Roman period. The higher ground on the banks of the stream provided an attractive place to live. The residual channel later served as a place where rubbish could be dumped conveniently.

1.1.2 RESULTS OF THE EXCAVATIONS IN TIEL-PASSEWAAIJ

Oude Tielseweg and Passewaaijse Hogeweg are regarded as separate settlements. It is difficult to establish the boundaries of unenclosed rural settlements, but one method is to take a certain distance as an indication for a separate settlement. A minimal distance of 250 metres has been regarded as appropriate for the Eastern Dutch River Area.[5] Since the distance between the two settlements in Tiel-Passewaaij is around 300 metres, they are seen as separate settlements. However, the settlements are close, and two other arguments make it likely that the inhabitants of the two settlements formed a single community. The use of a common cemetery suggests close ties between the people from the two settlements. Another

1 BATO stands for Beoefenaren Archeologie Tiel en Omstreken. It also refers to the mythical ancestor of the tribe of the Batavians.

2 Middle Iron Age: La Tene A/B, 500-250 BC; Late Iron Age: La Tene C/D, 250-15 BC.

3 Heeren 2006, 90; Heeren 2007b, 59.

4 Aarts/Heeren 2007, 72.

5 Willems 1981, 89; Vossen 2003, 424.

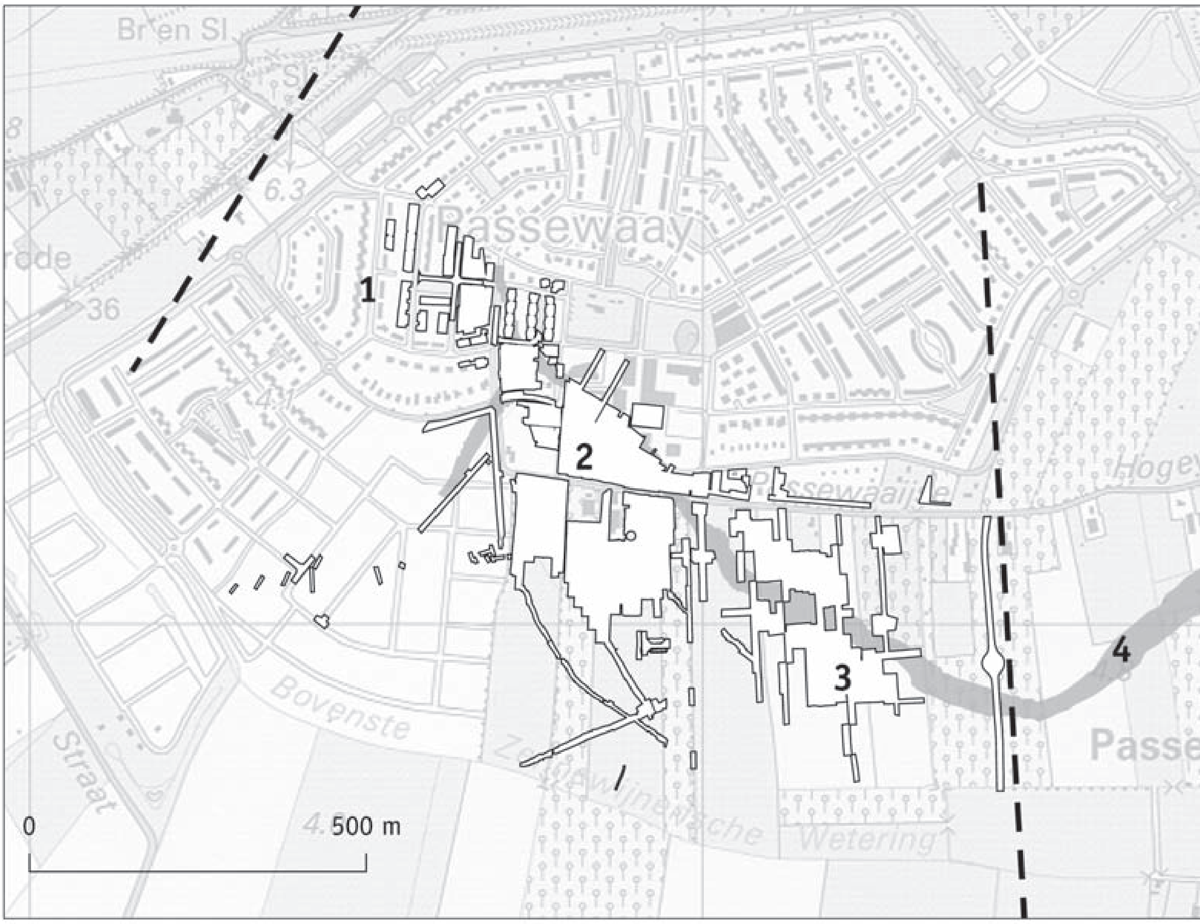

Fig. 1.2. Map of Tiel-Passewaaij showing the locations of the settlements Oude Tielseweg (1) and Passewaaijse Hogeweg (3), the cemetery (2) and the residual channel (4). Excavation trenches in white.

indication for perceiving the two settlements as representing one community is the existence of ditches connecting the settlements.[6]

Nevertheless, results from the excavations and the analysis of the animal bones from the two settlements will be discussed separately. A first reason for this is pragmatic: the two settlements were excavated separately and the results analysed by different people. The analysis of the animal bones from the two settlements was commissioned by two different organisations. Furthermore, the settlements each have their own chronologies, which differ slightly. A second reason for separate analysis of the animal bones from the two settlements is that this could uncover possible differences between the two settlements that might be overlooked if they were discussed as one. The two settlements possibly specialised in different types of production or crafts. Even within one settlement, differentiation between farmhouses may have occurred. Therefore, it would be even better if the animal bones could be analysed for each house separately. Unfortunately, that was not an option because it would mean splitting the assemblage into many smaller assemblages which would not be large enough for interpretation. Furthermore, many of the animal bones were found in pits and ditches and can rarely be attributed unambiguously to individual farmyards.

Below, the main developments of the two settlements and the cemetery will be described in short, focusing on settlement structures, house types, and enclosure ditches. Most if not all of the houses

6 Heeren 2007a, 52, 54.

Fig. 1.3. Plan of a byre house during the excavation of the settlement Passewaaijse Hogeweg (house 3, phase 4).

described are byre houses, where man and animal lived under one roof. Figure 1.3 gives an indication of the size of one of the larger houses, house 3 from phase 4.

1.1.2.1 The settlement Oude Tielseweg[7]

Phase 1: Middle – Late Iron Age

Refuse from the stream to the east of Oude Tielseweg can be dated (by ceramics, brooches and C14 dating) to the later part of the Middle and the early part of the Late Iron Age: 350-175 BC. No house plans were found dating to this phase. However, fourteen small outbuildings were dated to phase 1, in one case based on pottery and in the others based on orientation. These buildings consisted of four, six or eight postholes. The buildings were found in three clusters, which could reflect the presence of three separate farmyards. However, these three clusters would not necessarily have been contemporary.

Phase 2: 15 BC – AD 70 (fig. 1.4)

The site was inhabited again from the Early Roman period onwards. Habitation started around 15 BC and lasted until 170 AD. This period is divided into three phases: 2, 3 and 4. Although these phases are divided into several sub-phases, we will use only the broader phases here. Phase 2 can be dated from 15 BC to 70 AD, and is characterised by a high percentage of hand-formed ceramics. Two house plans were dated to phase 2 (although to different sub-phases). The houses were roughly 22-23 by 6 metres. Four-

[7] The main results of the excavation of Oude Tielseweg as described here are based on the unpublished MA dissertation by Verhelst.

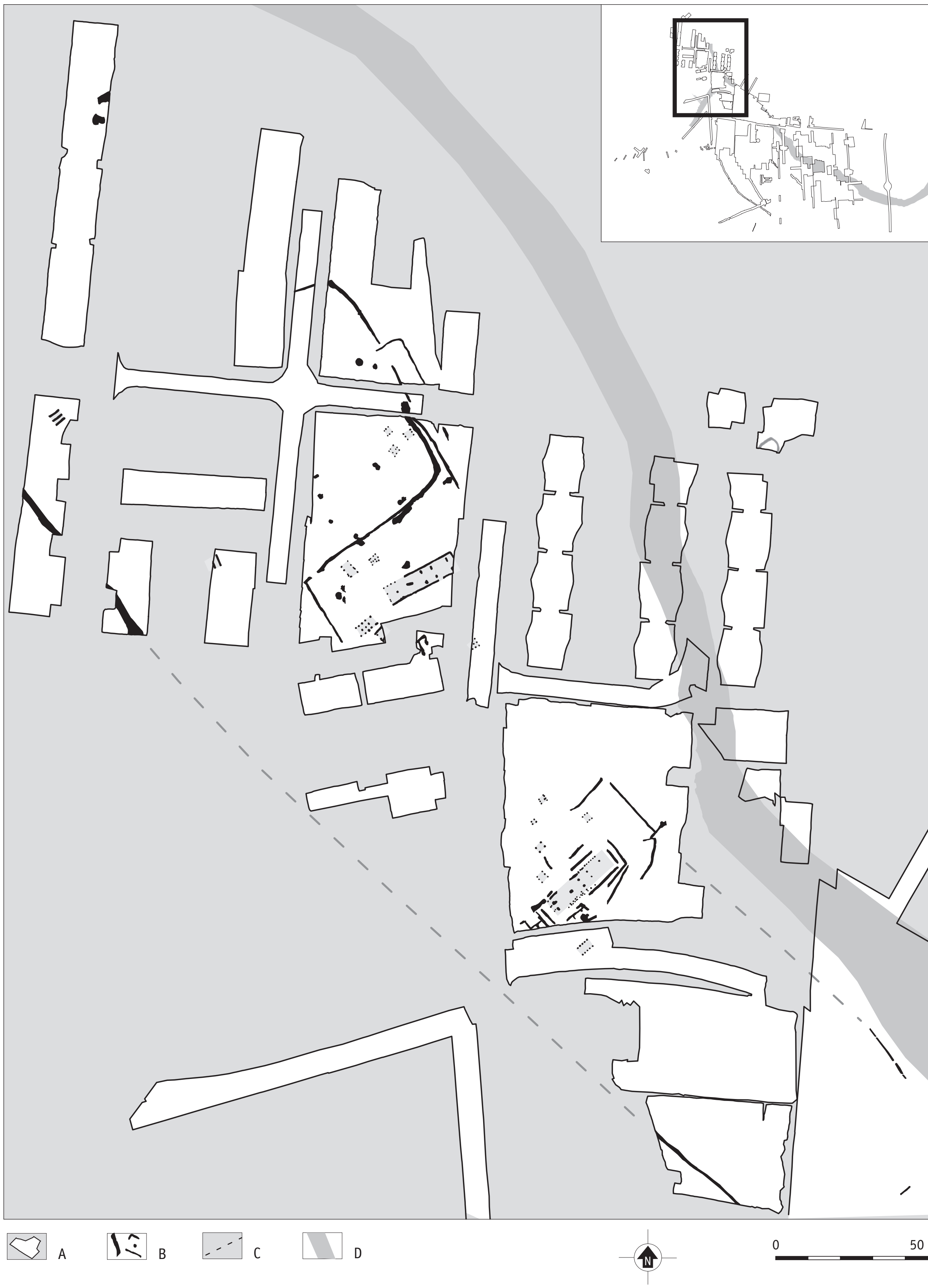

Fig. 1.4. Archaeological features from phase 2 in Oude Tielseweg.
A: excavation trenches, B: archaeological features, C: reconstructed ditches, D: residual channel

Fig. 1.5. The cemetery in Tiel-Passewaaij. The circles and squares represent the ditches surrounding individual graves.

teen smaller outbuildings were dated to this phase, mainly based on orientation. These buildings consisted of four, six, nine, ten or twelve postholes. Four buildings could be associated with one of the houses, and five with the other house. Both houses were located within a rectangular plot surrounded by ditches.

Phase 3: AD 70 - 120

Phase 3 lasted from 70 to 120 AD. Imported types of ceramics now dominated. One house, of which only part was excavated, could be dated to this phase. As in phase 2, the house consisted of two parts. Plot boundary ditches were found associated with this house. Four small buildings were assigned to phase 3 based on orientation and a higher ratio of wheel-thrown pottery to hand-formed pottery. Two pits were interpreted as manure storage pits.

Fig. 1.6. Archaeological features from phase 2 in Passewaaijse Hogeweg. See fig. 1.4 for legend.

Phase 4: AD 120 - 170

Phase 4 dates from 120 to 170 AD. One partially excavated byre house was dated to phase 4. Two smaller buildings were found dating to this phase. The larger of the two outbuildings was interpreted as a possible sheep barn. An interesting phenomenon is that whereas in previous phases houses were rebuilt on uninhabited parts of the settlement, in phase 4 the new house was built in the same location as the phase 3 house. The plot boundary ditches were probably in use during both phases 3 and 4. The presence of refuse pits and the location of one of the outbuildings suggest the presence of a second farmhouse in phase 4.

Fig. 1.7a. Archaeological features from phase 3.1 in Passewaaijse Hogeweg. See fig. 1.4 for legend.

Phase 7: AD 270 - 350

A final period of habitation dates to the Late Roman period: 270-350 AD.[8] No houses or other buildings dating to this phase were found in Oude Tielseweg. However, habitation is suggested by the presence of two wells dating to this period. The upper fill of one of the wells contained a large quantity of animal bones. Brick and stone found in this phase almost certainly originates from a stone building in a different settlement.

[8] Although phase 7 was originally referred to as phase 5, in the present comparison of the two settlements this would suggest that the two phases 5 are contemporary, which they are not. Phase 5 of Oude Tielseweg coincides with phase 7 of Passewaaijse Hogeweg, which is why Oude Tielseweg's phase 5 will be referred to as phase 7 in this study.

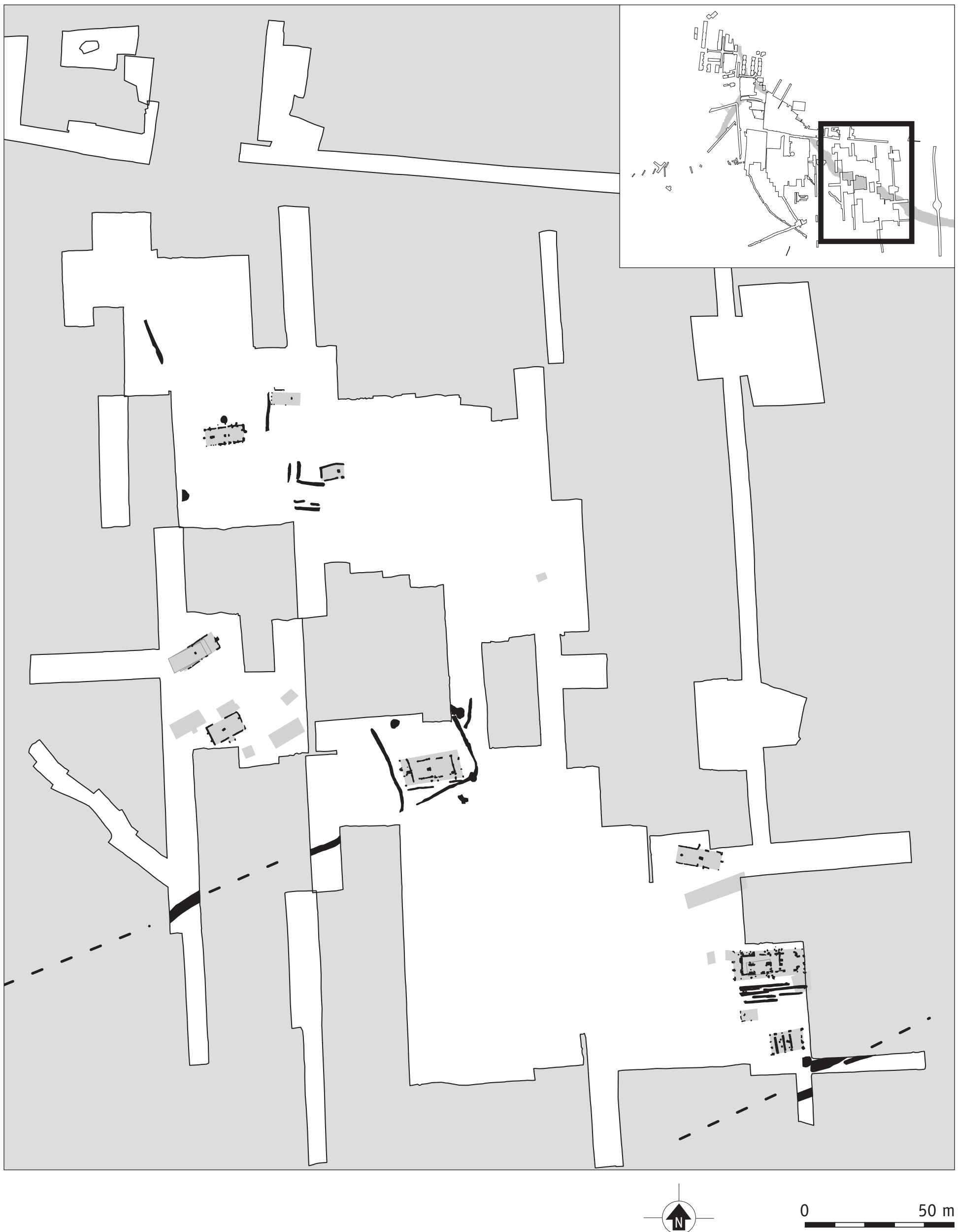

Fig. 1.7b. Archaeological features from phase 3.2 in Passewaaijse Hogeweg. See fig. 1.4 for legend.

1.1.2.2 The cemetery[9] (fig. 1.5)

The cemetery did not yet exist in phases 1 and 2 of the settlements. Two small groups of cremation graves dating to phases 1 or 2 were found. Burials were not demarcated in this phase and were accompanied by few or no grave goods. For the Early Roman phase, no graves were found at all. The first graves in the cemetery date to around 60 AD (phase 3), whereas the last burials can be dated around 240 AD (phase 5-6). No burials were found that could be associated with the final phase of the settlements. Both settlements in Tiel-Passewaaij used this cemetery to bury their dead. It is probable that a third settlement

[9] The information in this paragraph is based on Aarts/ Heeren 2007.

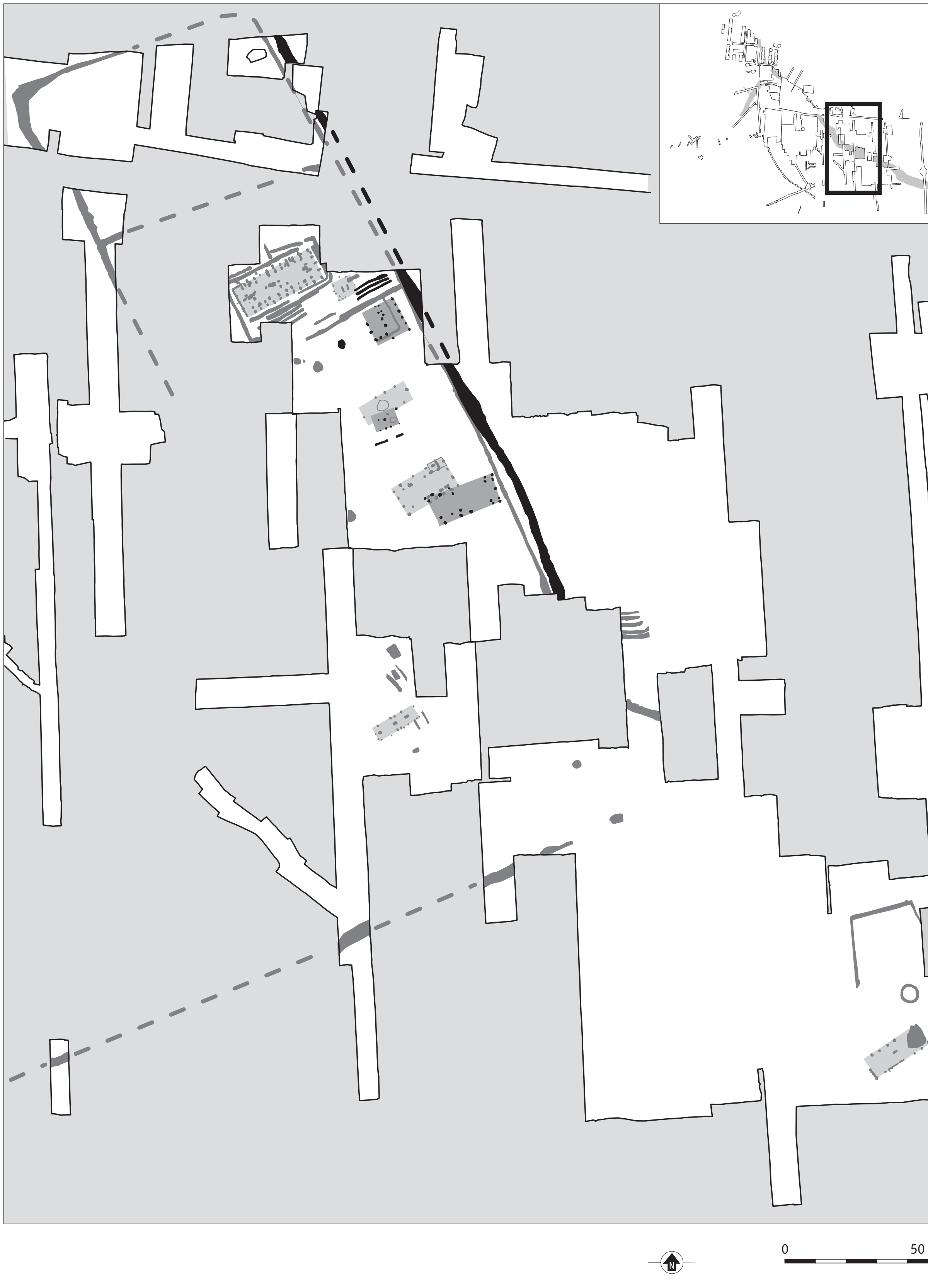

Fig. 1.8. Archaeological features from phase 4 in Passewaaijse Hogeweg. See fig. 1.4 for legend.

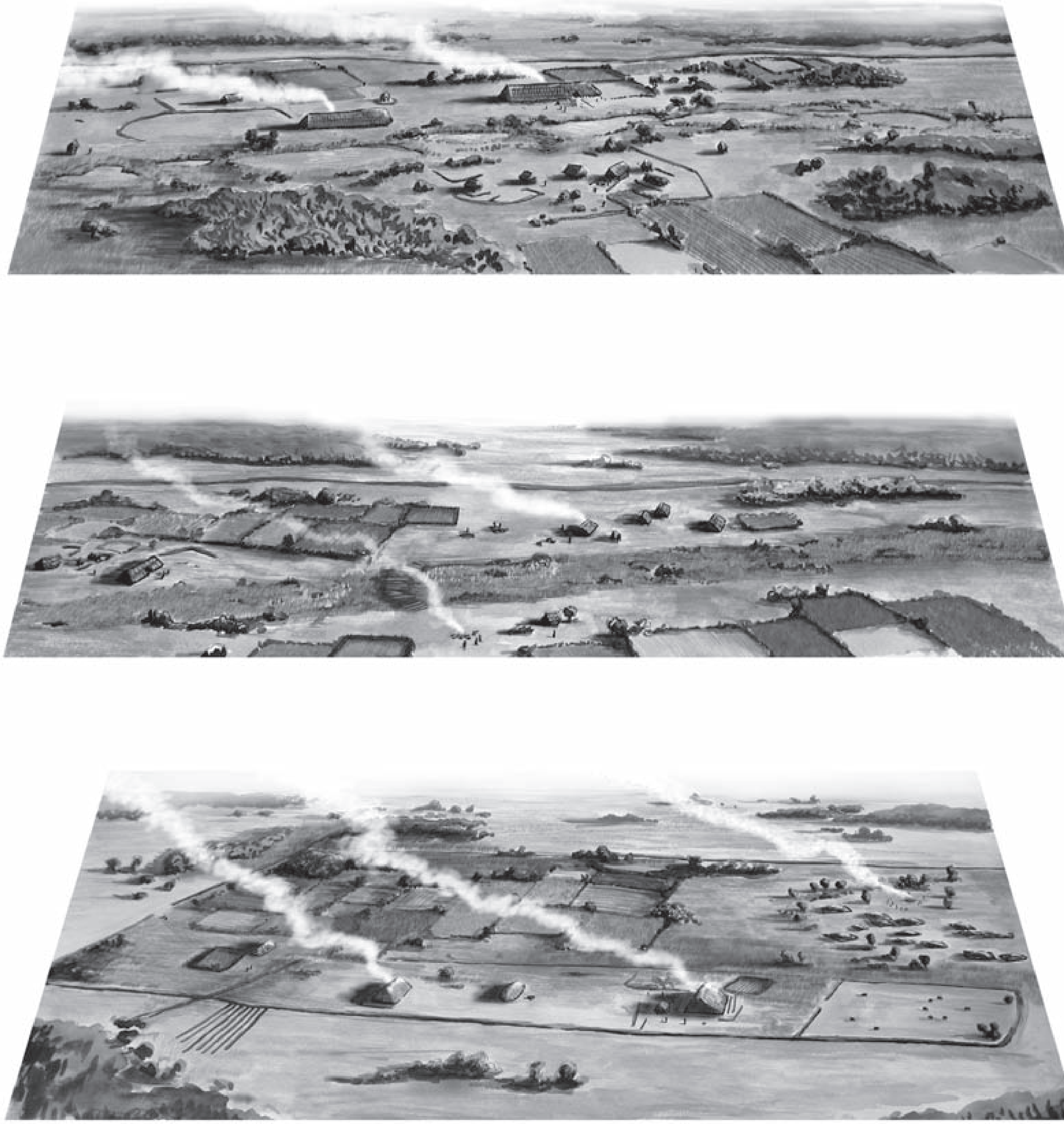

Fig. 1.9. Reconstruction of the settlement Passewaaijse Hogeweg in phases 2, 3 and 4. Illustration M. Kriek.

also used the same cemetery, as is suggested by the discrepancy between the number of graves and the demographics based on settlement data.

With one exception, all graves in the cemetery were cremation graves. After the body had been cremated, the remains were selected from the burned pyre debris and buried in a grave. In some cases, pyre debris was included in the burial. As time progressed, less care was taken over the selection of the cremated bones, and pyre debris including some human bones was buried in the grave without selection. Most cremation graves were surrounded by a circular or rectangular ditch. The earth from the ditch was used to build a low mound. An opening in the ditch was often found on the northwest side. Cremated remains and pyre debris were not the only finds from graves. Most burials included grave goods. The goods could either be placed on the pyre and burned with the body, or placed in the grave when the

Fig. 1.10. Archaeological features from phase 5-6 in Passewaaijse Hogeweg. See fig. 1.4 for legend.

cremated remains were buried. Grave goods usually consisted of several pieces of pottery: plates, beakers and jars. Other grave goods found are glass vessels, brooches, knives and coins.

The number of burials that was excavated is estimated at 343. This number is not easy to establish, because in the later phases of the cemetery, many cremation graves were lost as a result of post-depositional processes. Fortunately, the ditches surrounding the grave were still visible. Considering that 20 % of the cemetery was not excavated, the total number of graves in the cemetery can be estimated around 400.

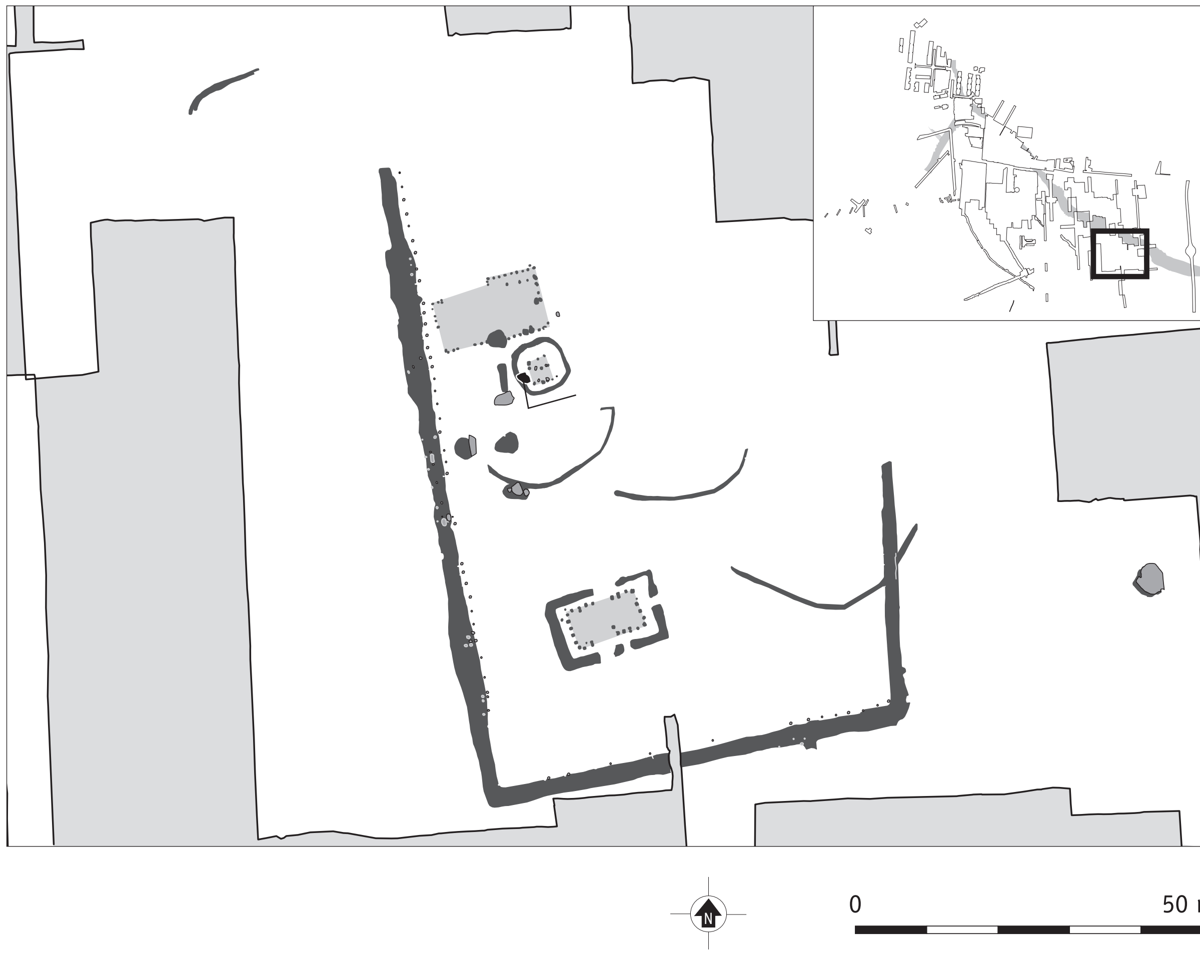

Fig. 1.11. Archaeological features from phase 7 in Passewaaijse Hogeweg. See fig. 1.4 for legend.

1.1.2.3 The settlement Passewaaijse Hogeweg[10]

Phase 1: Early Iron Age - 175 BC

Renewed activity of the stream during the Late Iron Age has resulted in the Iron Age occupation being silted over. Little of it has been excavated. No house plans were found, but some finds prove that there was habitation during this period. Hand-formed pottery and brooches can be dated to this earliest phase.

Phase 2: 60 BC – AD 50 (fig. 1.6, 1.9)

After a period without occupation, we find evidence that people started living in Passewaaijse Hogeweg again at the end of the Iron Age. Habitation may not have been possible in the intervening years due to frequent flooding of the stream. The stream still carried water, although it was rapidly silting up. All the earlier houses from this phase followed the orientation of the stream: the axes of the houses run parallel to the stream. The later houses from phase 2 had a slightly different orientation. The farmhouses were all located on the southern bank of the stream. There was certainly some settlement activity on the northern bank, shown by the presence of small four-poster structures, boundary ditches and numerous pits. The activities can probably be related to agriculture. Farmhouses from this phase were long (up to 34 metres).

[10] The information on the settlement Passewaaijse Hogeweg is based on Heeren 2007a and Heeren in prep. More information on the settlement can be found in Heeren 2006 and Roymans/Derks/Heeren 2007.

Some early imported pottery was found, but most of the ceramics was made locally. Small metal finds provided dates for some of the features from this period. A long ditch connected Passewaaijse Hogeweg with Oude Tielseweg, suggesting that there were close ties between the two settlements.

Phase 3: AD 40 - 150 (fig. 1.7a and b, 1.9)
Houses in this phase were much shorter and no longer orientated on the stream, which had probably dried up by this time. Three or four houses would have been in use at the same time. The absence of ditches around the house plans could indicate drier conditions in this period, and thus less need for drainage. Another indication for a dry phase is an increase in the number of wells compared to phase 2. A practical consequence of the absence of house ditches is that the number of animal bones dated to phase 3 is smaller than it would otherwise have been, since animal bones are found in ditches rather than postholes. In the later part of phase 3, some large granaries were found in the settlement for the first time, possibly indicating centralised storage of crops. There is some evidence for a road that ran to the north of the settlement and crossed the stream and the area where the cemetery would arise in the next phase. Another important development is that the cemetery was first used for burial of the dead during this phase.

Phase 4: AD 140 - 220 (fig. 1.8, 1.9)
In phase 4, houses increased in size but decreased in number. Three houses were lived in simultaneously. Drainage ditches were now found around the houses again. The farmhouses and outbuildings were surrounded by ditches, creating what looks like two separate compounds. Several large, straight enclosure ditches were found in this phase, demarcating the land surrounding the settlement.

Phase 5-6: AD 210 - 270 (fig. 1.10)
Phases 5 and 6 are discussed as one phase here, for two reasons. First, these two phases both have very short time spans. Second, the number of animal bones that could be dated to either one of the phases was very small. Most bones were dated to a longer period: phase 5-6. The decrease in the number of people living in Passewaaijse Hogeweg is visible in the number of houses: only one house was in use during this period. The house dating to the early part of phase 5-6 was enclosed by a rectangular ditch, which contained a number of special animal deposits. The large enclosure ditches outside the settlement from phase 4 were replaced by a single, curved ditch which may have enclosed both settlement and cemetery. An interesting find from this phase is a coin hoard of silver *denarii* that was found in a posthole of a house.[11] Oude Tielseweg was not inhabited during phase 5-6.

Phase 7: AD 270 - 350 (fig. 1.11)
In phase 7, changes in building style and finds such as metal objects and ceramics indicate a change in inhabitants. In the later part of the 3rd century, people crossed the Rhine from the north and settled in the Dutch River Area. Some of these people may have settled in Passewaaijse Hogeweg. Two house plans could be dated to this phase, but the houses were not contemporary. Both houses were much smaller than the houses in previous phases. The large rectangular ditch from phase 5-6 was re-used in this phase, and a palisade erected along the inside.

1.2 HISTORICAL AND GEOGRAPHICAL CONTEXT OF TIEL-PASSEWAAIJ

1.2.1 THE BATAVIANS

The Eastern Dutch River Area was part of the province of *Germania Inferior.* This province was divided into several *civitates.* The one we are concerned with in this study is the *civitas Batavorum*, which more or less comprised the Eastern Dutch River Area (fig. 1.12). The Eastern Dutch River Area formed the core area of the Batavians. Whenever the Batavians are mentioned, many people will think of the stereotypical image from history books of groups of wild-haired Batavians floating down the river Rhine on rafts. As always, reality was more complex and less romantic. The Batavians first arrived in the eastern part of the Dutch River Area in the second half of the 1st century BC, after the Eburones had been decimated by Caesar. Motives behind this move could have varied from demographic pressure to promises made by the Roman authorities. The settling of friendly tribes on the southern bank of the Rhine would give the Roman authorities tighter control of the frontier zone. The Batavian immigrants almost certainly fused with the remaining Eburones to create a new ethnic group.[12]

A special treaty existed between the Batavians and the Romans. Under this treaty, the Batavians did not have to pay regular taxes. However, they were expected to supply large numbers of soldiers for auxiliary units as well as the Imperial Guard. Recruitment during the 1st and 2nd centuries AD ensured that the Batavians remained a soldiering people. Around 5,000 men served in the Roman army at any time. The substantial drain of men to the army and the return of veterans to their homeland would have had a big effect on the small communities. Horse-riding skills would have been encouraged in young men, to prepare them for a life in the army.[13]

While temples and towns were built in a Roman style and people started to adopt Latin names, most Batavians continued living in traditional farmhouses.[14] New identities were constructed in which both the old warrior and pastoral values and the new values connected with Roman civilisation were represented. The Batavian elite served as officers in the Roman army and were mediators between their fellow Batavians and Roman military culture. The Batavians who served in the army may have facilitated trade contacts between the Roman army and the rural settlements in the Eastern Dutch River Area.

1.2.2 THE EASTERN DUTCH RIVER AREA: A DYNAMIC LANDSCAPE

Since agriculture is dictated to a large extent by the local landscape, it is important to understand the landscape of the Eastern Dutch River Area. The landscape of the Holocene Dutch River area was defined by river channels and their sedimentations. The meandering rivers changed their course over time and often flooded their banks in winter. The river banks or natural levees were higher than the surrounding land and composed of sandy-silty clay, whereas the flood basins were low-lying, with soil consisting of clay sediment.[15] When a river was no longer active the river bed silted up. A stream ridge consisted of the old river bed with its sandy deposits, possibly with a residual channel, and the former river banks. A stream ridge remained a higher feature in the landscape. Active river channels, stream ridges and flood basins formed the main elements of the landscape of the Eastern Dutch River Area (fig. 1.13).

11 Aarts 2007, 126.

12 Roymans 2004, 19, 25-27, 55.

13 Roymans 2004, 23, 55, 57, 227-228.

14 Roymans 2004, 252-253.

15 Berendsen/Stouthamer 2001, 23-24.

Fig. 1.12. The *civitas Batavorum*, with sites mentioned in the text.

Banks of active rivers were originally covered by forest consisting of ash, alder and elm. Fossil river banks, so-called stream ridges, were covered by oak, ash, elm, and a variety of bushes and herbs. The flood basins were mainly covered by alder, willow and marshy vegetation such as reed and sedge. Riverine forest was cleared from the Bronze Age onwards to make land available for settlements and arable agriculture. Cutting of trees and sedge in the flood basins allowed grassland to be established.[16]

The stream ridges were most suitable for habitation and arable agriculture. The amount of produce that could be grown was limited by the surface area of the stream ridges. We should, however, be careful not to define a landscape in a negative way, focusing on the restrictions.[17] The variations in the landscape of the Eastern Dutch River Area offered plenty of opportunities, especially for a people adapted and used to the dynamic character of the landscape. The flood basins offered plentiful grazing in summer. Livestock would thrive on the rich grassland. Although the surface area was limited, the dry and sandy stream ridges offered fertile ground for arable agriculture. The use of crops adapted to the local environment ensured successful harvests. Rivers could be used as channels for quick and easy communication and transportation of goods. Rivers and natural ponds were suitable for various species of fish. The flood basins and what remained of the riverine forest offered a good habitat for wild mammals, although as we shall see this source of food was only used in a limited way. The presence of the Roman army and towns, small as they may have been, offered opportunities for trade. Good infrastructure also offered local communities the opportunity to participate in wider networks.

16 Lange 1990, 18-19.

17 Van Driel-Murray 2003, 205.

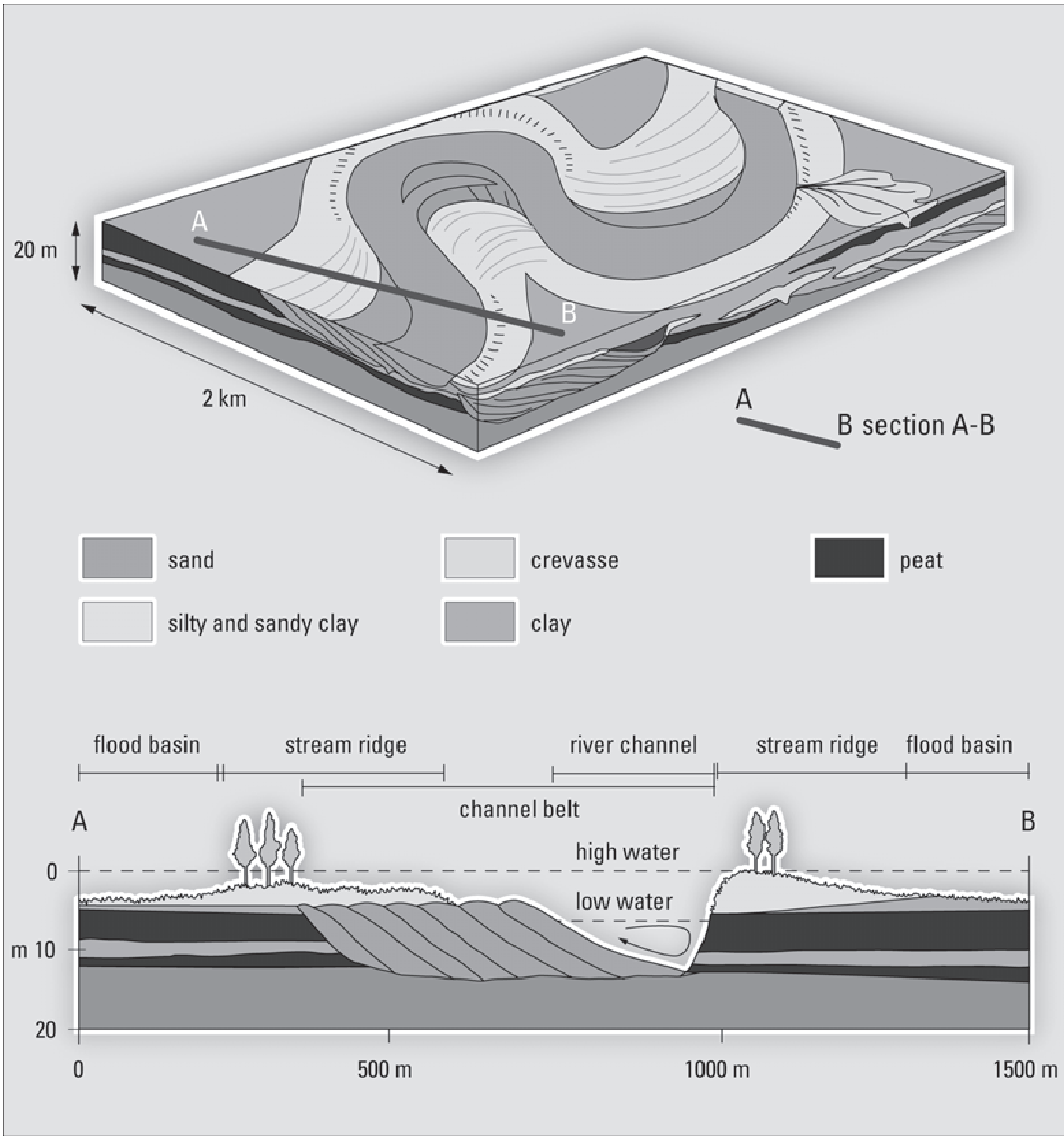

Fig. 1.13. Geological components of a riverine landscape. After Vossen 2007.

The geology of the Eastern Dutch River Area has had another important influence on the animal bones from Tiel-Passewaaij: it is because of the excellent preservation of the clay soils that a large assemblage of animal bones was found, and in such a good condition that detailed analysis was possible.

1.2.3 RESEARCH AREA

Results from the study of the animal bones from Tiel-Passewaaij will be placed in a wider context by comparison with animal bone studies based on other excavations in the eastern part of the Dutch River Area. This holocene river landscape was the core area of the Batavians. There are two arguments for limiting our research area to this region. First, the environment is broadly similar within the whole region. Although comparison with sites with a different local environment can be interesting because the environment partly determined possibilities for animal husbandry, this was felt to fall outside the scope of the present research. Second, the Eastern Dutch River Area was not just a geological entity but also an administrational one: the *civitas Batavorum*. We can assume that taxation would have been similar for every community within one *civitas*.

1.3 PREVIOUS ZOOARCHAEOLOGICAL RESEARCH OF THE ROMAN PERIOD IN THE EASTERN DUTCH RIVER AREA

It is vital to classify the animal bone assemblages from the Eastern Dutch River Area according to the nature of the site they derive from. We can distinguish between military sites and their accompanying habitation, the town of Nijmegen, rural settlements and temples. This classification is important for the study of production and consumption of food.

One of the first Roman sites in the Dutch River Area for which animal bones were collected, analysed and published was the temple of Elst.[18] Other early zooarchaeological studies analysed the assemblages from the military sites of Zwammerdam, Velsen and Valkenburg, and the settlement Rijswijk-De Bult, which are all located in the coastal part of the frontier zone, west of the Eastern Dutch River Area.[19] The first systematic and comparative study of animal bones from Roman sites in the Eastern Dutch River Area is that by Lauwerier.[20] The strength of this study is that animal bones from different types of site were analysed: military sites, the urbanised centre of Nijmegen, native settlements, and a cult site. Lauwerier first touched on many research themes that have dominated zooarchaeological studies of Roman assemblages from the Eastern Dutch River Area.

1.3.1 THE CONSUMPTION OF HORSE MEAT

One of the research themes introduced by Lauwerier is the consumption of horse meat, or rather the apparent taboo on eating horse meat. Lauwerier compared butchery marks on horse and cattle bones and concluded that horse meat was not eaten in the Eastern Dutch River Area.[21] Butchery marks were explained by the segmentation of horse carcasses to feed horse meat to dogs. In a later article, which was based on a larger data set, Lauwerier concluded that horse meat was consumed in some rural settlements but not in others. The perception of horses as comrades was mentioned as the most likely reason for the avoidance of horse meat.[22] More research is needed to clarify the relation between the location of the settlement and the consumption or non-consumption of horse meat. Also, the use of horse meat as dog food is unsatisfactory as an explanation for the butchery marks that are found on horse bones, some of which clearly indicate the removal of meat.

18 Bogaers 1955, 137-143.

19 Clason 1978; Van Wijngaarden-Bakker 1970; Gordijn-Vons 1977; Clason 1960; Clason 1967; Prummel 1975.

20 Lauwerier 1988.

21 Lauwerier 1988, 153-4.

22 Lauwerier 1999, 107-109.

1.3.2 ANIMALS IN RITUALS

Excavations at temple sites have revealed animal bones from a specific, ritual context. Several animal bone assemblages from temples in the Eastern Dutch River Area have been published: one from a sanctuary in Nijmegen dedicated to Mercury and Fortuna, and three from rural temple sites: Empel, Elst-Grote Kerk and Elst-Westeraam.[23] The assemblage from Westeraam is rather small, but Elst and Empel have good assemblages (around 800 fragments) for at least the temple phase. When compared with rural settlements, the temples show a different use of animals. The animal bones from the rural temples all point to a selection of young cattle.

The study of animals in a ritual context has focused mainly on temples. Rituals taking place outside temples received less interest, probably because these are harder to identify. Some research was done into animal bones in a funerary context.[24] Recently, interest in the ritual use of animals has increased, both in settlements and other contexts. One publication focused on rituals involving animals in a settlement, while two others provided an overview of different kinds of sacrifice, offerings, ritual meals and depositions.[25] A recent study describes the evidence for settlement rituals in the modern province of Noord-Holland, many of which involved animals.[26]

1.3.3 URBAN-RURAL RELATIONSHIPS

The relationship between rural and urban sites is closely tied in with the study of production and consumption. The presence of towns and the army stimulated production in rural settlements, as well as the improvement of local cattle breeds, all in order to answer demand for meat.[27] To investigate these processes, information on animal bone assemblages from both rural and urban sites is needed.

The urban centre of Nijmegen has recently been the focus for two studies. The first focused on cattle remains from the excavations at the Maasplein in Ulpia Noviomagus (AD 75-275), whereas the second includes animal bones from several excavations in Nijmegen, covering the entire Roman period.[28] The provenance of meat consumed in towns is an important theme and requires data from rural settlements.

1.3.4 PRODUCTION OF A SURPLUS

The past two decades have seen the start of a debate on the possibilities for the production of an agricultural surplus in the Eastern Dutch River Area. Lauwerier's study intended to provide a review of animal husbandry in the Eastern Dutch River Area. The emphasis was not on investigating possibilities for surplus production. For his conclusions on animal husbandry, Lauwerier used a combination of age data and classical sources. The relevance of classical sources for the Eastern Dutch River Area is, however, questionable. The local farmers are unlikely to have read these Roman authors, and even within Roman Italy the intended readership of such texts was a very specific and limited part of society. Lauwerier expected the rural settlements in the Eastern Dutch River Area to have intensified their pig production

23 Lauwerier 1988, 111-121; Robeerst 2005; Robeerst in prep.; Seijnen 1994; Zeiler 1996.

24 Lauwerier 1983; Lauwerier 1990; Lauwerier 1993; Thijssen 1990.

25 Lauwerier *et al.* 1999; Lauwerier 2002; Lauwerier 2004.

26 Therkorn 2004.

27 Lauwerier 1988, 15.

28 Filean 2006; Robeerst 2004; Robeerst in prep.

to supply the demand for pork.[29] He mentions the possibility of twice-yearly litters, which seems unlikely for this area. Sheep were exploited for meat, milk, wool and manure.[30] Age data for cattle show no large-scale production of milk. Some settlements possibly raised cattle primarily for meat, but most exploited them mainly for traction and manure, with meat as a welcome by-product.[31] The meat component of the military diet was formed by beef, supplemented with pork and mutton. The relative frequency of the different types of meat depended not just on taste, but also on what was locally available.[32]

Roymans inferred that intensification in agriculture in the Eastern Dutch River Area, a result of increasing orientation on the market, was mainly found in cattle and horse breeding.[33] The landscape did not lend itself to competitive cereal production when compared to the fertile loess regions of *Gallia Belgica*. The emphasis on cattle breeding also formed a continuity of the Iron Age pastoral ideology of our region.

Kooistra concluded that some degree of surplus production was possible in the Kromme Rijn area.[34] The extent of the surplus depended on the size of the population. In the 1st century, it was possible to produce a surplus of both cereals and meat animals. In the 2nd century, the possibilities for surplus production decreased with the increase in population. The produced surplus now consisted not of food, but of horses. Kooistra stated that production capacity was restricted by the environment.[35]

Van Driel-Murray picked up on this last statement, and assumed that the situation was so bad that even self-sufficiency is questionable for part of the Roman period. Population pressure and agricultural stress forced the local population to rely on intensive horticulture. However, Van Driel-Murray still left room in this pessimistic picture for small-scale production and selling of a surplus: vegetables, eggs and cheese.[36]

To sum up, there is general agreement on the existence of surplus production in the Eastern Dutch River Area, but opinions vary on the type and extent of surplus. Possible markets were not far away, and the finds of non-native goods in rural settlements are evidence for trade. Traded goods consisted of cereals, animals and animal products. Species ratios and data on age distribution allow a reconstruction of the livestock herds to be made. This provides a first line of evidence for identifying surplus production.

1.3.5 WITHERS HEIGHT AND THE IMPROVEMENT OF LIVESTOCK

One way of investigating the intensification of production in reply to the growing demand for meat from towns and the army is the study of changes in withers height. An increase in size in cattle is seen in rural settlements in the Roman period. Larger cattle provided more meat. This increase in size of cattle is seen as the result of Roman influence on animal husbandry. The Romans were considered to be better stock-breeders.[37] This Roman influence is believed to have consisted of improved nutrition, selective breeding directed at larger animals and the introduction of imported large cattle.[38] This last factor is seen in the occurrence of two populations side by side: small, native cattle and large, imported cattle. Lauwerier saw the aim for larger cattle as stemming from the desire for more traction power.[39]

The theory of the Romans being responsible for the size increase in cattle both belittles the animal husbandry expertise of local people and projects a modern appreciation of large cattle on the past.

29 Lauwerier 1988, 129.
30 Lauwerier 1988, 132-133.
31 Lauwerier 1988, 136-140.
32 Lauwerier 1988, 161.
33 Roymans 1996, 82-83.
34 Kooistra 1996, 65.
35 Kooistra 1996, 72-73, 125.
36 Van Driel-Murray 2003, 205-206.
37 Lauwerier 1988, 15; Robeerst 2004, 83-84.
38 Lauwerier 1988, 15.
39 Lauwerier 1988, 168-169.

Another problem with this theory is that it provides a very one-sided view. The small, native cattle were suited to the needs of local Iron Age and Early Roman communities. It was not until the demand for meat arose that large cattle were considered to be desirable. Even then, it was almost certainly a combination of the influence of large imported cattle on the smaller local types and the striving of local people to breed and raise larger animals. Although the question of how the increase in cattle size was brought about is an interesting one, the increase in size itself in combination with the time at which this occurred provides information on the intensification of cattle breeding and meat production. Robeerst was able to date the start of the increase in size to the early 1st century AD.[40] She saw this as evidence for the early start of a market system revolving around military and civil Roman settlements. Robeerst assumed that most animal products consumed in military and urban sites were produced locally.

1.4 PRODUCTION AND CONSUMPTION IN THE EASTERN DUTCH RIVER AREA

The community living in Tiel-Passewaaij was not a self-sufficient community; it was integrated in an exchange network. Several agents can be identified in this network: the inhabitants of the rural settlements, the Roman army, markets in towns and rural centres, and the Roman authorities. We can distinguish between consumption sites, which did not produce their own food, and production sites, which produced the food for consumption sites. Of course, production sites also consumed part of the food they produced, which complicates matters. Production of an agricultural surplus in rural settlements was stimulated in two ways. First, both soldiers and urban dwellers had little opportunity to grow their own food, and were therefore dependent on the surrounding areas, military supply lines and markets. This need for food created an opportunity for the local inhabitants to sell their produce. Second, taxation also created a demand for a surplus. Taxation could have been in money, in which case a surplus had to be sold at market first, or it could be in kind. The next paragraphs will take a closer look at the various agents involved. Paragraphs 1.4.1 to 1.4.3 describe the consumption sites (the Roman army and markets) and the production sites (the rural settlements). The final paragraph will discuss market systems and taxation.

1.4.1 CONSUMPTION: THE ROMAN ARMY

The Roman army first reached this region around the middle of the 1st century BC. A more permanent military presence did not exist until the reign of Augustus, when military sites were built along the Rhine as operating bases for the planned conquest of *Germania*.[41] Attempts to conquer *Germania* were abandoned by Tiberius in 16-17 AD, after which the Rhine became a permanent border. The Roman *limes* consisted of a line of forts and fortresses along the southern bank of the river, connected by a road. The only legionary fortress, or *castra*, in the Roman Netherlands was located in modern Nijmegen. Other military sites were auxiliary forts or *castella*, so-called *mini castella* and watchtowers. Apart from the military on land, the provincial fleet or *classis Germanica* was also active in our region.

The military presence affected many different aspects of life. The army controlled traffic across the river Rhine and along the *limes* road. All the land adjacent to the Rhine was probably owned by the army.[42] Soldiers needed food and other necessities, part of which would have been acquired locally. The

[40] Robeerst 2004, 84, 88.

[41] Bechert/Willems 1995, 24-5.

[42] Bechert/Willems 1995, 15.

size of the army of *Germania Inferior* varied. It started to decrease after 16-17 AD, from a maximum of 42,000 men to 20,000 men from the early 2nd century onwards.[43] When the army first reached our region, much of the food they needed must have come from military supply lines, because the local population was not yet used to the demand for food products. However, it was not long before the necessary networks were created or existing networks tapped into, and the army came to rely on the local rural settlements for at least part of its food.

1.4.2 Consumption: markets, towns and temples

The Roman army is only one agent in the complex network that existed in the Eastern Dutch River Area during the Roman period. Other agents include markets held in towns, military settlements adjourning forts, and temples. There were very few towns or urban centres in the Roman Netherlands. The most important one in the vicinity of Tiel-Passewaaij was the capital of the *civitas Batavorum* in modern Nijmegen. The settlement of Oppidum Batavorum was founded at the beginning of the 1st century AD. The town was inhabited by Batavians, administrators, merchants, craftsmen and veterans from the Roman army.[44] The Batavian revolt in 69-70 AD halted further development when the town was burned to the ground. A new civilian settlement was built in a different location, about 1500 metres to the west of the previous one.[45] The town soon thrived, partly due to the presence of a legion in the fortress nearby.[46] Evidence was found here for crafts such as metalworking, bone working and pottery making. Under Traianus, the town received municipal status, market rights and a new name: Ulpia Noviomagus Batavorum. The town was finally abandoned around 265 AD.[47] Late Roman occupation, much reduced in size, was concentrated to the east of Ulpia Noviomagus, in a fortified settlement on and around the Valkhof.[48]

The population of Nijmegen in the late 1st century AD has been estimated at 5,000 civilians and 5,000 soldiers.[49] Between 71 and 102/104 AD, the Tenth Legion was quartered in Nijmegen, which explains the large number of soldiers. Civilians not only lived in the town but also in the camp settlement or *canabae* surrounding the legionary fortress. *Canabae*, just as military *vici,* were inhabited by merchants, shopkeepers, craftsmen, veterans, farmers and the wives and children of soldiers. All these people had close links with the Roman army. In the excavations in the *canabae*, indications were found for specialised processing of meat: the smoking of shoulders of beef and the production of brawn out of cattle heads.[50] The *canabae* ceased to exist after the Tenth Legion left Nijmegen. From the early 1st century AD onwards, Nijmegen must have been an important market place for the surrounding region. Inhabitants from rural settlements in the Eastern Dutch River Area brought their surplus produce and animals here. The animals were transported on the hoof and slaughtered in the town. In Ulpia Noviomagus, an assemblage of highly fragmented bones from a boundary ditch is believed to be commercial waste from high-volume processing of cattle.[51]

The rural temples in Empel, Elst and Kessel are all successors of Late Iron Age sanctuaries.[52] Temples would not just have been focal points for religious activities, but also housed markets.[53] Cattle, sheep and pigs were frequently sacrificed on the temple site. Part of the animal was offered to the gods, but most

43 Alföldy 1968, 137ff-143, 141, 149ff-152, 160-162ff.

44 Roymans 2004, 204.

45 Van Enckevort/Thijssen 2003, 65; Haalebos/Willems 2005, 52.

46 Willems 1990, 41.

47 Van Enckevort/Thijssen 2003, 71.

48 Willems 1990, 79-80, 84.

49 Willems 1990, 71.

50 Lauwerier 1988, 61-64; Lauwerier 2005, 235.

51 Filean 2006, 340-341; Lauwerier 2005, 236.

52 Roymans 2004, 12-13; Roymans/Derks 1994, 14.

53 Van Es 1981, 194.

of the meat was consumed by priests and members of the community.[54] The use of sacrificial animals in the temples meant that livestock had to be supplied from the surrounding settlements. Empel and Elst stopped functioning as sanctuaries in the early 3rd century AD.[55]

1.4.3 PRODUCTION: RURAL SETTLEMENTS

The rural settlements in the Eastern Dutch River Area were usually small, with only one to a handful of farmhouses. Continuity from the Late Iron Age is observed at many rural settlements. The typical farmhouse found in these settlements was the byre house, housing man and livestock under one roof. Farmhouses were constructed from wood and wattle-and-daub, with thatched roofs. Despite the sporadic incorporation of Roman-style building materials, the native type of farmhouse stayed recognisable.[56] Other structures found in rural settlements are small granaries and other outbuildings, wells and ditches.

A characteristic aspect of the Eastern Dutch River Area is the lack of Roman-style villas. Although some rural settlements have been labelled 'proto-villas', they were very different from the villas in other regions such as the loess area in the southeast of the Netherlands. The Roman villa was an agrarian operation with a stone main building built in a Roman style. Arable agriculture and the production of a surplus for the urban market were the basis of the Roman villa. The rarity of villas in the Eastern Dutch River Area has been seen as a reflection of the poverty of the local people or of environmental constraints, but it was also related to cultural values.[57] Instead of spending surplus wealth on stone-built houses, money was spent on pottery, bronze brooches, textiles, food and livestock. It is also possible that the Roman-style villa – being strongly associated with grain production - was not an obvious choice for a community primarily dependent on livestock.

Both the towns and the military sites offered trading opportunities to the inhabitants of the rural settlements. Taxation further stimulated agricultural production. The rural settlements would have produced not only food but also products such as wool. Middlemen may have acted as go-betweens between the many small rural settlements and the Roman army or the urban markets, but it is also possible that farmers took their own produce to market. Of course, the rural settlements were not just production sites. They were also consumption sites, because part if not most of what was produced was consumed locally. The surplus may have formed only a small part of the total agricultural production.

1.4.4 MARKET SYSTEMS AND TAXATION

Unless goods were exchanged directly for other goods, knowledge of the use of money was necessary for a market system to develop.[58] The first half of the 1st century AD was a period during which both this knowledge and money itself spread rapidly through the Dutch River Area. Batavian soldiers and ex-soldiers played a crucial role in this process. At this time, Batavian troops were stationed in *Germania Inferior*. During visits to their home villages, part of their army wages would be left behind. Roman coins dating to this period are frequently found in rural settlements. More crucial is that the soldiers would pass on their knowledge about how money could be used. Although coins were already used in the Eastern Dutch River Area in the Late Iron Age, they were used in specific social contexts. Not much evidence

[54] Roymans/Derks 1994, 31; Seijnen 1994, 171.

[55] Derks *et al.* in prep.; Roymans/Derks 1994, 25; Van Es 1981, 198.

[56] Roymans 1996, 74-76.

[57] Roymans 1996, 73.

[58] This paragraph is based on Aarts 2005, 5-6.

is found during the Early Roman period for trade between rural settlements and the army. It may have occurred at a small scale, but it did not significantly influence the rural settlements. It is not until the Flavian period (AD 70-100) that a substantial increase in imported pottery in rural settlements in the Eastern Dutch River Area can be noticed. This implies the existence of trade at a larger scale, and with it, an increasingly monetised society.

The treaty between the Romans and Batavians exempted the Batavians from regular taxation. This situation may have changed after the Batavian revolt in 69-70 AD. The Batavians were now probably taxed not only for recruitment, but they had to pay taxes like any other people living in the Roman Empire. Taxation and trade are similar in the way they affected agrarian production methods. An agricultural surplus needed to be produced, either to sell at market for personal profit, or to use the proceeds or the surplus itself to meet tax demands. The main difference with taxation is that trading was done voluntarily and that this would have resulted in a two-way flow of goods. The goods purchased with the profits may be archaeologically visible, whereas taxation is very difficult to identify.

1.5 THE ANIMAL BONE ASSEMBLAGE FROM TIEL-PASSEWAAIJ

1.5.1 POSSIBILITIES

The assemblage of animal bones from Tiel-Passewaaij has a high potential for (zoo)archaeological research. There are several reasons for this. First, the excavations in Tiel-Passewaaij uncovered remains of two settlements and a cemetery, enabling us to compare differences in the use of animals in different contexts. We can grasp a whole community instead of just one aspect of it. Not only can we study the role of animals in the local economy, but also the part they played in funerary rituals. The special deposits found in Passewaaijse Hogeweg enable us to get a glimpse of rituals performed within the settlement: rituals that are little-known and deserve more attention. Second, a detailed chronology for the settlements has been established. Passewaaijse Hogeweg was inhabited continually from the Late Iron Age until the middle of the 4th century, so we can track changes in animal husbandry over time. Next, the assemblage of animal bones is large enough to allow us to make some solid statements on the significance of the various roles of animals in a rural settlement from the Roman period. Finally, it is not only the size of the assemblage that is to our advantage; the preservation of the animal bones varied from good to excellent, as a result of the clay soil and the high water table.

1.5.2 LIMITATIONS

However, despite the potential of the animal bone assemblage from Tiel-Passewaaij, there are limitations to what the animal bones can tell us. One of the problems is that the number of animal bones from some of the phases is rather small. Conclusions for these phases will be more tentative than those for phases with larger bone numbers. The size of the assemblage from the cemetery is also much smaller than would be desirable. A second problem is that some of the methods to establish age at death used for the two settlements differ. As a result, not all the data from the two settlements can be easily compared. This problem will be addressed in paragraph 1.6.4. Finally, the majority of the results from the excavations of the cemetery and Passewaaijse Hogeweg has not yet been published and is still being processed. This means that information on other find categories was not available. Fortunately, a lot is already known about the development of the farmhouses in Passewaaijse Hogeweg.

1.5.3 CHRONOLOGY

A chronology of the settlement Passewaaijse Hogeweg has been developed by Heeren.[59] He also dated many features containing animal bones. Due to time restrictions, a proportion of the animal bone assemblage had to be disregarded because it was not feasible to date all features containing animal bones. The selection of features that were dated was made as follows. First, all features were selected which contained five or more animal bones that had been identified to species. A second selection consisted of features with animal bones that provided information on age or withers height. Third, a quick scan of the features that had not yet been dated revealed a number that could easily be dated on the basis of the phasing of the settlement. Unfortunately, some features proved impossible to date.

The dates of features are based on pottery, stratigraphy and orientation. A problem that arose was the occurrence of older material in younger features. In a multi-phased settlement, any digging activity will unearth earlier rubbish, which will be incorporated in the younger feature. This problem was revealed by the pottery, which also provided information on the scale of the problem. Although this problem caused some initial concern, it turned out that although a feature often contained material from earlier archaeological periods, these periods often fell within the same settlement phase, or within two adjacent phases. Besides, many of the features contained material that could confidently be dated to one phase. Where there was any uncertainty about the date of the contents of a feature, a broader date has been assigned to the feature.

Another problem that was encountered was that settlement phases do not necessarily correspond to zooarchaeological trends. In Passewaaijse Hogeweg, continuity in livestock management was observed between some phases, whereas one phase turned out to contain an important shift in livestock management. If it had not been for the fact that phase 3 was divided into two sub-phases, this shift would have been less noticeable and dated later than it actually occurred. Two phases, 5 and 6, contained rather small numbers of animal bones. Significant changes between phases 5 and 6 could not be observed in the animal bone assemblage, so the decision was made to treat these two phases as one: phase 5-6. In this way, a larger sample of animal bones could be discussed. An additional advantage is that the length of this phase (60 years) is now closer to that of the other phases (80-100 years for the Roman period phases).

For Oude Tielseweg, a chronology was established before the analysis of the animal bones started. Only animal bones from dated features were selected for analysis. For the cemetery, chronology is less relevant because the sample size is too small to allow a division into sub-samples.

1.5.4 THE ANIMAL BONES

From the considerable amount of animal bones from Oude Tielseweg, 3,663 could be assigned to a phase and were identified to a species. The analysis of the animal bones from Oude Tielseweg by the author took place from September 1998 to April 1999.[60] The number of identified animal bones from the cemetery is small: 528 fragments. The animal bones from the cemetery were analysed by the author in 1999-2000.[61] The results from the analyses of the animal bones from both Oude Tielseweg and the cemetery will be used in this study. A large number of animal bones was found during the excavations of Passewaaijse Hogeweg. The author was present on site for much of the excavation, ensuring that many

59 Heeren 2006; Heeren 2007a; Heeren in prep.

60 Groot 1999. Most of the animal bones from Oude Tielseweg phase 7 were identified earlier by Frits Laarman.

61 Groot 2000.

of the special animal deposits were observed first-hand. 6,354 animal bones from datable features were identified to species.

During the excavations of Passewaaijse Hogeweg, much care was taken to collect as many animal bones as possible by hand. Despite the excavation team's best efforts, the nature of the clay soil, especially during wet weather, makes it inevitable that fragments were overlooked. Certain features were sieved, but sieving did not take place systematically in the settlements. "Promising" features, rich in finds, were partially sieved. The volume of the sieving samples was not recorded, which limits the possibilities for statistical research. During the analysis of the animal bones, sieved and hand-collected samples were not separated. Therefore, it is not possible to compare the results of sieved and hand-collected samples or draw any conclusions on the differences in animal distribution between them. However, some general remarks are possible. Most of the fish bones were found in sieved samples, although some of the larger fish bone fragments were hand-collected. Contrary to expectations, bird bones were found both in sieved and hand-collected samples, although the smaller species were mainly found in sieved samples.

The preservation condition of the animal bones from Tiel-Passewaaij is generally good to very good. There are variations in preservation between bones from different features and different depths. Animal bones from deep and waterlogged features, such as wells, showed the best preservation, while shallow features with a sandy fill produced bones with the worst preservation. In most cases, any traces of butchery or gnawing could easily be observed.

1.6 METHODS OF ZOOARCHAEOLOGICAL RESEARCH IN TIEL-PASSEWAAIJ: RECORDING

1.6.1 IDENTIFICATION OF ANIMAL BONES

When identifying animal bones from archaeological excavations, some problems are encountered.[62] The distinction between sheep and goat can only be made for certain skeletal elements. The majority of fragments from Tiel-Passewaaij identified as either sheep or goat are cranial fragments, mandibles, radius and metapodials. The distinction is based on the criteria described by Boessneck, and Payne for the fourth deciduous premolar.[63] Wild boar was identified by size and comparison with modern wild animals. Roman domestic pigs are modest in size, and some of the bones from Tiel-Passewaaij were clearly much larger than domestic pig bones. It is possible that some young or female wild boar fragments have been misidentified as domestic pigs. No attempt has been made to identify aurochs. Large cattle bones were present among the material from the settlements, but it is well-known that large domestic cattle first appeared in the Roman period. No extremely large horncores have been found. The effect of any possible misidentifications cannot be very significant, because the percentage of wild animals in any rural settlement from the Roman period is generally very small.

Fragments that could not be identified to species have been identified to size classes: large mammal (which includes cattle, horse and red deer), medium mammal (sheep/goat, pig, dog, roe deer) and small mammal (cat, hare). For many fragments, size classes could not be established with certainty. These fragments are labeled Indeterminate. Ribs and vertebrae, especially from large mammals, are often fragmented and can be difficult to identify. Therefore, most ribs and vertebrae have not been identified to species.

Although many bones from amphibians and small rodents were found in Tiel-Passewaaij, they were not systematically identified and will not be discussed in this study. The focus of this study is on human

62 The zooarchaeological reference collection at the Amsterdam Archeologisch Centrum was used to identify the animal bones from Tiel-Passewaaij.

63 Boessneck 1969; Payne 1985, 143-144.

action and history, and the microfauna found in the excavations almost certainly did not end up there as a result of human behaviour. Microfauna can be useful in reconstructing the local landscape, but it was felt that this would not add to what is already known about the Eastern Dutch River Area.

In this study, not all the data from the animal bone analysis will be used. The focus will be on animal bone numbers and age data. To ensure that data from Tiel-Passewaaij are available for future research, they are presented in the appendix. Measurements were taken following Von den Driesch.[64] Estimated withers height was calculated using various factors.[65]

1.6.2 Quantification

The number of identified bone fragments was used as the basis for the animal bone analysis. No correction was made for the fact that not every mammal's skeleton has the same number of bones. The effect on the overall ratios is believed to be negligible. Absolute numbers of bone fragments are mainly a consequence of post-depositional processes. They can never be translated into a total number of animals that died at a site. Therefore, zooarchaeological interpretations are based on proportions of animal bones, rather than absolute numbers.

Although it is customary to interpret changes in percentages per species as increases and decreases in animal numbers, this is not necessarily what really happened. Theoretically, it is possible that a higher percentage of a certain species does not reflect an increase in the numbers of that species, but a decrease in numbers of all other species. Whenever an increase or decrease of a species is mentioned in the text, it should be understood as a relative increase or decrease.

1.6.3 Taphonomy

Any animal bones assemblage is affected by taphonomical processes such as butchery and carnivore gnawing. To understand the influence of these processes, fragmentation of bones was recorded. Five categories were distinguished: less than 25 % of skeletal element present, 25 % present, 50 % present, 75 % present, and 100 % for complete or nearly complete bones. Butchery marks were recorded as chop marks, cut marks, saw marks or scraping marks. For part of the assemblage from Passewaaijse Hogeweg, butchery marks were further recorded by butchery codes that accurately describe type and location.[66] The aim was to look for differences between butchery of cattle and horse, to establish whether horse meat was eaten or not. Unfortunately, the butchery code data set was too small for any conclusions on this subject. Although butchery marks were found on horse bones, the number of butchery marks per phase was too low for a comparison between butchery of horse and cattle. Descriptions and photographs of the worked bone from Passewaaijse Hogeweg are published elsewhere, as are some of the animal bones exhibiting pathological changes.[67] Gnawing was recorded as present or absent. In almost all cases, gnawing marks were caused by dogs. For burnt bones, the degree and extent of burning was recorded.

64 Von den Driesch 1976. Due to constraints of space, measurements are not included in the appendix. However, they are available from the author.

65 May 1985 for horse; Bergström/Van Wijngaarden-Bakker 1983 and Matolcsi 1971 for cattle; Von den Driesch/Boessneck 1974 for cattle, sheep and pig; Harcourt 1974 for dog.

66 Lauwerier 1988, 182-212.

67 Groot 2005; Groot 2006; Groot in press.

68 Silver 1969; Habermehl 1975.

1.6.4 AGE AT DEATH

In order to identify patterns in animal husbandry, it is necessary to study mortality profiles for the different domestic species. Exploitation for different products of animals will result in different population structures. The interpretation of mortality profiles is discussed in 2.2.1. Mortality profiles are based on age data for single bones. Two basic methods of ageing individual fragments were used. The first uses tooth eruption and tooth wear of the mandibles. The different teeth erupt at roughly the same age for each individual of a certain species, first the deciduous or milk teeth and later the permanent teeth. By recording which teeth have erupted and which have not, the age of an animal can be established with reasonable accuracy. Although this seems straightforward, there are some problems. First, many archaeological mandibles are fragmented. This means that it is not always possible to record the eruption stages for all teeth. Second, different studies of modern animals have resulted in tables with eruption ages that differ from each other.[68] Choosing to use one instead of another has implications for the ages that will be estimated. Fortunately, the differences are in months rather than years. As long as broad trends are studied, the differences between methods should not be too big a problem.

When an animal has its full set of permanent teeth, eruption data can only provide a minimum age for that animal. We must now use a second way of ageing mandibles, by recording tooth wear. Again, there are different ways of doing this, and the choice of method will affect the outcome.[69] A problem associated with tooth wear is that the degree of wear depends not just on age, but also on the type of food animals consumed. More abrasive food will result in more rapid tooth wear.

The long bones provide us with a second way of ageing. In a young animal, long bones consist of three separate parts: one diaphysis in the middle and an epiphysis at each end. Growth plates between the diaphysis and epiphyses allow the bone to grow. Once an animal has reached its full height, growth stops and the epiphyses fuse to the diaphysis. This occurs at different ages for each skeletal element and species. Again, there are several epiphyseal fusion tables that give somewhat different results.[70]

In archaeological animal bone assemblages, the data from tooth wear and epiphyseal fusion for sheep and cattle do not always agree. There are several explanations for this discrepancy. First, it could be a result of the methodology used. Translating biological events such as the fusing of long bones to absolute ages is an interpretation and not completely reliable. Also, the moment of fusion is dependent on many different factors, such as genetic background, nutrition and health. Castration, for instance, can delay fusion.[71] Tooth eruption seems less easily influenced by health and nutrition. Another explanation is that bones of very young animals are more fragile than those of older animals, and are more likely to be lost to taphonomy. Therefore, early-fusing epiphyses will usually be underrepresented, and with them, the younger age classes. Finally, it is possible that the two types of data are samples of two different parts of the population. When the two types of data do not match, the tooth eruption and wear data are taken as more reliable, mainly because the preservation of teeth is less dependent on the age of the animal. A mortality profile based on tooth eruption and wear is less likely to be influenced by taphonomy and post-depositional processes than one based on epiphyseal fusion.[72]

For both settlements, horse teeth were aged by comparison of their crown height to Levine's tables.[73] For Oude Tielseweg, mandibles of cattle, sheep and pig were aged following O'Connor's method.[74] O'Connor distinguished only five age categories, whereas Grant's ageing method is much more detailed.[75] Grant's method was believed to offer more possibilities for both the present and future studies. Therefore,

69 Payne 1973; Grant 1982; O'Connor 1989.

70 Silver 1969; Habermehl 1975.

71 O'Connor 2000, 95.

72 Amorosi 1989, 11.

73 Levine 1982.

74 O'Connor 1989.

75 Grant 1982.

the decision was made to use Grant's method for Passewaaijse Hogeweg despite the consequence this would have on the comparability of our data.

For Passewaaijse Hogeweg, tooth wear stages for mandibles, isolated fourth deciduous premolars and third molars of cattle, sheep and pigs were recorded following Grant's method.[76] For mandibles with no missing molars, a mandible wear stage was established. For incomplete mandibles, the most likely mandible wear stage was estimated by comparison with Grant's tables 2-4. Because Grant's mandible wear stages are not presented as absolute ages, they were converted to the age stages of Payne for sheep and Halstead for cattle and pig according to Hambleton's tables.[77] Hambleton's tables include absolute ages, which are used in this study. Using absolute ages instead of age categories is always risky, as the relation between age and tooth wear depends on breed, nutrition, soil type and other factors we may not even know of. However, absolute ages are vital in understanding herd exploitation.

Unfortunately, the different methods used for the two settlements mean that it is difficult to compare the results. In order to be able to compare the data from the two settlements, the following method was used. Many mandibles from Passewaaijse Hogeweg were scored according to both Grant's and O'Connor's methods. The results from the different methods were compared for each mandible, and O'Connor's categories were converted into absolute ages based on Grant, Halstead and Hambleton (table 1.1).[78]

For sheep, two age categories used by O'Connor could easily be linked with the absolute age categories of Payne: immature and subadult. For sheep, two age categories used by O'Connor could easily be linked with the absolute age categories of Payne: immature and subadult (table 1.1). Out of 40 mandibles scored as immature, 98 % were aged between 6 and 12 months. 92 % of 13 mandibles scored as subadult were aged between 1 and 2 years. No mandibles were scored as juvenile, so the absolute age for that category is unknown, although it is likely to cover the first six months of life. We cannot exclude an overlap with the 6-12 months category. The adult and elderly categories have one overlapping year: 3-4 years. For cattle, similar results were obtained. O'Connor's youngest three categories could be linked to Hambleton's categories in a straightforward manner. O'Connor's oldest two categories have one overlapping category: the adult one. For pig, there is considerable overlap between the categories. O'Connor's first two categories together roughly cover the first year of life (0-14 months), and the next two categories the second year (14-27 months). To conclude, for sheep, two of O'Connor's five categories can reliably be converted to absolute ages, and for cattle, three.

O' Connor	Sheep absolute age	Cattle absolute age	Pig absolute age
Juvenile	0-6 months (0, 0)	0-8 months (100 %, 6)	0-14 months (100 %, 5)
Immature	6-12 months (98 %, 40)	8-18 months (76 %, 17)	7-14 months (71 %, 7)
Subadult	1-2 years (92 %, 13)	18-30 months (100 %, 11)	14-21 months (75 %, 16)
Adult	2-4 years (86 %, 21)	30 months to adult (83 %, 24)	14-27 months (100 %, 16)
Elderly	older than 3 years (100 %, 16)	adult to senile (100 %, 24)	> 21 months (100 %, 3)

Table 1.1. O'Connor's age categories converted into absolute ages (based on Grant and Hambleton). Between brackets is the percentage of mandibles that were assigned to a certain age category, and the total number of mandibles for each category by O'Connor.

76 Grant 1982.

77 Hambleton 1999.

78 Grant 1982; Halstead 1985; Hambleton 1999, 64-65; Payne 1973.

Knowing the sex as well as the age of animals adds enormously to the value of mortality profiles. Unfortunately, the sex of animals could be established infrequently. To determine sex, use was made of biological differences between males and females in some species. In complete skeletons of dogs, the presence of the baculum or penis bone is used to identify males. The absence of the baculum cannot be used for identification of females, as it could have been missed during the excavation. In horses, males have canine teeth which are missing or very small in females. In pigs, canines of males are much larger than those of females. In cattle and sheep, the shape of the pubic bone and the shape and size of horn cores was used to determine sex.

In paragraph 2.2.1, the interpretation of mortality profiles is discussed. One methodological problem of using mortality profiles to interpret the economy of a rural settlement that is likely to have produced a surplus, is that the products that are sold as surplus are not found in the settlement, but in the towns and military sites. Comparing complementary age data from both a production site and a related consumption site is a way to understand the full picture of a rural production settlement.

1.7 RESEARCH QUESTIONS

This study is part of the research program *Rural communities in the* civitas Batavorum *and their integration into the Roman Empire,* financed by NWO (Netherlands Organisation for Scientific Research) and based at the VU University Amsterdam. The availability of new results from excavations of rural settlements in the Eastern Dutch River Area is one of the strengths of the present research programme. This research programme contains three studies: the present one focusing on animal husbandry, and two studies focusing on rural settlement structure and development.[79]

The main purpose of this study is to reconstruct the various roles of animals in a rural community in the Eastern Dutch River Area, and to find out how this community was integrated into the Roman Empire. The animal bones from Tiel-Passewaaij will allow us to answer not just zooarchaeological research questions, but wider archaeological ones. This will be accomplished by considering several research questions which can be grouped into three main sections. These sections are discussed in three separate chapters.

Chapter 2 will be concerned with the agricultural economy of the settlements Passewaaijse Hogeweg and Oude Tielseweg. The integration of these rural settlements in the wider, Roman world would have been reflected in the local economy. Taxation would have required the production of a surplus. Surplus animals or animal products could have been sold for money at markets in towns and *vici*, or exchanged for other goods. With these new obligations and opportunities, livestock husbandry methods would presumably have changed. In this chapter, we will try to find out whether specialisation in animal husbandry occurred in rural settlements, how animals were managed, and whether there are any differences between the two settlements. Changes through time in animal husbandry will be used to answer these questions. We will also try to find out how the landscape was utilised for animal husbandry. Finds of wild animals provide additional information on the local landscape.

In chapter 3, we will take a closer look at the special animal deposits found in the settlement of Passewaaijse Hogeweg. Types of special animal deposits are described, as well as their occurrence throughout time and space. We will decide whether these special deposits are in fact ritual deposits. Anthropological theory on ritual will help us understand the nature and meaning of special animal deposits. Little is known about rituals performed within rural settlements. This chapter will provide new information and offer some interpretation. The rituals performed in rural settlements can be seen as domestic equivalents of the Romanised rituals performed at temples such as Empel and Elst.

79 Heeren in prep.; Vos in prep.

Chapter 4 is also concerned with rituals, but rituals of a different kind and performed in a different place. Animals or parts of animals were used during different stages of funerary ritual. Research on Roman cemeteries has concentrated too much on the contents of the graves, and only rarely on the evidence for the entire process of the funerary ritual. The animal bones from contexts other than graves give a tantalising glimpse into the complex system of rituals surrounding death. This chapter will answer the question of how animals were incorporated into these rituals.

Chapter 5 will tie in the different components of chapters 2 to 4 and offer a comprehensive view of animals in one rural community in the Eastern Dutch River Area. The zooarchaeological data will be used to determine the extent of integration in the Roman Empire. This chapter will then briefly consider the position of zooarchaeological research within the recent developments in Dutch archaeology. It will also present some recommendations for (field) archaeology as well as suggestions for further research.

PREFACE

This study was written as a doctoral thesis, which I successfully defended at the VU University Amsterdam in October 2007. Only minor changes have been made to the original text and illustrations. My research forms part of the wider research programme *Rural communities in the* civitas Batavorum *and their integration into the Roman Empire,* financed by the Netherlands Organisation for Scientific Research (NWO) and based at the VU University Amsterdam. I am still amazed that someone actually paid me for several years to look at animal bones, read a lot of publications and write a book. I have NWO to thank for this privilege. Working on my research on the animal bones from Tiel-Passewaaij has been a great opportunity and I have enjoyed every minute of it. I first started analysing the animal bones from Tiel-Passewaaij in 1998, but it was not until 2003 that I started my doctoral research. By this time, I had acquired most of my data set while being employed by the Hendrik Brunsting Stichting, the archaeological excavation unit affiliated to the VU University Amsterdam.

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