THE LARGER MAMMAL FAUNA FROM SECTOR I11 (Q 69, 79, 89)

HORSE

Introduction and basic data

Horse dominates, with 92.8% of the total number of remains identifiable to a species, the fauna from the Magdalenian horizon in sector I11. Basic data for horse from this sector are presented in table 20.

NISP	NISP after refitting	MNE	MNI	carnivore gnawing	cut marks	impact notches	worked bone	charred bone
466	457	364	6	60	24	5	4	0

Tab. 20 Basic data for the remains of horse from the sector I11 site.

A total of 466 identifiable specimens (NISP) and 364 elements (MNE) of horse were present at this site. The highest minimum number of six individuals was recorded on upper third molars of the right body-side. Both juvenile and adult horses were present at the site. Cut marks and impact notches were observed on a total of 29 horse remains. Four horse bones had been utilised by the Magdalenians as raw material for needle production, but none of the horse remains were charred. 60 horse bones had been chewed by carnivores.

Numbers of individuals and skeletal part representation

Counts of horse skeletal remains are listed in table 21. Element type, body-side, the minimum number of elements and minimum number of individuals for each element are given, along with the number of elements gnawed by carnivores. For long bones of the fore and rear limbs, MNE's and MNI's are placed next to the portion of the element on which these were counted (for example, MNE and MNI for the scapulae were counted on the distal ends of this bone); the number gnawed by carnivores refers to the total number of scapulae (distal ends and blades) which bear such traces.

A total of 139 horse teeth and 327 horse bones have been recorded at the sector I11 site. Expressed as percentages, teeth represent 29.8% and bones 70.1% of the total number of remains identified to this species. The dominance of bones over teeth shows that this assemblage was well-preserved and, as in the case of the horse remains from sector P16, had hardly been affected by differential post-depositional destruction.

As in the sample from P16, upper deciduous cheek teeth were underrepresented in the I11 sample, and only five deciduous teeth out of a total of 59 upper cheek teeth were recorded. The opposite appeared to be the case among the lower cheek teeth from sector I11, where deciduous molars represented almost one fifth of the total number of identifiable mandibular cheek teeth (7 deciduous teeth out of a total of 36 teeth).

Tab. 21 Counts of horse remains from sector I11. – P = proximal, D = distal, * = indeterminable to body-side, indet = not determinable to fore or rear limb (phalanges), mc/mt = not determinable to metacarpus 3 or metatarsus 3. All MNI's and MNE's are based on number of fragments after refitting. Counts of carnivore gnawing for phalange 2 are pooled counts from anterior and posterior second phalanges. →

Element	left	*	right	MNE	MNI	number gnawed
Head						
cranium	3	3	6	3	3	0
mandible	5	2	5	3	3	0
maxillary teeth	44	0	35	78	6	0
mandibulary teeth	18	3	21	42	5	0
tooth fragments	18					
Axial						
atlas		5		4	4	0
axis		2		2	2	0
cervical		14		13	3	1
thoracic		26		25	2	11
lumbar		20		19	3	7
sacrum		2		2	2	0
caudal		0		0	0	0
unidentified vertebrae		4				
pelvis	10	3	5	10	5	5
ribs	8	10	8	14	1	2
sternebra	0	1	0	1	1	0
Fore-limb						
D scapula	4	0	1	5	4	2
scapula blade	0	1	0			
humerus complete	0	0	1			
P humerus	1	0	0			
D humerus	3	0	5	8	5	5
P radius	2	0	2			
shaft	0	2	0			
D radius	3	0	1	4	3	4
ulna	2	0	3	5	3	4
carpals	7	1	11	19	4	1
metacarpal 3, complete	0	0	3			
D metacarpal 3	0	0	2	5	5	3
metacarpal 2	0	0	1	1	1	1
metacarpal 4	1	0	2	3	2	1
Rear-limb						
P femur	6	0	2			
shaft	4	0	1			
D femur	6	0	1	6	4	5
patella	1	0	0	1	1	1
tibia shaft	1	0	1			
D tibia	1	0	4	4	3	1
calcaneum	2	0	4	6	4	2
astragalus	4	0	3	7	4	0
tarsals	8	0	6	14	4	0
metatarsal 3, complete	1	0	3			
P metatarsal 3	1	0	1			
shaft	0	0	1			
D metatarsal 3	0	0	1	7	5	1
metatarsal 4	1	0	4	4	3	0
phalange 1 ant.	2	1	2	4	2	
phalange 1 post.	1	0	5	6	3	0
phalange 1 indet.	0	1	0			
phalange 2 ant.	2	0	1	3	2	
phalange 2 post.	2	0	3	5	2	3
phalange 2 indet.	1	3	2	3	1	
phalange 3		14	0	14	3	0
sesamoids		14		14	2	0
mc/mt		4				
Totals		**466**		**364**		**60**

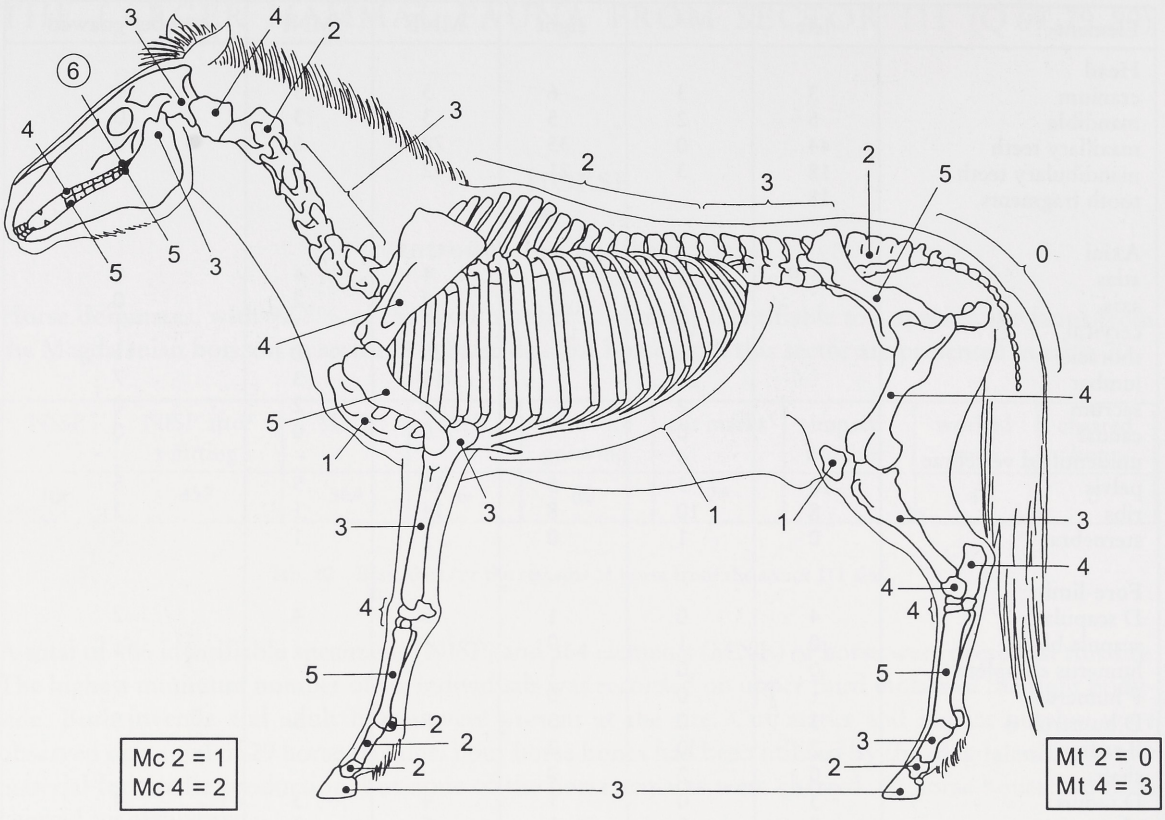


Fig. 38 Horse skeletal representation at sector I11 depicting counts of minimum number of individuals (MNI) for each element.

All skeletal parts of horse were recorded from the I11 site, except caudal vertebrae and second metatarsals. The highest minimum number of six individuals of horse was counted on upper third molars from the right side of the body (fig. 38). Five individuals were recorded on lower third molars from the right body side, on the pelvis, humerus, third metacarpals, and third metatarsals.

Low counts of individuals were recorded on ribs, sternebrae and the patella, and also on the sesamoids. A similar situation was observed in the assemblage of horse bones from sector P16, where the low numbers of these elements was attributed mainly to bone fragility (ribs), bone porosity (patella) and carnivore attrition (sesamoids).

There was no differentiation between the anterior and the posterior portions of the lower dentition of horse at sector I11, and five individuals were recorded on the second premolars and on the third molars. Similarly, there was only a difference of one individual between counts on the anterior and on the posterior portions of the upper dentition. The strong differential preservation between cervical vertebrae 3-7 and vertebrae from the thoracic region of the spine, noted for the axial assemblage of horse from sector P16, was also absent in the assemblage from I11.

In figure 39, the numbers of individuals for each element are expressed as percentages of the highest MNI (MNI 6 = 100%) and further divided into four main groups (0-25% etc.). High-ranking percentages were recorded on high-utility (pelvis, humerus) as well as on low-utility portions (metapodials) of the limbs. At sector I11, there was no apparent selection of high or low utility body parts of horse, and a comparable situation was recorded at sector P16.

Equally comparable was the role that bone preservation played in the representation of portions of horse bones at sector I11. High numbers of individuals were counted on parts of elements which are less likely to be destroyed by carnivore attrition or weathering processes. Thus, the minimum of five indi-

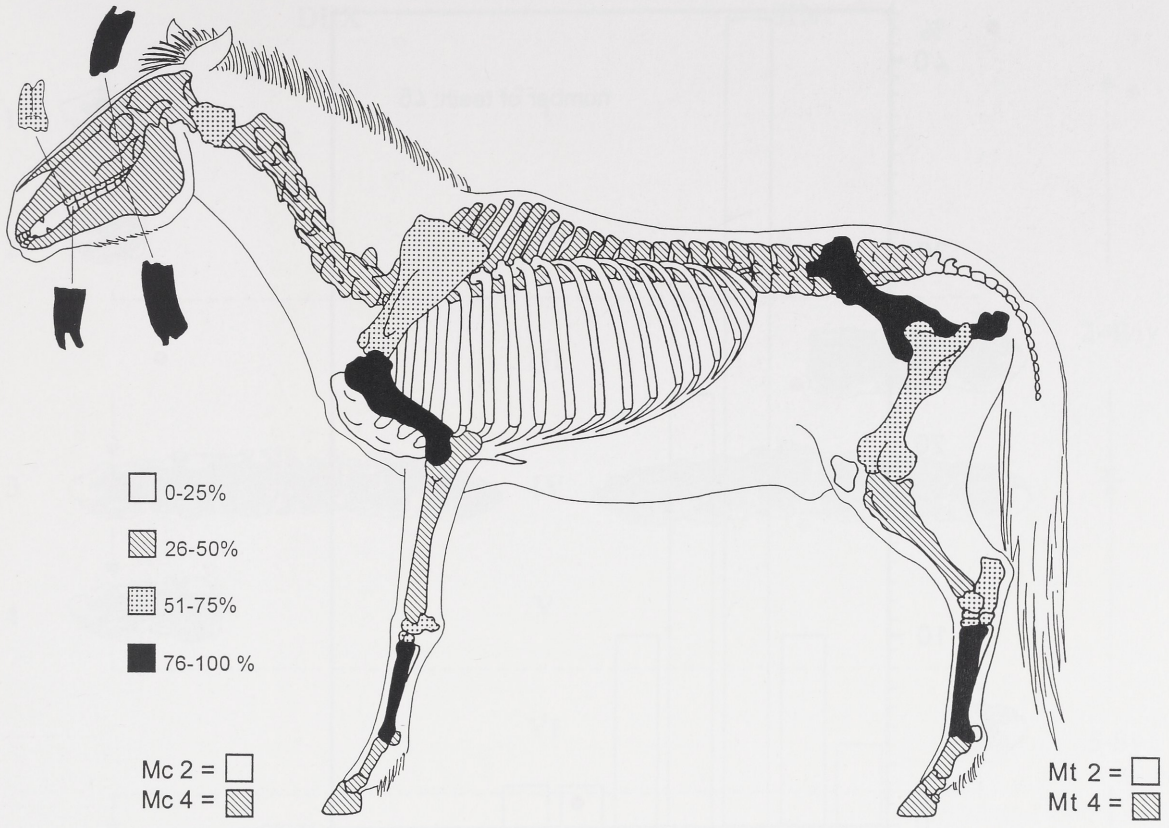


Fig. 39 Horse skeletal representation at sector I11 with MNI's depicted in figure 38 expressed as percentages of the highest minimum number of individuals (MNI 6 = 100%).

viduals recorded on the pelvis was counted on the acetabulum, this being the sturdiest part of the pelvic girdle. Similarly robust portions of bones, such as distal scapula, distal humerus, proximal ulna, tarsal bones and metapodials, had relatively high individual counts.

On the whole, horse skeletal part representation from the sector I11 site was comparable to that observed at the P16 site. Minor differences, including the absence of a strong differential preservation between bones of different regions of the spine, are probably related to the relatively small total amount of horse remains recovered at the sector I11 site and the chance sampling bias that is always associated with assemblages from small sites such this one, rather than indications of Magdalenian butchery activities at Solutré.

Determination of horse age and sex demography on certain skeletal elements

The age structure of the horse population from sector I11

Cheek tooth height and wear ageing

The crown-heights of 32 upper and seven lower permanent premolars and molars were measured following Levine's method (1979; 1982), and aged using data in her comparative tables. The three upper and four lower deciduous teeth included in this sample were aged using comparative wear-stages in Levine's

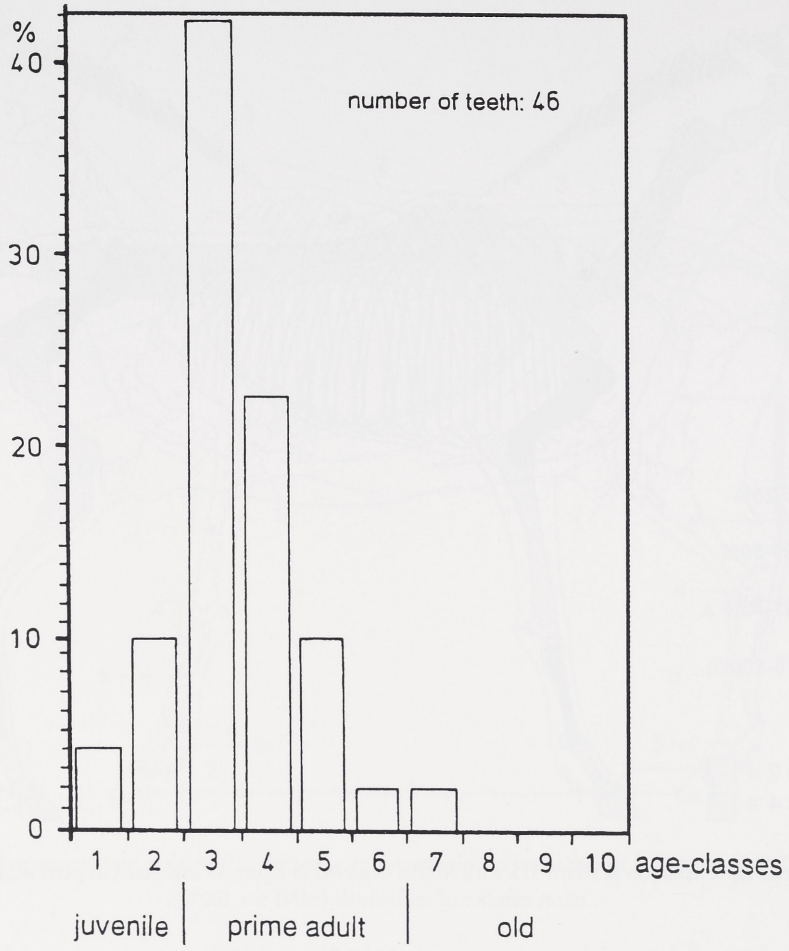


Fig. 40 The age-structure of the horse population from sector I11 at Solutré based on cheek teeth crown heights and wear stages. Each age-class represents 10% of the natural longevity of the horse, which was set at 20 years in this study. For definition of juvenile, prime adult and old classes see page 39.

tables (ibid). The results of the analysis are shown in figure 40, expressed as percentages of the total number of teeth in the sample (see page 39 for explanation of age-classes used in the analysis). Horse incisor teeth from sector I11 were not aged.
The resulting mortality-profile is dominated by horses in the age-classes 3 (5-6 years) and 4 (6-8 years). These are prime adult animals. Approximately 14% of the population were juveniles and only one tooth, or 2% of the sample, was from an old horse. A similar mortality structure with low numbers of juveniles and old horses and a dominance of prime adults was established for the sample of aged horse teeth from sector P16. In contrast to the sample from sector P16, slightly higher percentages of prime adults and a lower percentage of old individuals were recorded for I11. In order to test whether these differences were due to biasing because of the small amount of teeth in the I11 sample, a more detailed analysis of numbers of individuals and their ages was undertaken on the upper premolars and molars.

The minimum number of six individuals was based on the upper third molar of horse, of which there were six from the right and from the left sides of the body respectively. By sorting this total of twelve teeth to body-side, and by comparing their individual tooth morphology and wear stages, nine indivi-

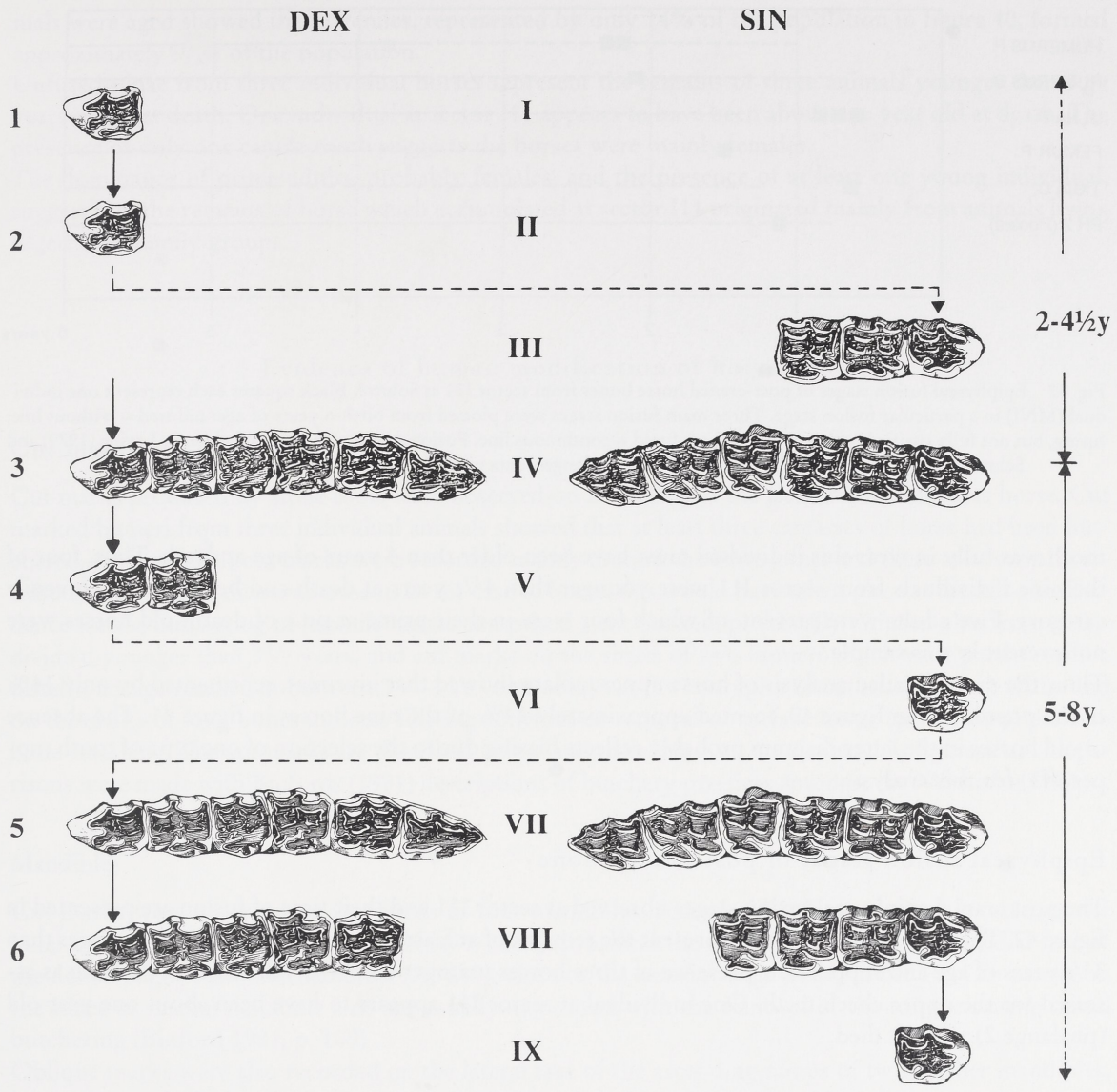


Fig. 41 An alternative method of counting numbers of individuals of horse from sector I11 using upper cheek teeth. 1-6 the minimum number of individuals (MNI) counted on six upper M3's from the right side of the body. I-IX higher minimum number of individuals established by comparing body-side, tooth morphology and tooth wear. The approximate ages of the individuals are given on the right side of the figure.

duals of differing ages could be established. The flow-chart in figure 41 shows how this higher number of individuals was assessed using isolated upper third molars and third molars in sets of upper cheek teeth belonging to individual animals, and gives their approximate ages.

The third molars of horses I-III are unworn and belong to individuals which died between 2 and 4 1/2 years of age, this being the period prior to upper M3 being in wear. Horse 4 has the first trace of wear on the M3. Wear can begin at around 3 1/2-4 years on this tooth, and horse 4 thus belongs to the older end of 2-4 1/2 year age-cohort. Horses V, VI and VII could be aged by their tooth heights and are prime adults aged between 5 and 8 years. Horse VIII was about 8-9 years old when it died. Horse IX couldn't be aged by tooth height as the roots of this tooth were missing. However, as the occlusal surface of the

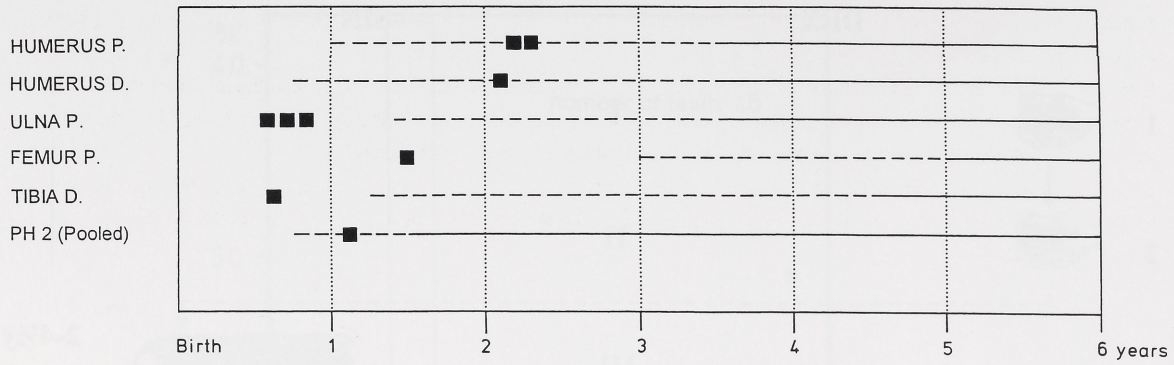


Fig. 42 Epiphyseal fusion stages of post-cranial horse bones from sector I11 at Solutré. Black squares each represent one individual (MNI) in a particular fusion stage. Three main fusion stages were plotted from birth-6 years of age: unfused = without line; fusing, but not fully ossified = discontinuous line; fused = continuous line. Fusion stages based on data given in Levine (1979) and Schmid (1972). P = proximal; D = distal. PH = phalanges, data pooled from anterior and posterior specimens.

tooth was fully in wear this individual must have been older than 4 years of age at death. Thus, four of the nine individuals from sector I11 were younger than 4 1/2 years at death and belong to the juvenile category. Five adults were present, of which four were in their prime at time of death: old horses were not present in this sample.
Thus, the more detailed analysis of horse upper molars showed that juveniles, represented by only 14% of the population in figure 40, formed approximately 44% of the nine horses in figure 41. The absence of old horses in the latter diagram probably reflects biasing due to the selection of one type of tooth (upper M3) for this analysis.

Epiphyseal fusion stages of post-cranial bone

The post cranial epiphyseal fusion stages observed at sector I11 and their time of fusion are presented in figure 42. The three unfused ulnae represent the remains of at least three animals at the site younger than 3 1/2 years of age and support the presence of three horses younger than 4 1/2 years at time of death as assessed for the upper cheek teeth. One individual at sector I11 appears to have been about one year old (phalange 2) when it died.

Sexual demography and season of death

The absence of foetal bones among the horse remains meant that there was no evidence of season of death for this species from the sector I11 site. Only one canine was recovered, suggesting that the majority of the horses recovered from the Magdalenian deposits at sector I11 were females.

Summary

Information about the age-structure and sexual demography of the horses from sector I11 was obtained from analyses of cheek teeth heights and tooth wear stages, epiphyseal fusion stages of post-cranial bone and numbers of canines.
A conventional analysis of tooth height and wear stages produced a mortality-profile dominated by prime adult horses in the age-classes 3 (5-6 years) and 4 (6-8 years). Approximately 14% of the population were juveniles and only 2% were old horses. A similar mortality structure with low numbers of juveniles and old horses and a dominance of prime adults was established for the sample of aged horse teeth from sector P16. A more detailed analysis of the I11 sample, in which teeth from individual ani-

mals were aged showed that juveniles, represented by only 14% of the population in figure 40, formed approximately 44% of the population.
Unfused ulnae from three individual horses represent the remains of three animals younger than 3 1/2 years of age at death. One individual at sector I11 appears to have been about one year old at death. The presence of only one canine tooth suggests the horses were mainly females.
The dominance of prime adults, probably females, and the presence of at least one young individual, suggest that the remains of horse which accumulated at sector I11 originated mainly from animals living together in family groups.

Evidence of human modification of horse bones

Cut marks

Cut marks produced by stone tools were observed on 24 (5.1%) of the elements identified as horse. Cut marked humeri from three individual animals showed that at least three carcasses of horse had been butchered. At sector I11, cut marks were recorded mainly around the bone joints and these are normally attributable to carcass dismemberment. In the case of horse, this would have taken place at the kill-site. Evidence for the butchering of juvenile horses comprised a cut marked, proximally unfused ulna from an individual younger than 3 1/2 years, and cut marks on the shafts of two humeri which were partly ossified distally, a stage reached at between 1 1/4-1 1/2 years of age. A few examples of cut marks on rib shafts and on the shafts of long bones indicate filleting activities or removal of surface tissue (periosteum) prior to bone smashing. The cut marks are described below and their locations are depicted in figure 43a: comparisons were made with Binfords (1981) descriptions of butchery practices amongst the Nunamiut eskimo.

Mandibles

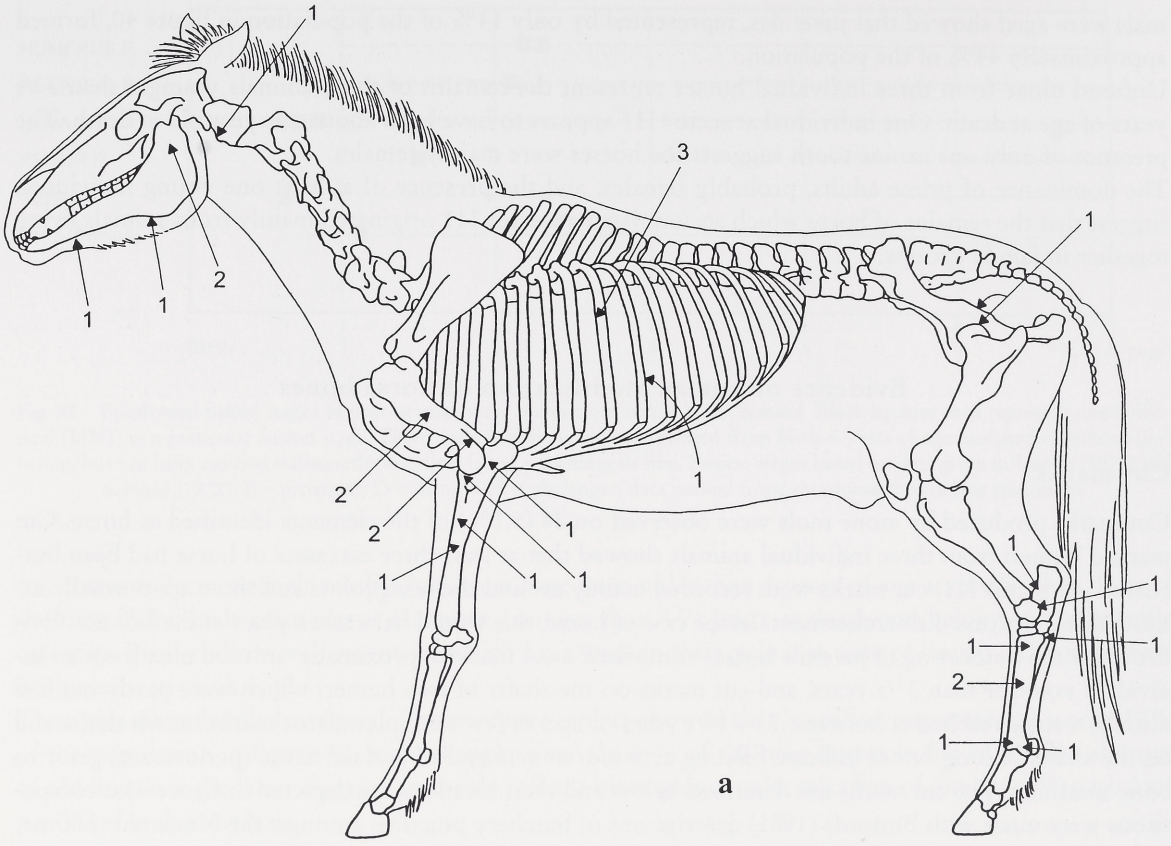
Cut marks were observed on fragments of four mandibles. Sets of oblique marks were located on the inner or medial face of a right mandible (79/306) just behind the third molar, and on the medial face of the dorsal edge of another mandible (79/649), close to the anterior edge of the lower P2. Cut marks on the inner or medial mandible side are usually associated with the removal of the tongue during initial butchering (Binford 1981, p. 109)
Oblique marks were also recorded on the lateral face of the ascending ramus of two further mandibles, located towards the basal edge on one find (79/4) and close to the anterior edge of the second specimen (79/669). The cut marks were probably produced when the masseter muscle was cleaned off the mandible, a process described by Binford (ibid.) as filleting in situ.

Cervical vertebrae

The rather fragmentary atlas (89/375) was the only element from the vertebral column with traces of cut marks. A transverse cut was located on the ventral side of the right cranial surface of the atlas. This mark compares with Binfords CV-1 (1981, fig. 4. 20) cut mark produced when severing the head from the neck of the carcass during primary butchering.

Pelvis

Only one pelvis (conjoining finds 69/272 and 69/328) showed traces of butchery. Four sets of multiple cut marks were located around the acetabulum. Two sets are on the lateral sides of the pubis and ischium bones just below the acetabulum rim, corresponding to Binfords (1981, fig. 4. 22) PS-9 and PS-10 cut



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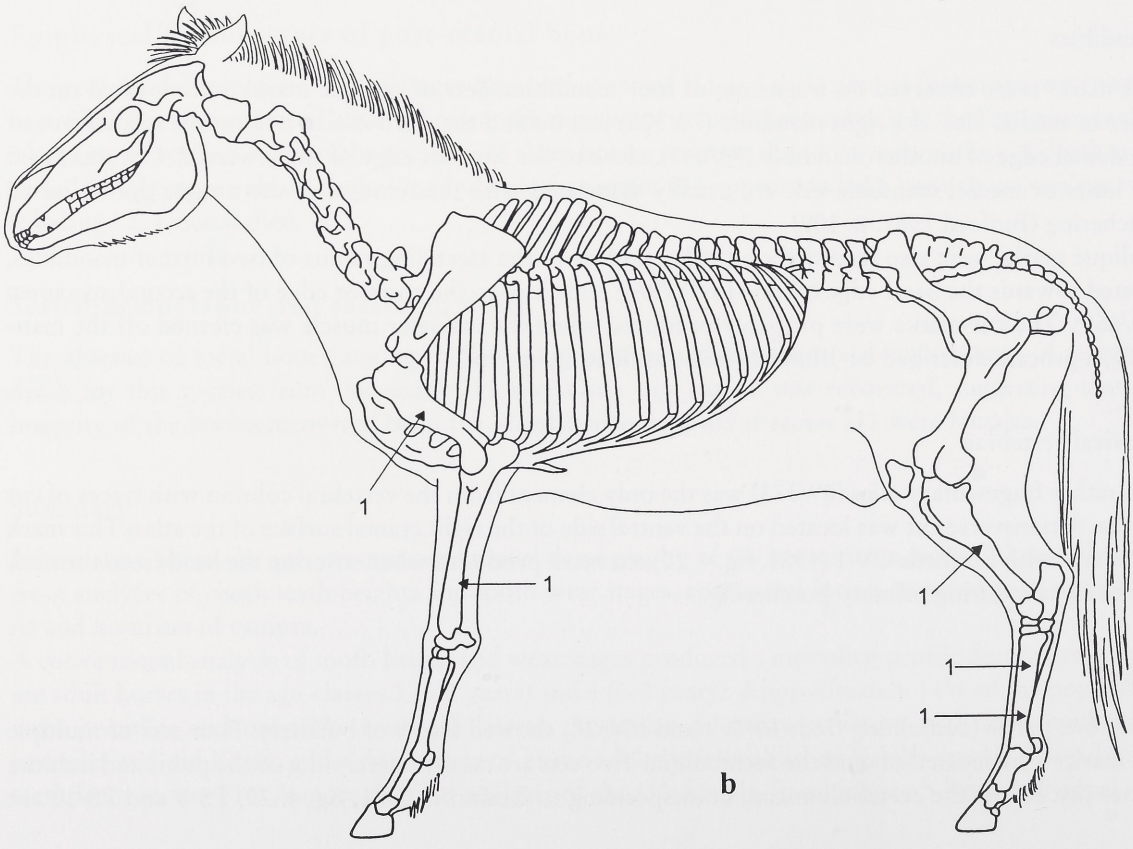

b

marks which are produced while severing the rear-leg muscles during disarticulation of the femur head from its pelvis socket. More interesting are two further sets of marks located on the inner or medial side of the pubis bone, one set at the base of the pubis bone close to the ventral edge, and a second set placed close to the end of the stump of bone left behind after the pubis bone had fractured. These marks were probably produced during evisceration of the carcass.

Ribs

Three rib fragments bore oblique or transverse cut marks on the outer or lateral surface of the bone. The ribs were too fragmentary to establish the exact location (eg. proximal part or distal part) of the cuts, but they could have been produced during the removal of the tenderloin from the rib-cage. Cuts on the inner side of the rib were observed on a fourth rib fragment (89/636): these could have originated while major organs, such as the heart and the lungs, were removed from the chest cavity. Similar cut marks were recorded by Olsen (1989) in her study of the horse remains from Solutré.

Humerus

Sets of cut marks on two distal humeri from the right side of the body (89/21 and 89/361), correspond to Binfords (1981, fig. 430 f) Hd-2 mark, this being the most common cut on the medial face of the distal end of the bone during dislocation of the humerus from the radio-cubitus. On the 89/21 specimen, the Hd-2 mark is restricted to a set of three distinct transverse cuts located on the medial face of the distal trochlea. On the 89/361 find, the Hd-2 marks consist of a set of oblique cuts located on the medial face of the distal epicondyle. This specimen also has a further set of marks higher up on the cranial face of the bone shaft. These transverse marks indicate that they were associated with dismemberment rather than filleting activities, where the marks are located in a similar position, but placed obliquely to the shaft (cf. Binford 1981, fig. 439, Hd-6) (plate 5, 4). Two humeri from one individual bore fine marks similar to those produced by stone tools on the medial and caudal shaft faces respectively (79/157 and 79/160).

Radius

Cut marks were recorded on two radii of horse. The first specimen is an almost complete right radio-cubitus (79/179: missing are parts of the proximal and distal ends and the proximal ulna). A set of marks similar to those produced by stone tools are located on the medial face of the bone towards the proximal end and lower down in the mid-shaft area of the bone.
The second specimen is a proximal radius fragment (79/343) from an articulating set of three bones (proximal radius, ulna and distal humerus) forming the »elbow joint« of a mature horse. The radius is the only bone out of this set which is cut marked. Three sets of marks were located on the dorsal face around the proximal margin of the bone corresponding to Binfords RCp-5 mark (1981, fig. 4. 32 a-c) produced during dismembering. A fourth set of oblique marks is located on the dorsal face of the shaft close to the green fracture of the shaft end (about 80 mm below the proximal end).

Ulna

One cut marked ulna was present in the assemblage of horse bones. The specimen (69/148) is from a young animal not older than 3 1/2 years of age at death (epiphyseal fusion). A single set of short cut

Fig. 43 The various stages of horse carcass butchery recorded at sector I11 at Solutré. – a Location of cut marks. Arrows with numbers indicate the approximate location and number of times cut marks were observed in these locations. – b Location of impact notches produced during marrow extraction. Arrows and numbers indicate the approximate location of impact notches and the total number of times impact notches were observed on each element. ←

marks more or less parallel to the long axis of the bone are located on the lateral face of this ulna close to the proximal articulation. The location of these marks is similar to those described by Binford (1981, fig. 4. 32 a, RCp-2) produced during dislocation of the humerus from the radio-cubitus.

Metatarsals

A single transverse cut mark is located just below the proximal edge of the bone on a right metatarsal (79/14). A similar mark at the same level and in the same direction was observed on the lateral face of a proximal fourth metatarsal (79/28), which may have belonged to the same individual. Such marks are produced during primary or secondary butchery activities, and if the two bones do belong to the same horse, the placement of the marks shows that the elements were still anatomically connected when butchered.
A single cut mark was observed on the distal end of a complete right metatarsal (79/237). The mark was placed on the dorsal side of the distal keel. Cut marks relating to dismemberment were present on the lateral (multiple marks) and medial (single cut mark) condyles of a distal metatarsus (89/136). This bone had been subsequently utilized as a »needle-core«.
Two mid-shaft fragments bore cut marks. One fragment (69/616) had two sets of oblique marks located at the proximal and the distal ends of the fragment. The second fragment (79/681) had a set of very short marks located mid-shaft. Cut marks on bone shafts probably indicate that bones were being cleaned of periosteal tissue, a technique employed so that the bone could be successfully smashed open afterwards.

Tarsals

Cut marks were observed on two major tarsal bones, a right calcaneum (89/261) and a left astragalus (89/360). A series of short oblique marks on the dorsal edge of the calcaneum just behind the arcticulation for the astragalus compares with those figured by Binford (1981, fig. 4. 27, TC-3). This mark has often been interpreted as being produced during tendon cutting. Binford (ibid) suggests that such marks could also have been produced when the carcass of an animal is hung up by its rear legs by cutting through the thin skin between the tibia shaft and the tendon at the tuber calcis and inserting a rope through the opening. Hanging of the whole carcass would probably be associated with primary butchery activities, for example to facilitate removal of the viscera. Marks comparable to these have been described not only on the bones of medium-sized mammals (Frison 1971), but also on the bones of large animals such as bison (Wheat 1979).
A set of fine, short oblique cut marks were located on the dorsal edge of the medial trochlea of a left astragalus (89/360). They correspond to Binfords TA-1 (1981, fig. 4. 27, e) and are produced during dismemberment.

Impact notches

That some bones were deliberately smashed open at the site, presumably to obtain marrow, can be seen by the presence of four specimens with impact notches and one example of a metatarsal opened longitudinally (fig. 43b).

Humerus and radius

The humerus belongs to the set of anatomically reconstructed bones forming the elbow joint of a horse and has a clear impact notch on the cranial face above the distal joint. This humerus was not cut marked, but the articulating proximal radius bore dismembering marks around the joint. Both the radius and the ulna had been deliberately fractured below the joint as an articulated unit: the set of cut marks on the

dorsal face of the radius is located just above the fracture edge and probably indicates cleaning of tissue from the bone surface to obtain a clean break at this point. The radius shaft fragment which had been utilized as a »needle-core« (79/705) also has an impact notch on the volar shaft face.

Tibia

A clear impact notch on the planter side of the tibial shaft fragment (79/339) shows that this bone had been smashed open by humans in the mid-shaft region.

Metapodials

Two fragmentary finds show that some intentional smashing of metapodials was carried out. Two impact notches were observed on one edge of a mid-shaft fragment of a metapodial bone (79/670).
Although only a single impact notch was observed mid-shaft on the second fragment, the form of the remaining piece is typical for metapodials which have been split longitudinally by controlled blows to the shaft.

Summary of horse butchery practices at Sector I11

Altogether 24 horse bones with cut marks and five horse bones with impact notches were recorded from the Magdalenian horizon at the sector I11 site. The counts represent 5.1% and 1.0% respectively of the total number of horse bones found at this site. The carcasses of at least three individuals of horse were processed, and both adult and juvenile horses had been butchered.
The locations of the cut marks show that primary butchery activities included hanging the carcass by its rear legs, probably in order to facilitate evisceration. The chest cavity had been emptied. Cut marks on the mandible show that the tongue had been removed and the masseter muscle had been cleaned off the jaw. The carcasses had been dismembered (separation of head from neck, humerus from radio-ulna, and metapodials from phalanges). Secondary butchery activities included the removal of tissues from the surfaces of a radius and two metapodia, and possibly filleting of the tenderloin.

Worked bone

Altogether four horse bones from the Magdalenian deposits at Sector I11 had been worked. These comprise a horse radius and a metatarsus which had been utilized as needle cores, as well as a rib fragment and a fragment of a maxillary or mandibulary bone which appear to have been engraved. The long bones are of interest as they show traces produced during butchering activities, such as dismembering cut marks on the lateral and medial condyles of the distal metatarsus and a single impact notch on the radius shaft, associated with evidence of deliberate working of the bone afterwards. Multiple cut marks and the remains of a groove on the dorsal face of the metatarsus show that this find was utilized as a needle-core (fig. 44a). The bone appears to have been fractured after the spall had been removed. An attempt to remove a spall of bone from the radius was, apparently, not completed (fig. 44b).
Two small fragments of bone, including a piece of maxillary or mandibulary bone and a segment of a rib from a horse, show stone tool traces which appear to have been carried out in a more deliberate manner than those attributed to butchering activities, as though these finds represent fragments of engraved pieces (fig. 44c and d). Only one large piece of engraved bone has been recorded from the I11 site. It is a fragment of the iliac blade from the pelvis of a horse, upon which a stylized depiction of a reindeer has been engraved (Combier 1987).

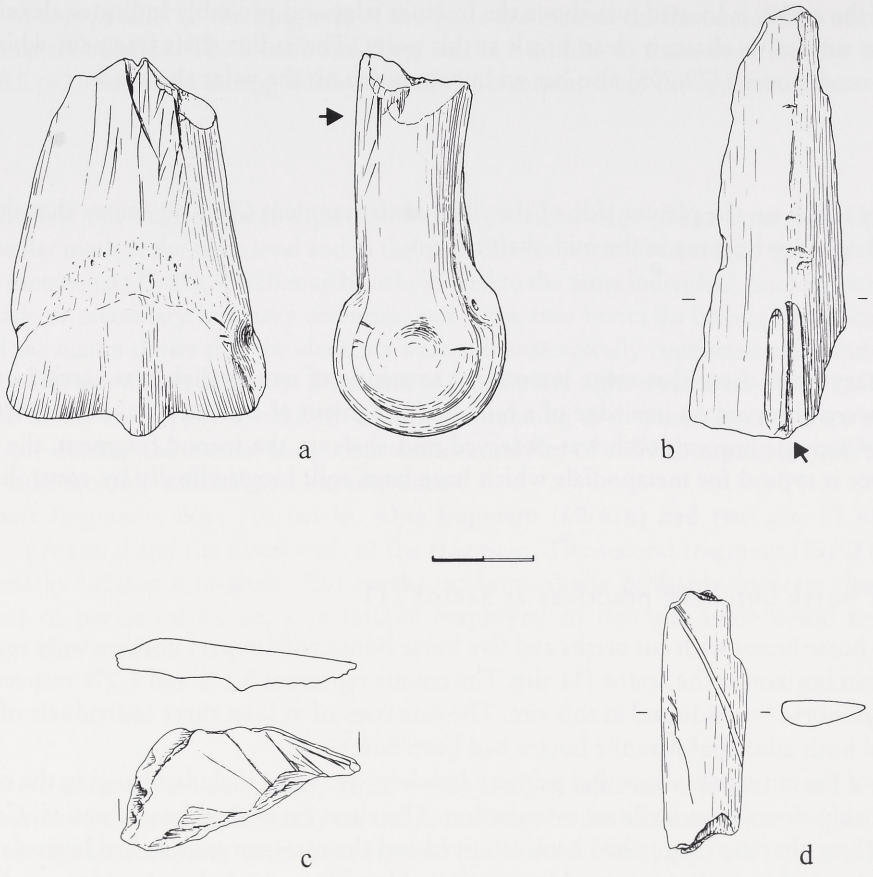

Fig. 44 Bone needle cores from sector I11 at Solutré. – a Horse metatarsus (I11 89/136). – b Horse radius shaft (I11 79/705). – c Fragment of horse cranium with ? partially preserved engraving (I11 69/312). – d Fragment of a horse rib with ?engraved lines (I11 79/170).

Carnivore modification

Details of carnivore modification of the horse bones from sector I11, percentages of gnawed bones out of the total number of finds for each element and a description of the type of damage and the degree of bone and carcass utilization following Binford (1981) and Haynes (1982) are listed below (see p. 129).
Carnivore gnawed elements represented 16.4% of the total number of horse bones present in the Magdalenian horizon at this site. Almost all the elements of horse, except the teeth, had been affected by carnivore modification ranging from minor tooth mark traces on the distal end of metapodials to total destruction of some long bone joints. Patterns of damage show that all stages of carcass utilization, from light to heavy, are represented.
The location of gnawing marks depicted in figure 45 shows that carnivores had access to horse bodies rather than their heads and necks. Only one fragment of mandibular bone bears tooth scores; gnawing marks were not recorded on any of the elements of the skull. This underrepresentation may be due to the fragmentary nature of the cranium, which was represented at the I11 site mainly by petrosum bones and pieces from the occipital and zygomatic areas. Nasal and palate bones, where carnivore gnawing is often located, were not identified although it is possible that they are present as not further identifiable cranial fragments in the »secondaire« category of material.

	%	damage type	carcass utilization
Cranium			
mandible	9.0	Light furrows on lateral face of mandible fragment	
Axial			
pelvis	50.0	Pitting and furrowing on ilium, ischium and pubis bone stumps; gnawing on cranial edges of ilium and caudal edge of ischium	Light to heavy carcass utilization
ribs	15.3	Single or multiple puncture marks just below proximal articulation	
cervical vertebra	7.6	Single puncture (?) mark on caudal articulation of one specimen	
thoracic vertebra	44.0	Single or multiple puncture marks on ventral surfaces of centrum; Puncture marks along fracture edges of processes	Typical carnivore modification
lumbar vertebra	38.8	As thoracics	
Fore-limb			
scapula	40.0	Transverse tooth scoring on lateral end. Typical gnawing pattern on distal face; furrowing and puncture marks on distal end	
humerus	62.5	Tooth scoring and furrowing on proximal head or proximal end missing; one example with crenulated proximal shaft end. Pitting, furrowing and gouging of distal joint leading to bone loss	All carcass utilization stages light through to heavy. Gnawing of distal condyles typical of scavenging.
ulna	80.0	Puncture marks and tooth scoring on olecranon; proximal edge of olecranon missing	Typical gnawing pattern.
radius	60-75	Distal end missing, chipping back at distal end of shaft; oblique tooth scores mid-shaft	Distal end commonly chewed off
carpals	5.2	Single puncture mark on articular surface	
metacarpals	55.5	Furrows and gouging leading to some bone loss distally on third metacarpals; furrows on proximal articulation; transverse tooth scoring and pitting on shaft	Typical minor damage on distal end resulting from chewing up through phalanges
Rear limb			
femur	71.4	Light tooth scoring on third trochanter on one specimen; femur head undercut. Punctures and furrows leading to bone loss on distal end; gouging on medial condyle	All carcass utilization stages present
patella	100	Tooth furrows, scoring and bone loss on inner side	
tibia	25.0	Possible tooth marks on proximal edge of shaft; proximal joint missing	Heavy carcass utilization
calcaneum	33.3	Furrowing and bone loss on distal on end of corpus	Most common form of gnawing this element
metatarsals	14.2	Lightly furrowed distally	See above metacarpals
second phalanges	21.4	Tooth scoring on distal articulation; distal end chewed away on one specimen	See above metacarpals

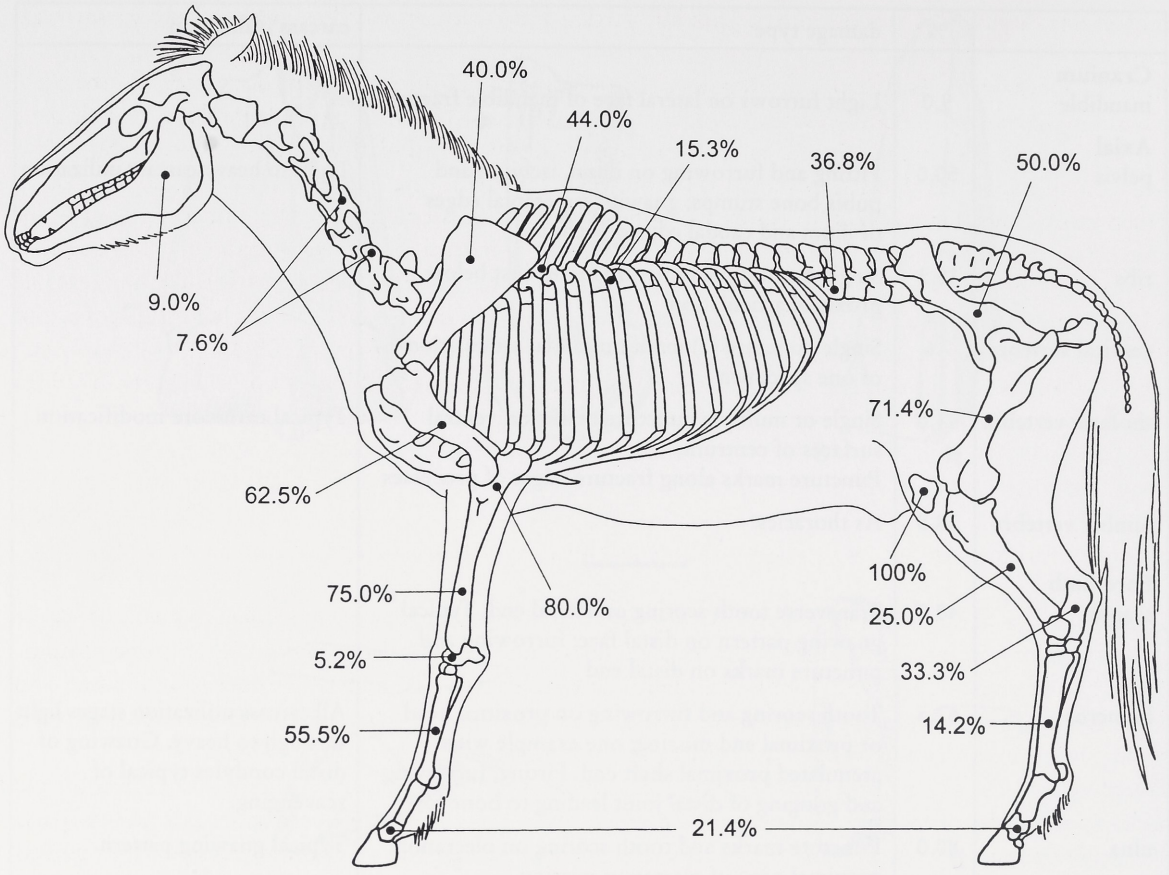

Fig. 45 Carnivore modification of the horse bones from sector I11 at Solutré expressed as a percentage of the total number of finds for each element.

Interesting is the relatively high incidence of gnawing on thoracic and lumbar vertebrae and a very low incidence (one element with a possible puncture mark) of tooth-marks on the cervical vertebrae, suggesting that carnivores had access to the rib-cage and back of some carcasses, but not always to the neck. The percentage of gnawing by element shows, as to be expected, that high-utility bones from the upper limbs of the fore-leg (humerus, radius and ulna) and the pelvis-femur area were preferentially gnawed. On the whole foot bones were less sought after, with the exception of the third metacarpal.
The form of carnivore modification indicates that wolves were the main scavengers of horse carcasses. However, tooth punctures on some bones were rather small in circumference. One puncture mark on a vertebra (79/303) measured only 4.07 mm in diameter, another example on a rib shaft measured 3.54 mm, indicating a small carnivore (juvenile wolf?) in these cases.

Bone pathologies

Four horse bones were pathological specimens. A small, elevated patch of open, porous bone located mid-shaft on the lateral side of a complete metatarsal (89/387) was probably caused by an infectious inflammation, in this case osteoperiostitis. An area of dissoluted spongiosa above the distal end of the bone

on the dorsal side and pitting on the proximal articulation surface may have also resulted from this disease.
Interesting was the presence of a short, sinous depression close to the anterior or dorsal edge of the proximal articulation of this bone. Baker and Brothwell (1980, p. 110-111; fig. 5) have described similar, non-pathological, »slits« on the articulatory surfaces of bovine third phalanges from Scottish Neolithic sites and these are the closest comparisons found so far to this feature on the specimen from Solutré.
The proximal metatarsus (79/340) has excess bone growth or exostosis around the dorsal edge of the articulation. Two tarsal bones (79/190) were fused together, a condition termed »spavin« in domesticated and draught horses, which typically affects the small bones of the distal tarsal row but can also extend onto the proximal tarsal row and the proximal metatarsus. Exostose of the bone limits movement at the hock joint and can lead to a mild degree of lameness (Baker and Brothwell 1980). Mild forms of »spavin« probably occur in wild horse populations, and Baker and Brothwell point out that Moodie (1923) illustrates a probable case of spavin in fossil three-toed horse from the American Pliocene.

Summary of the horse remains from the Magdalenian deposits at Sector I11

The remains of horse represent the bulk of the faunal material from the Magdalenian deposits at sector I11. A total of 466 remains could be identified to horse and these bones form 92.8% of the total number of bones from this site which could be identified to a species. The highest number of individuals – 6 – was counted on upper third molars from the right side of the body. However, a more detailed analysis of the upper cheek teeth showed that at least nine individuals of horse could be identified.
The effects of density-mediated bone destruction on this assemblage were minimal, as shown by the high counts for less dense post-cranial bones and relatively low counts for dense teeth. All skeletal parts of horse were recorded from this site, except the caudal vertebrae and second metatarsals. High counts of individuals were also recorded on the pelvis, humerus, third metacarpals and third metatarsals. Low counts on the ribs, sternebrae, patella and sesamoids were probably due to the fragility or porosity of these elements, or carnivore attrition.
At sector I11 high numbers of individuals were counted on high and low-utility parts of the carcass, and a comparable situation was recorded on horse bones from Sector P16. Equally comparable was the role that bone preservation played in the representation of portions of the bones, and high numbers of individuals were counted on the robust portions of the elements concerned.
A conventional analysis of cheek tooth height and wear stages produced an age-structure, or mortality profile, dominated by prime adult horses with low numbers of juvenile horses and extremely low numbers of old horses. A more detailed analysis, in which teeth attributed to individual horses were aged, showed that juveniles represented approximately 44% of the horses from this site.
Epiphyseal fusion stages of post-cranial bones showed that at least three horses were younger than 3 1/2 years of age at death, and one horse was younger than one year at death. The presence of only one canine suggests that the bulk of the horses were females.
Thus, the dominance of prime, mainly female, adults and the presence of young animals indicate that the horse remains which accumulated at the I11 site originated from animals living together in family groups.
Cut marks were recorded on 24 horse bones and impact notches on five horse bones. At least three horse carcasses had been butchered, and the remains of both juvenile and adult individuals bore traces of butchery. Two horse bones had served as raw material for a bone industry and two further horse bones had possibly been engraved.
Carnivores had modified 60 horse bones from sector I11. Patterns of damage show that all stages of carcass utilization by carnivores, from light to heavy, are represented.
Three horse bones showed traces of pathological and non-pathological alterations resulting from osteoperiostitis, abnormal bony outgrowths, non-pathological bony lesions and a case of spavin.

REINDEER

Introduction and basic data

Remains of reindeer *Rangifer tarandus* represented only 5.7% of the total number of faunal remains identifiable to a species from the Magdalenian horizon at sector I11. Basic data for this species is given in table 22.

NISP	NISP after refitting	MNE	MNI	carnivore gnawing	cut marks	impact notches	worked bone	charred bone
29	29	22	3	0	4	1	4	0

Tab. 22 Basic data for the remains of reindeer from the sector I11 site.

A total of 29 bones representing 22 elements of reindeer could be identified. A minimum of three individuals was established on lower permanent third molars from the left body side. An extremely worn upper molar probably provides evidence of a fourth individual of this species. Nevertheless, in comparison to the remains of horse, reindeer remains are highly underrepresented. Cut marks and impact notches were observed on a total of five reindeer remains. None of the remains of reindeer bore traces of gnawing by carnivores and none had been charred. Three fragments of reindeer antler and one fragment of reindeer bone had been utilized by humans as raw materials for tools.

Numbers of individuals and skeletal part representation

Counts of reindeer skeletal remains are listed in table 23, where element type, body-side, minimum number of elements (MNE) and minimum number of individuals (MNI) are given.

	left	*	right	MNE	MNI	number gnawed
Head						
antler fragments		3		0		0
mandible	0	0	1	1	1	0
maxillary teeth	1	1	0	2	2	0
mandibulary teeth	3	2	4	9	3	0
Axial						
ribs	0	2	0	1	1	0
Fore-limb						
P metacarpal	1	0	0	1	1	0
Rear-limb						
femur shaft	0	0	2	1	1	0
tibia shaft	1	0	0			
D tibia	1	0	0	1	1	0
astragalus	1	0	0	1	1	0
P metatarsus	0	0	2	2	2	0
phalange 2	1 proximal; 1 distal; 1 fragment			2	1	0
phalange 3	1 proximal			1	1	0
Totals	**29**			**22**		0

Tab. 23 Counts of reindeer remains from sector I11. – P = proximal, D = distal, * = indeterminable to body-side. All MNI's and MNE's are based on number of fragments after refitting.

The skeletal part representation of reindeer is shown in figure 46, where minimum numbers of individuals, taken from table 23, are depicted for those portions of the reindeer skeleton present at the I11 site. Reindeer remains are extremely underrepresented in this assemblage, and even when factors such as differential bone preservation and carnivore attrition are taken into consideration, it is more or less impossible to interpret the very small collection of reindeer bones from this sector.

Determination of reindeer age-mortality on certain skeletal elements

Numbers of individuals and age at death using the upper and lower cheek teeth

Three adult reindeer were counted on three left lower third molars in different stages of wear. An extremely worn upper molar, which did not belong to any of the individuals represented by the lower cheek teeth rows, probably indicates the presence of a fourth adult individual at the site.
The lower third molars were aged using Miller's age class groupings (see page 75).

Reindeer 1: the crown of the lower M3 (79/383) shows only slight traces of wear on the buccal part of the anterior cusp, placing this individual into the age-cohort two years or younger.

Reindeer 2: the crown of the lower M3 (79/118) has all three cusps in wear, but the cusps are not fused together. This individual belongs to the 3-5 year age-cohort.

Reindeer 3: the lower M3 from this animal has the same stage of wear as reindeer 2, but the cusps are in an advanced stage of fusion. This individual belongs to the 3-5 year age-cohort.

Reindeer 4: the extremely worn upper molar places this putative individual in the 10 + year age-cohort.

Epiphyseal fusion stages of postcranial bone

Two reindeer bones in different stages of epiphyseal fusion provided evidence of at least one individual younger than 14-15 months of age at death. The distal epiphysis of a tibia was fused to the diaphysis but the fusion line was still visible indicating an animal between 14-15 months of age. An unfused proximal epiphysis from a second phalange shows that one reindeer had died in its first year.

Evidence of human modification of reindeer bones

Cut marks

Cut marks were recorded on four reindeer bones representing a total of 13.7% of the elements from this species; the percentage is only slightly higher than that reckoned for cut marked horse bone. The marks were generally located in positions recorded during filleting processes.

Ribs

Two fragmentary ribs (69/612 and 69/613) were assigned to this species due to their small size. Both bore oblique cut marks on the outer rib surface and may testify to filleting processes in much the same manner as recorded for horse.

Femur

A right femur shaft (79/102) showed two sets of fine cut marks, one set of oblique marks placed towards

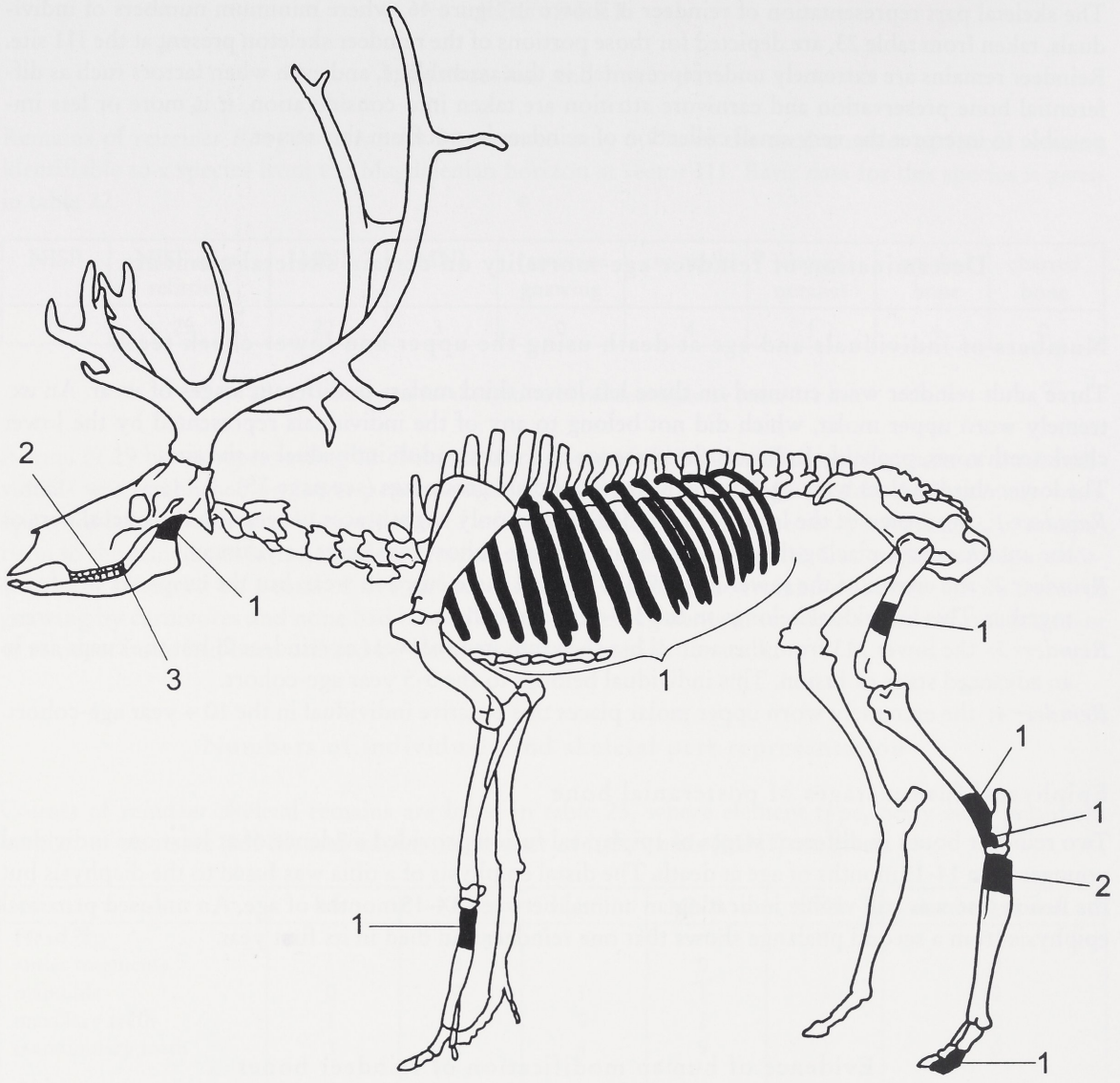

Fig. 46 Reindeer skeletal representation at sector I11 depicting the minimum number of individuals (MNI) for each element. Black areas on elements of the head, legs and on the pelvis indicate those portions of the bones which were preserved in the assemblage.

the distal end at the top of the *Fossa plantaris* and a second set mid-shaft on the cranial side of the bone. Both sets were probably produced during filleting.
Oblique cut marks were observed on a second femur shaft fragment (89/626). Two sets, one consisting of only a single mark, were located on the cranial face of the shaft just to one side of the foramen at the proximal end of the shaft and may correspond to Binfords Fp-6 mark (1981, fig. 4. 37, b).

Tibia

One set of oblique marks is located on the lateral edge of a left tibia (89/625). They probably derive from filleting activities comparable to Binfords Tp-4 and 5 marks (1981, fig. 4. 37, d).

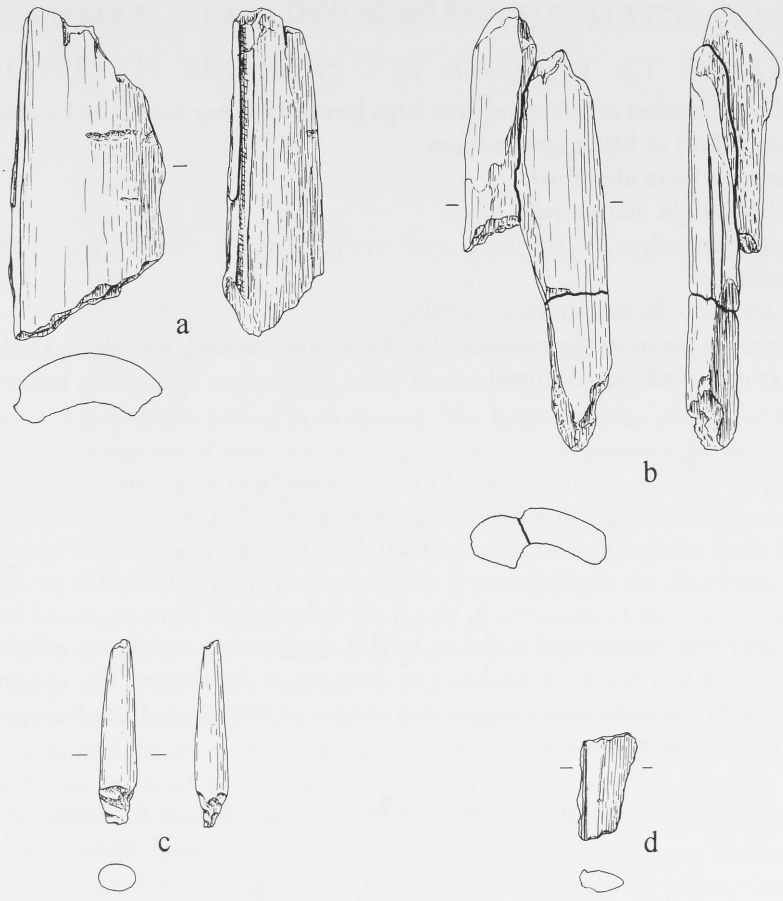

Fig. 47 Worked reindeer antler and bone from sector I11. – a (I11 69/704) and b (I11 69/613) fragments of antler beams with traces of grooves produced during working using the groove and splinter technique. – c Fragment of an antler point (I11 79/312). – d Fragment of ?reindeer bone with a groove on the outer surface of the bone (I11 89/621).

Impact notches

Only one possible impact mark was noted on the reindeer remains. The notch is located just below the proximal end of a metatarsal fragment (79/666) and has left a clear negative on the inner side of the bone on the dorsal face of the bone.

Worked antler and bone

Two larger pieces of antler represent fragments of debitage produced during the working of this material. Both finds bear traces of grooves on the outer surfaces (fig. 47 a-b). The antler industry also comprised a small point (fig. 47 c). A tiny fragment, possibly from a reindeer bone, bore the remains of a groove on the outer surface (fig. 47 d).

LARGE BOVID

Four bones could be identified as belonging to a large bovid, but they could not be identified further to either aurochs (genus *Bos*) or bison (genus *Bison*).
The following elements were identified:

distal end of a right metacarpus
right os centrotarsale
right cuneiform
fragmentary spine from a thoracic vertebra

These finds represent at the most the remains of a single, adult animal. The right tarsals could be re-articulated and are from an individual animal.

WOLF

The wolf *Canis lupus* was represented at the sector I11 site by only one bone, a right astragalus. The bone was complete and had not been modified by humans or carnivores. The specimen was slightly longer than some recent Eurasian wolf astragali, but compared with those from European sites dating to the Upper Pleistocene as shown below.

	Solutré (79/6)	Upper Pleistocene sites	Recent Eurasian
Length	35.2	33.4-37.1	33.3-34.4

Measurements given in mm. Comparative data taken from Kunst (in Nagel and Rabeder 1992)

SMALL CERVID

A fragment of a left metatarsal and a lower third incisor from a small-sized cervid (deer) were recovered. The metatarsus consists of the medial side of the proximal end and part of the shaft. The well-defined sulcus on the dorsal bone side is typical for all deer types; members of the caprid family have a less prominent sulcus. It was, however, clear that this bone did not belong to a reindeer. Reindeer foot-bones have a very characteristic morphology, including an extremely prominent medial sulcus edge at the proximal end of the metatarsus, so that the bone is asymmetrical in section. In smaller deer, such as fallow and roe deer, the edges of the sulcus extend equally and the sulcus is symmetrical in form. The morphology of the fragment from sector I11 resembled that of the smaller deer and, as far as could be ascertained from the form and size of the proximal end, compared more with roe deer metatarsals in the recent comparative collection.
The lower incisor has a broad, almost spatulate, crown not typical of the narrow-crowned teeth of reindeer recorded from the site.