



Fig. 1: Mosaic from Terme dei Cisari, Ostia.

Roman Mules

PHILIP ARMITAGE
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EXCAVATIONS carried out by a team of archaeologists from the Department of Urban Archaeology (Museum of London) at Billingsgate Buildings (northern side of Lower Thames Street, TQ 3301 8069) in 1974¹ revealed three sets of oak posts and horizontal planks forming revetments to artificial terraces on the hillslope above the River Thames². Amongst the dumped deposits of rubbish used as backfill to these revetments were large quantities of well preserved animal bone identified as discarded domestic refuse with some waste from bone and horn working industries. A detailed account of the

complete assemblage of animal bone is in press³. There is, however, one particular specimen, a right mandibular ramus (jawbone) of an equid, from the site that merits special mention. For the reasons set out in the following section of this paper, the jawbone is thought to be of a mule i.e. the hybrid offspring of a mare (female horse) crossed with a jack (male ass). This is a very exciting find as it represents the earliest record of a mule in Britain, and its discovery has prompted one of the authors (H.C.) to examine the depictions of mules that appear on mosaics, funerary reliefs and ceremonial columns in

1 Supervised by D. M. Jones.

2 B. Hobley & J. Schofield, 'Excavations in the City of London: First interim report, 1974-1975', *The Antiquaries Journal* 57 (Part 1) (1977) 34.

3 P. L. Armitage, 'Faunal remains from the Roman and Saxo-Norman levels, Billingsgate Buildings site, London' In D. M. Jones, 'Excavations at Billingsgate Buildings (Triangle), Lower Thames Street, 1974', *Transactions of the London and Middlesex Archaeological Society* (1980, in press).

order to ascertain just how extensive was their use as beasts of burden and draught animals during the

time of the Roman Empire. This evidence is reviewed in the second section of this paper.

1. Jawbone of a mule from the Roman levels, Billingsgate Buildings (TR 74), City of London

PHILIP ARMITAGE

THE jawbone came originally from the deposit of rubbish piled up behind revetment III (Context 208; ER 4007. Roman, period II phase 3, circa AD 125-160), and is now held in store at D.U.A., Museum of London, where it may be examined on request. Under the British Museum (Natural History) computer-based catalogue scheme, the mandible has been assigned the following registration number: DUA 1977 R5068.

General Osteological Description

Age:

The animal was certainly over 5 years of age at time of death, and may have been between 11 and 14 years. The age was determined using the criteria of Silver (1971)⁴ and by comparison with the series of horse and pony mandibles of known age in the collections of the British Museum (Natural History),

whose horizontal rami have sections of bone cut away in order to expose the developing teeth⁵.

Unfortunately, the portion of the jaw bearing the incisor teeth had been lost in antiquity, and it is therefore not possible to establish a more precise estimate of age than the one given here. Had they been present, the pattern of wear on the occlusal (biting) surface of the permanent incisor teeth would have provided a much better guide to the age of the animal⁶.

Sex:

The loss in antiquity of the anterior part of the diastema means that it is not possible to determine whether or not the canine tooth was present. When present, this tooth provides a clear indication of sex, for it is fully developed only in the male. In the female, the canine is either rudimentary or entirely absent⁷.

Point of measurement	Designation as in von den Driesch (1976)	Value
Length: Gonion caudale—aboral border of M ₃ alveolus	3	141.1
Length of cheektooth row	6	184.6
Length of cheektooth row, measured near the biting surface	6a	174.8
Length of molar row	7	90.9
Length of premolar row	8	94.6
Aboral height of vertical ramus	19	269.7
Middle height of vertical ramus	20	247.9
Height of the mandible behind M ₃	22a	115.8
Height of the mandible in front of M ₁	22b	79.7
Measurement of teeth:—	Length	Breadth
Second premolar	33.5	17.8
First molar	25.8	18.4
Third molar	30.3	14.7

Table I: Measurements of the mule mandibular ramus from Roman levels, Billingsgate Buildings, City of London (DUA Context 208; ER 4007). All measurements are in mm.

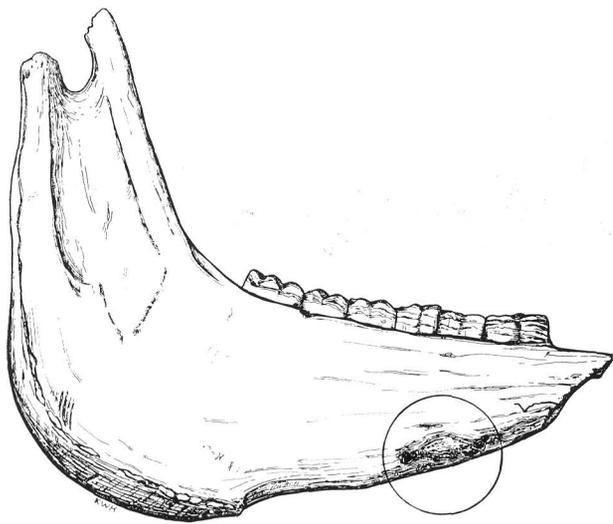
4 The Billingsgate Buildings mandible has the full set of permanent cheekteeth with the lower third molar erupted and in wear. According to I. A. Silver, 'The ageing of domestic animals' In (D. Brothwell & E. Higgs, Eds.) *Science in Archaeology*, London (1971) 283-302, the first molar cuts the gum at 4½ years and comes into wear 6 months later.

5 For the purpose of comparison with the BM(NH) mandibles, the Billingsgate Buildings specimen was examined radiologically in order to ascertain what

portion of the crown of each of the cheekteeth (premolars & molars) remained unerupted in the jaw, and how far the formation of the roots had progressed in these teeth.

6 For information on this method, reference may be made to the booklet, *Official Guide for Determining the Age of the Horse*, (1966) American Association of Equine Practitioners.

7 J. H. Scott & N. B. Bray Symons, *Introduction to Dental Anatomy*, London (1964) 380.



50 0 50mm

Fig. 2: Buccal side of right mandibular ramus of mule from Billingsgate Buildings, City of London. Area within circle shows evidence of pressure atrophy with associated erosion of the bone, probably the result of chafing by either a rope halter or a muzzle.

Size:

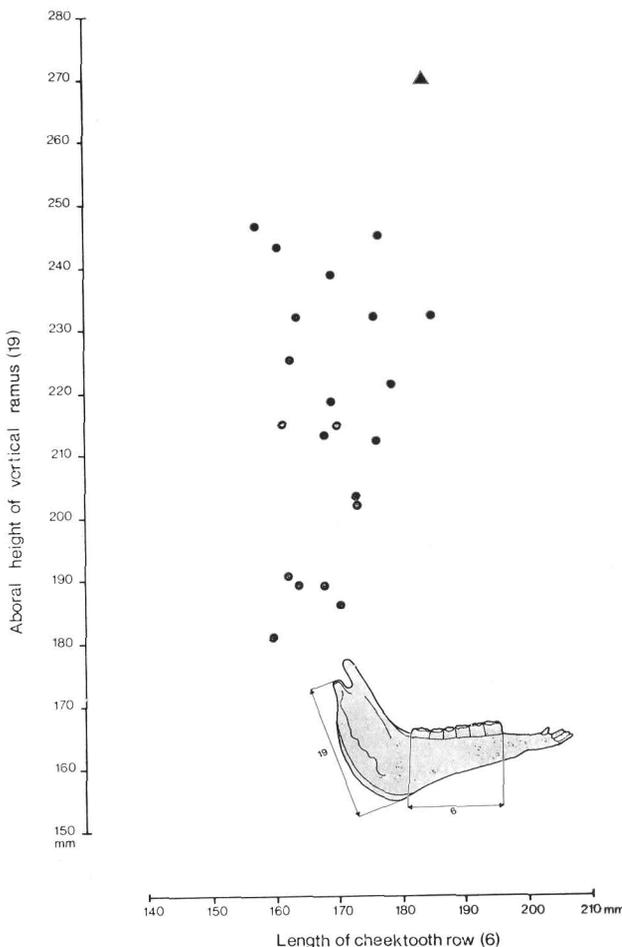
Although incomplete, the surviving section of the jawbone is sufficiently intact to allow measurement. These measurements, which were taken according to the method of von den Driesch (1976)⁸ are given in Table I.

Pathology:

Evidence that this animal may have received rough handling is shown by an area on the buccal surface exhibiting pressure atrophy with associated osteoporosis and erosion of the bone. The latter process has been interrupted by the presence of the roots of the third and fourth premolar teeth (Figure 2, circled)⁹. One may speculate that either a rope halter or a muzzle, such as those illustrated in the paper by Littauer (1969, Fig. 6,297 & Plate XLI(d), 302)¹⁰, had been placed round the nose and, being tied too tightly, resulted in the chafing of the underside of the jaw where there is little flesh to cushion and protect the surface of the underlying bone. It is of interest

that a similar, degenerative pathological condition has been recorded in the mandibles of modern horses, where periostitis (localised infection and inflammation) and necrosis (death of bone) followed from the rough use of the horse-breaker¹¹. Mention should also be made of another archaeological example that shows the effects of tying a rope around the lower jaw. In this example, a complete mandible of a male horse from the Roman site of Newstead Fort, Melrose (BM(NH) Reg. No. H32), there is a pronounced groove cut into the upper surface of the right and left diastema, halfway between the canine and second premolar. Here the rope must have passed inside the mouth rather than over the nose as in the London mule.

The question of whether or not the Billingsgate



▲ Mule from Billingsgate Buildings; DUJ A. context 208 E.R. no. 4007
● Horses from various Romano-British sites; 1st-4th century A.D.

Fig. 3: Scatter diagram of equid jawbones from various Romano-British sites. Aboral height of vertical ramus plotted against length of cheektooth row.

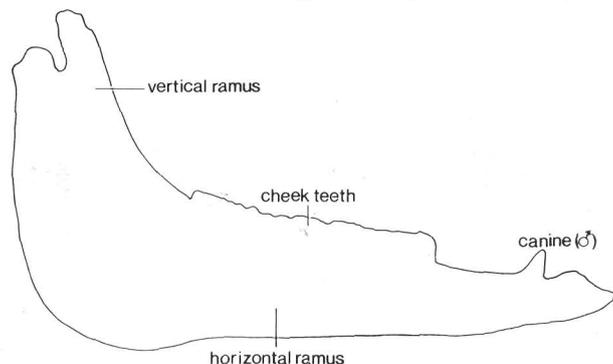
8 A. von den Driesch, *A Guide to the Measurement of Animal Bones from Archaeological Sites*, Peabody Museum Bulletin No. 1 (1976) 52-54.

9 Dr E. Appleby, Royal Veterinary College, London (pers. comm.).

10 M. A. Littauer, 'Bits and pieces', *Antiquity* 43 (1969) 280-302.

11 H. Thompson, *Elementary Lectures on Veterinary Science*, London (1919) 43.

(A) Romano-British horse from Angel Court BM(NH)Regno.76.5015



(B) Mule from Billingsgate Buildings context 208 E.R.no.4007

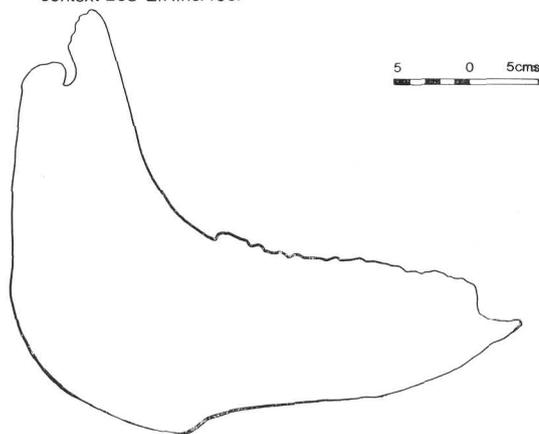


Fig. 4: Profile diagrams of equid jawbones from the City of London.

Buildings mule was fitted with a harness incorporating a bit cannot be resolved. Although the occlusal surface of the second premolar (P2) is worn, this is clearly the result of normal attrition during mastication of food. There is no sign of excessive abrasion on the anterior side of this tooth; a condition assumed to be associated with biting on a bit¹². The absence of uneven wear on P2 should not be considered, however, as firm evidence against the use of a bit in the London mule, for modern horses known to have been ridden with a bit that I have examined often show no evidence of this practice from their teeth.

12 See J. Clutton-Brock, 'The Buhen horse', *Journal of Archaeological Science* 1 (1974) 89-100.

13 See H. F. Osborn, 'Craniometry of the Equidae' *Memoirs of the American Museum of Natural History New Series* 1 (Part III) (1912) Fig. 12, 88.

14 W. B. Tegetmeier & C. L. Sutherland, *Horses, Asses, Zebras, Mules, and Mule Breeding*, London (1895) 87, 97 & 111; R. Lydekker, *The Horse and its Relatives*,

Identification of the Jawbone

The reasons for identifying the mandible from London as mule are as follows:

1. Size and shape.

In Figure 3, measurements taken of the Billingsgate Buildings mandible are compared with those from Romano-British horses. From the diagram, it is seen that although the length of the cheektooth row (and it should be added, the length of the horizontal ramus as a whole) falls within the upper range established for the 21 horses, the height of the vertical ramus is very much greater. The additional height of the vertical ramus produces a jawbone that appears massive and 'heavy set'. This is illustrated in Figure 4, where the profile of the Billingsgate Buildings specimen is compared with that of a horse. The outline of the mandibular ramus from London is, I believe, nearer to the shape found in ass than in horse, although much larger¹³.

Both the asinine shape and extraordinary robustness recorded in the London jawbone may be explained by reference to what is known about the size and conformation of mules. In essence, this may be stated as follows: it is traditionally held that the general appearance of the mule (especially the short, thick head, long ears and thin legs) follows that of the sire (i.e. the ass), whilst stature is determined by the height of the dam (i.e. the mare)¹⁴, with, in some instances, the fully grown mule exceeding the size of either of its parents¹⁵. This latter trait, an expression of hybrid vigour, provides one plausible explanation as to why the Billingsgate Buildings animal is much larger and more robust than any of the Romano-British horses that I have come across so far.

2. Enamel pattern of molar teeth

In addition to the unusual size and shape described previously, the Billingsgate Buildings man-

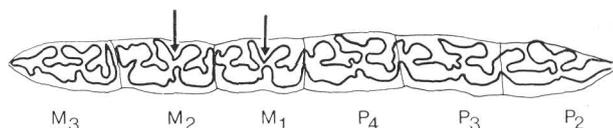


Fig. 5: Mule from Billingsgate Buildings, City of London. Enamel pattern of cheektooth row.

London (1912) 235; C. P. Groves, *Horses, Asses and Zebras in the Wild*, London (1974) 33.

15 W. B. Tegetmeier & C. L. Sutherland, *op cit* (1895) 141; A. Dent, *Donkey: The Story of the Ass from East to West*, London (1972) 63.

16 M. Petit, *Anatomie des Molaires des Equidés*, Toulouse (1939); J. Clutton-Brock, *An Analysis of Mammalian Faunas from Prehistoric Sites in India and*

dible differs from those of Romano-British horses that I have examined in the enamel pattern of the first and second molar teeth. The metaconid-meta-stylid valley (internal sinus) in these two teeth is deep and 'V' shaped (Figure 5, arrowed). This 'V' shape is very seldom found in Romano-British horses, where the same re-entrant fold is more usually 'U' shaped (Figure 6(b)).

Detailed descriptions of horse and ass dentition may be found in the works by Petit (1939), Clutton-Brock (1962, 205) and Churcher & Richardson (1978, 412)¹⁶, but there is, as far as I am aware, very little information available on mule teeth. As a contribution to this subject, I have made a comparative study of the mandibles of modern horses, asses and the one mule (BM(NH) Reg. No. 1888.12.3.1) held in the collections of the BM(NH), the results of which are incorporated in Table II (see also, Figure 6(a)). On the basis of the data collected, I have reached the conclusion that the enamel pattern seen in the Billingsgate Buildings mandible compares favourably with that of the mule.

Unfortunately, enamel patterns in equid teeth are variable and cannot always be used to identify species¹⁷. In view of this variability in enamel pattern, further examples of horse and mule dentition need to be examined before any positive conclusion on the identification of the London jawbone based on the teeth can be made. Such a study is hindered by the lack of comparative material; enquiries made to several museums in Europe and North America have so far failed to find a collection which possesses a series of mule skeletons. Nevertheless, it is reassuring that the general consensus of opinion of a number of zoologists whom I consulted on the identity of the Billingsgate Buildings jawbone¹⁸, is in accord with my own observation that the enamel pattern in this mandible is what is to be expected in a mule. Furthermore, I was very interested to learn that an equid mandible with a similar enamel pattern had been found at Dangstetten, West Germany during excavations of a military camp constructed by the Roman 19th Legion sometime between 15 and 9 BC. This jawbone has been identified as mule by Dr Hans-Peter Uerpmann using the same criterion that I employed for the London mandible, namely the deep, 'V' shaped internal sinus¹⁹.

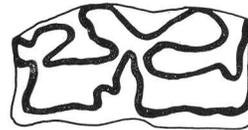
Western Asia, Ph.D. thesis, University of London (1962); C. S. Churcher & M. L. Richardson, 'Equidae', In (V. J. Maglio & H. B. S. Cooke, Eds.) *Evolution of African Mammals*, London (1978) 379-422.

17 See C. P. Groves & V. Mazak, 'On some taxonomic problems of Asiatic wild asses: with the description of a new subspecies (*Perissodactyla; Equidae*)', *Zeitschrift für Säugetierkunde* 32 (1967) 321-355.

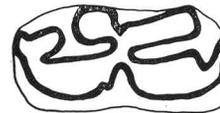
18 Dr Juliet Clutton-Brock, Professor W. Dalquest, Dr D. A. Hooijer & Dr A. Riedel (pers. comm.). It should be recorded that according to Dr. Vera Eisenmann, the possibility that the mandible from London 'belongs to a true horse' can not entirely be ruled out (1977, pers. comm.).

19 Dr. H. P. Uerpmann (1977, pers. comm.).

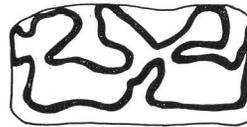
(A) Modern



Horse BM(NH) Reg.no.43.20.203

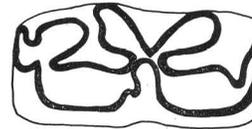


Ass BM(NH) Reg.no.99.3.14.18

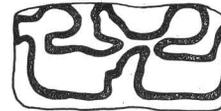


Mule BM(NH) Reg.no.1888.12.3.1

(B) Romano-British



Mule from Billingsgate Buildings
DU.A.context no.208 E.R.no.4007



Horse Angel Court BM(NH) Reg.no.76.5015

PLA ABL

Fig. 6: Modern and Romano-British equids. Enamel pattern of right lower first molar.

Discussion

Until now, the only piece of evidence attesting to the presence of mules in Britain during the time of the Roman occupation took the form of a graffito,

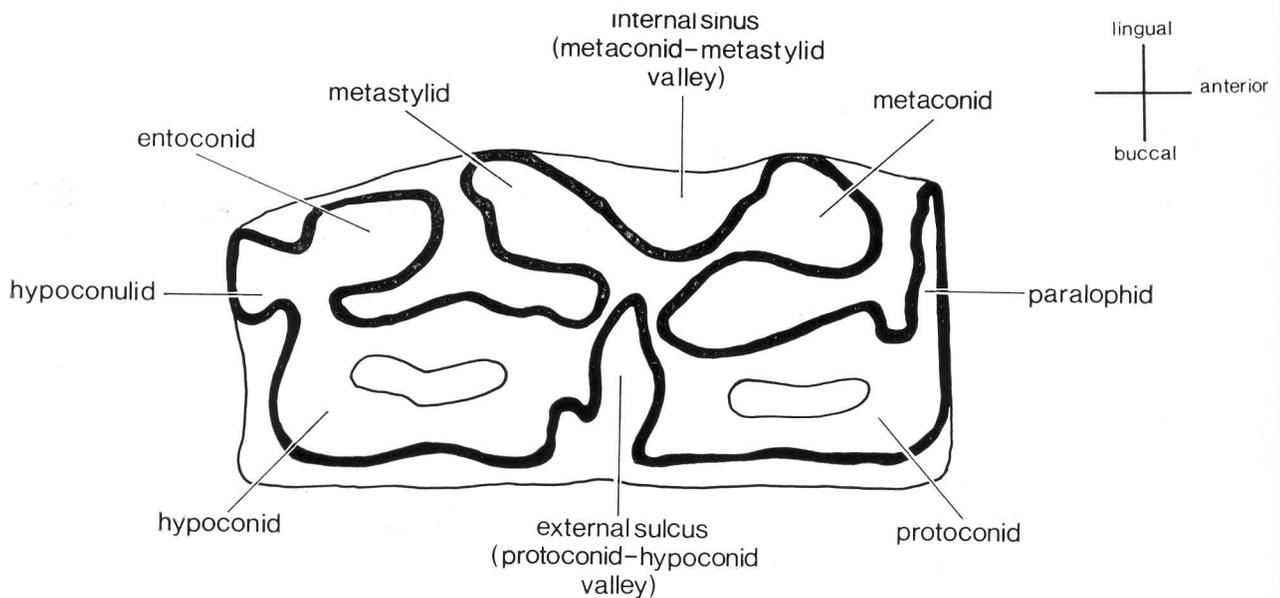


Fig. 7: Occlusal (biting) surface of right lower first molar of horse to show the terminology used in describing the enamel pattern in equid teeth. Nomenclature follows that of H. F. Osborn, *Evolution of Mammalian Molar Teeth*, London (1907) 174, with amendments proposed by R. A. Stirton, 'Development of characters in horse teeth and the dental nomenclature', *Journal of Mammalogy* 22 (No. 4) (1941) 434-446.

Character ^a	Modern			Romano-British Mule from Billingsgate Buildings, City of London (DUA Context 208; ER 4007)
	HORSE	ASS	MULE (1 specimen only)	
1. Protoconid-hypoconid valley (external sulcus)	penetrates deeply into the neck of the metastylid & metaconid	very rarely enters ^b the neck of the metastylid and metaconid	as in horse	as in horse
2. Buccal (external) walls of hypoconid & protoconid	both flat or slightly concave, protoconid may occasionally be slightly rounded	both rounded (convex)	as in horse	hypoconid flat as in horse protoconid slightly rounded
3. Metaconid-metastylid valley (internal sinus)	generally 'U' shaped only very occasionally 'V' shaped (as for e.g. in specimens of New Forest pony)	either 'V' shaped or 'tick' shaped, both forms have a pointed apex	'V' shaped as in ass but apex not quite so sharply pointed	deep 'V' shaped with pointed apex
4. Metastylid	elongate	rounded and constricted at base	as in horse	as in horse
5. Metaconid	slightly rounded, constricted near base	elongate, lingually flattened	as in horse	as in horse

NOTES:

- a. The terminology used to describe enamel patterns in equid teeth is explained in Figure 7.
- b. According to the observations made by other workers (which have been verified by examination of the specimens in the collection of the BM(NH)), this character is consistent and provides the most reliable means of distinguishing between horse and ass.

Table II: Modern and Romano-British equids. Comparison of enamel patterns of the permanent lower first and second molar teeth.

in Green script, on a fragment of cinerary urn from Amerden, near Taplow, Buckinghamshire. Although this sherd was found in the 1890's, it is only recently that the occupation of the person mentioned in the inscription has been translated by Wright (1977)²⁰ as 'mule physician'. Admittedly this reference on a sherd is rather indirect evidence for mules in Roman Britain, but if mules were not being kept in this country at this time, why then did a man specialising in the treatment of these beasts choose to live

20 R. P. Wright, 'A Roman veterinary physician from the Thames valley', *Britannia* 8 (1977) 279-282.

here. The recent discovery of the jawbone during excavations in the City of London provides more substantial evidence for the keeping of mules in Roman Britain, at least as far as south eastern England is concerned. Unfortunately, there is no way of establishing whether the London mule had been born and raised locally or had been brought into the country either by the Roman army or by travelling merchants. Careful study will be made in the future of all equid remains recovered from archaeological sites in the City of London in the anticipation that further examples of mules will be discovered.

2. Evidence for the use of mules in the Roman world

HUGH CHAPMAN

THE purpose of this additional note to Philip Armitage's paper identifying skeletal material of a mule from a Roman level in London, is to emphasise the important, though consistently neglected role, that the mule played in many areas of the Roman economy, and to suggest that many more mules await recognition amongst excavated bone material both in the province of Britain and elsewhere.

That the importance of mule breeding to produce animals better equipped as draught animals and beasts of burden was well understood in the Roman world, is clear from the comments of both Varro, writing in the second half of the 1st century BC (*De Rustica* II.8), and Columella, who lived and wrote about a century later (*De Re Rustica* VI.3.6). In addition the elder Pliny has some comments on the animal's characteristics and the results of the union of mares and tamed wild asses, their physical attributes and stubborn temper (*Naturalis Historia* VIII. 69-70), while later in the Roman period, we find the panegyrist Claudian praising the draught mules of Roman Gaul for their intelligence and obedience (*Carmina Minora* XLIII.4).

If Varro, Columella and Pliny provide evidence of Roman veterinary skills for the propagation of mules in the Roman world, many depictions of the beast on sculptured reliefs, mosaics and the like, combined with additional literary evidence from the Theodosian Code and similar sources, indicate that the mule was widely used in the Roman world for the pulling of carts and other vehicles, and for pack

animal duties. Varro's sweeping statement (*De Rustica* II.8.5.) that all vehicles on the roads were pulled by mules, is no doubt an exaggeration, but serves to emphasise the point.

The interpretation and exact identification of animals on pictorial evidence of this sort is always problematical and of a subjective nature, since anatomical details are rarely shown with sufficient clarity and precision to be certain of the identification of the species depicted. However, a sufficient number of mules can be recognised with some certainty to indicate that in the north-west provinces at least, and presumably throughout the empire, the mule provided one of the two main sources of traction power. The other animal employed was the ox, which was used for the pulling of heavy loads on slow-moving vehicles. The horse remained the animal *par excellence* for riding.

Mules are depicted pulling vehicles of a number of different kinds. Thus on the well-known 3rd-century funerary column from Igel near Trier, a light two-wheeled cart carrying a driver and passenger and pulled by two mules between shafts is depicted driving out of a gateway past a milestone inscribed LIII (leagues IV). On the same monument a four-wheeled cart is also shown, loaded with bales of merchandise (cloth?) and pulled by three mules guided by a single driver²¹. There are many other sculptured reliefs showing similar two-wheeled vehicles with shafts and pulled by one or two mules, — for example from Dijon (2), Trier, and Metz (2)²².

21 For the first of these scenes, see J. M. C. Toynbee *Animals in Roman Life and Art* (London 1973) Pl.85, but also pp.185-192 for many other references and collected evidence for the use of the mule in the Roman world. For the second scene from the Igel column, see P. La Baume *The Romans on the Rhine* 2nd ed. (Bonn) Pls.13-14.

22 Dijon, see M. A. de Caumont *Abécédaire . . . d'Archaéologie. 1. Ere Gallo-Romaine* (Caen, 1870) Figs. on pp.418-419. Trier, see E. Esperandieu *Recueil général des bas-reliefs . . . Gaule Romaine* (Paris, 1907-38) XI No. 7725. Metz, see Esperandieu *ibid* V Nos. 4297, 4321.

Evidence from a different geographical area is provided by a 2nd-century mosaic pavement from the Terme dei Cisari, Ostia, where four scenes of great animation and humour are sketched out in black and white tesserae. In one scene two mules, named *Pudes* ('Bashful') and *Podagrosus* ('Gouty') are led by their groom reluctantly towards a vehicle (not shown), while in a second another pair of mules, named *Potiscus* ('Thirsty Fish') and *Barosus* ('Mollycoddle'), have just been unharnessed from a four-wheeled vehicle and are drinking greedily from a water trough. The two other pictures that make up the pavement show a single mule between shafts pulling a four-wheeled cart (Fig. 1), and a pair of mules yoked to a second vehicle of the same size, which they are pulling away at high speed²³.

A more specialised vehicle is represented by the covered four-wheeled wagon pulled by two animals, perhaps mules, on the sculptured relief from Saal near Klagenfurt²⁴, whilst a relief from Arlon, apparently part of a brick-making scene, shows a single mule between shafts pulling a vehicle consisting of a large bin mounted on a pair of wheels²⁵. More spectacular is the well-known 'tanker' from Langres where a large wine barrel, perhaps containing as much as 400 litres, is mounted on a four-wheeled chassis, and is being dragged by two tired mules²⁶. A representation of a similar vehicle is known from Spain and here also the mules, two in number, are depicted with heads lowered and in an exhausted condition²⁷.

By the late empire the *cursus publicus*, the state transport system, largely because of its involvement with the carriage of state goods, especially the collection and distribution of the *annona* tax (a tax in kind irregularly applied in the 3rd century and regularised by Diocletian), had developed an elaborate bureaucratic machinery and complex chain of command in attempts to ensure the efficient running of its stations, the *mansiones* and *mutationes*, strung out along the main roads. The division of the system into a bipartite one with two branches, the *cursus velox* ('fast') and *cursus clabularis* ('slow'), was one such development.

Chapter 8 of the Theodosian Code, the great compendium of Roman legislation that includes material dating from the reign of Constantine I, collects together the edicts promulgated in attempts to stop

abuses by users of the *cursus publicus*, and supplies many details about the animals and vehicles used.

The *cursus clabularis* employed four-wheeled carts drawn by oxen (*Codex Theodosianus* 8.5.16) and carried bulk goods. The *cursus velox*, on the other hand, used two types of vehicles, the *birota* and the *raeda*, both of which were pulled by mules. The *birota*, as the name indicates, was a two-wheeled vehicle pulled by three mules (*C.Th.* 8.5.8) and could have a maximum weight placed on it of 200 *librae* (c.66 kilos or 150lbs). Its purpose was as a passenger conveyance. By contrast the *raeda* was a four-wheeled vehicle, pulled by eight mules in the summer and ten in the winter, and had a weight restriction of 1000 *librae* (c. 330 kilos or 730lbs) (*C.Th.* 8.5.8), though this was even further reduced when the vehicle was conveying gold or silver bullion for the imperial largesses or privy purse (*C.Th.* 8.5.48). At other times the *raeda* was used for conveying other special, though less precious goods, especially linens and cloaks from the state cloth mills, the *gynaecia* (*C.Th.*8.5.48). It also carried passengers (*C.Th.*12.12.9) or state officials going about their business, and the tombstone of the *speculator* Lucius Blassius Nigello in Belgrade showing a four-wheeled cart pulled by three mules, perhaps represents a *raeda* of the *cursus publicus*²⁸.

It is not possible to discuss here the problems raised by the harnessing of the numbers of the mules suggested for these vehicles or the very light maximum weight restrictions that were imposed, but it is clear that mules provided the basic traction power of the vehicles of the *cursus velox* and must therefore have been required in very large numbers. The treatment handed out to them must also have ensured that a constant supply of fresh beasts was required, for the annual turnover of animals was, by modern standards, alarmingly high. A quarter of the post-horses (*veredi*) of the *cursus velox*, for example, had to be replaced annually (*C.Th.*8.5.34) and strict laws forbidding the encouragement of animals 'by knotty and stout clubs' but allowing a whip or switch with a short prick at the tip to be used (*C.Th.* 8.5.2), suggest that the mules and other animals of the *cursus publicus* were constantly subjected to harsh treatment, and often needed the services of the *mulomedicii* stationed at the *mansiones*²⁹. Frequent laws attempting to stop

(Continued on p.359)

Montemajor' *Zephyrus* 16 (1965) Pl.12 opp. p.33.

28 M. Rostovtseff *The Social and Economic History of The Roman Empire* 2nd ed. (Oxford, 1957) Pl.74 Fig 1.

29 For evidence for a Greek 'mule-physician' see note 20 above; for a funerary relief from Nancy showing perhaps a vet (or groom) holding a hipposandal see Esperandieu *op cit.* in Note 22, VI No. 4611.

23 G. Calza ed. *Scavi di Ostia 4. Mosaici e Pavimenti Marmorei* (Rome, 1961) 42-44 No. 64 and Pl.108.

24 For this and many other illustrations, see P. Vigneron *Le Cheval dans L'Antiquite* 2 vols. (Nancy, 1968). Pl.65a (Klagenfurt).

25 Esperandieu *op. cit* in Note 22, V. No. 4031.

26 Esperandieu *ibid* IV No. 3232.

27 J. R. Hervas 'Las Lapidis votivas de Baros de

The split central pedestal was about 2.5m (8ft 3in) by 1.75m (5ft 9in) overall, with a central gap about 0.2m (8in) wide, leaving a space about 0.4m (1ft 4in) wide between the pedestal and the kiln wall. Both ends of the two pedestal halves were formed of single large blocks of Reigate stone. The rest of the western half consisted of brick and stone rubble, while the eastern half appeared to have been robbed, and showed only as a "ghost" of unburnt sand. The wall survived to a maximum height of 3 courses, 0.48m (1ft 7in), and the pedestal to a maximum height of 0.33m (1ft 1in).

The area immediately outside of each flue was bounded by diverging "wing" walls, 1.0m (3ft 3in) long at the northern end and at least 1.6m (5ft 3in) long at the southern. They seem to have revetted the natural sand into which the stoke pits (and the kiln itself) were cut. The floor of the kiln is about 0.33m (1ft 1in) below the surface of the sand, as far as can be judged after allowing for sand redeposited when the pit for the kiln was dug.

Discussion

This simple description of the kiln and its products raises many questions, some of which are below:—

- 12 C. J. Marshall, "A Medieval Pottery Kiln discovered at Cheam", *Surrey Archaeol. Collect* 35 (1924) 79-94.
 13 F. W. Holling, "A Preliminary Note on the Pottery Industry of the Hampshire-Surrey Borders", *Surrey Archaeol. Collect*, 68 (1971) 84.
 14 P. Mayes, "A 17th-century kiln Site at Potterspurpy, Northamptonshire, *Post-Medieval Archaeol* 2 (1968)

- (i) *operation of the kiln*: this is a large example of a twin flue kiln, having perhaps three times the volume of comparable kilns, e.g. Cheam 1923 kiln¹², (possibly late 14th century), Farnborough Hill¹³ (c 1580) and even Potterspurpy¹⁴ (mid 17th century). Did it have an open or domed top? how was it loaded? to what temperature was it fired? how successfully?
- (ii) *production of pottery*: were both red and white ware fired in the same kiln? At the same time? Or was the red ware later than white ware? If so, why change? Was it made by the same potters? Or new ones moving into the area? Was there an hiatus?
- (iii) *distribution of the pottery*: the red ware is apparently far less common outside Cheam than is the white ware. Why? Was less produced? (At least two and possibly four, dumps of white ware are known¹⁵, but only one of red ware.) Was production unsuccessful? Or was it produced primarily for a more local market? Was the London market lost to more suitably located kilns (e.g. Woolwich, Kingston, South Lambeth¹⁶)? Is there any connection with Nonsuch Palace, only 1½km (1 mile) to the west?

55-82.

- 15 Parkside, 19-23 High Street, The Harrow Car Park (see *op. cit.* fn. 1) and Whitehall, 1 Malden Road, (N. Nail, *pers. comm.*).
 16 Rhoda Edwards, "London Potters circa 1570-1710", *Jour. Ceramic Hist.* 6, 4.

(Continued from p.346)

the practice of travellers illegally using post-horses to pull vehicles when the statutory mules were *defecta* and in short supply, suggests that the fall-out rate of the latter was high (*C.Th.* 8.5.24). It is perhaps not surprising that the slang term for a *raeda* was *flagella* (*C.Th.* 6.29.5).

If the large numbers of mules were required for the *cursum publicum*, greater numbers were needed for use by the army, and their all-purpose duties as beasts of traction to pull vehicles loaded with arms, supplies, wine barrels and artillery, — sharp-shooting arrow firing machines (*ballistae*) mounted on two-wheeled carts as mobile field guns — or to act as simple pack animals, are all depicted in great detail both on Trajan's column and the column of Marcus Aurelius³⁰.

If a mule escaped conscription into the army or the slavery of service with the *cursum publicum*, other openings in civilian life were available — as tow-paih animals pulling barges (Horace *Satires* 1.5.13, Strabo *Geog.* 5.36) or as members of long teams of mules harnessed in tandem to drag large blocks of marble (*Martial Epigrams* V. 22.7.8) or, as fragmentary reliefs from the area around

Luxembourg and West Germany show, as the main motive force to push the curious grain harvesting machines (*vallus*)³¹, and even in old age there was no escape since Apuleius (*Metamorphoses* IX.11-13) tells us that *muli senes* were sentenced to the eternal repetitious drudgery of turning the baker's mill round and round.

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30 See Vigneron *op. cit.* in Note 24, Pls. 59-63.

31 K. D. White, 'Gallo-Roman Harvesting Machines' *Latomus* 26 (1967) 634-647.