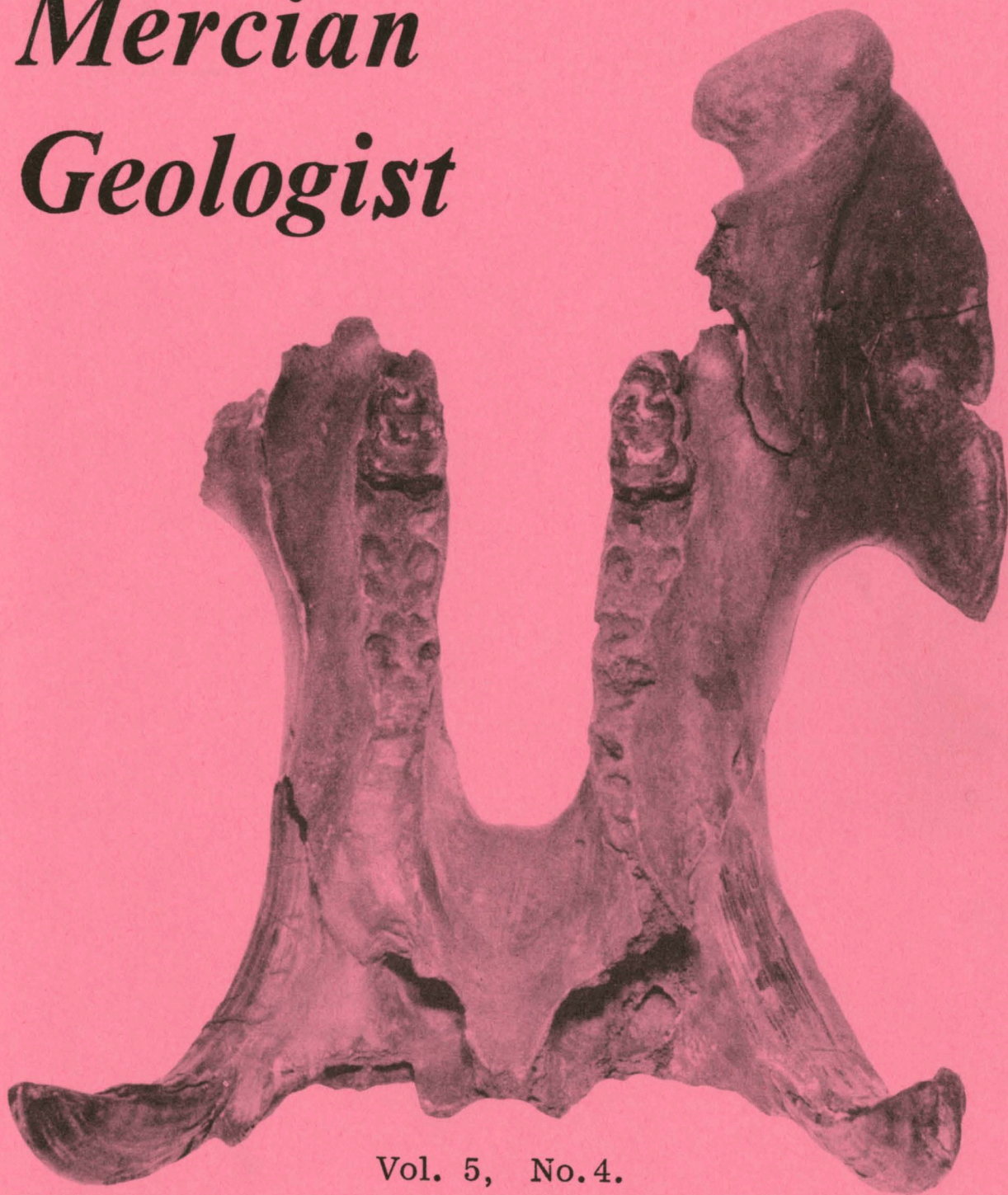


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Front Cover: *Hippotamus amphibicus* Linnaeus. Occlusal view of Allenton mandible (F1030) showing canines and molar teeth. The alveoli (sockets) of the four incisors can be seen between the canines. Two large first incisor alveoli at centre with the smaller second incisor alveoli on either side. This is the typical tetraprodont condition as seen in the modern species. (See Jones and Stanley, pp. 259-271 of this issue).

DESCRIPTION OF HIPPOPOTAMUS AND OTHER MAMMALIAN REMAINS
FROM THE ALLENTON TERRACE OF THE LOWER DERWENT VALLEY,
SOUTH DERBYSHIRE

by

P. F. Jones and M. F. Stanley

Summary

The Allenton Terrace of the lower Derwent Valley has yielded a rich Pleistocene mammalian fauna from two closely spaced localities. Recent discoveries at Boulton Moor have considerably supplemented the original finds made at Allenton in 1895. Seven taxa are recorded, representing a typical Ipswichian assemblage dominated by *Hippopotamus*. A re-examination of the Allenton hippopotamus remains has been undertaken and a description of the complete fauna from both localities is presented.

Introduction

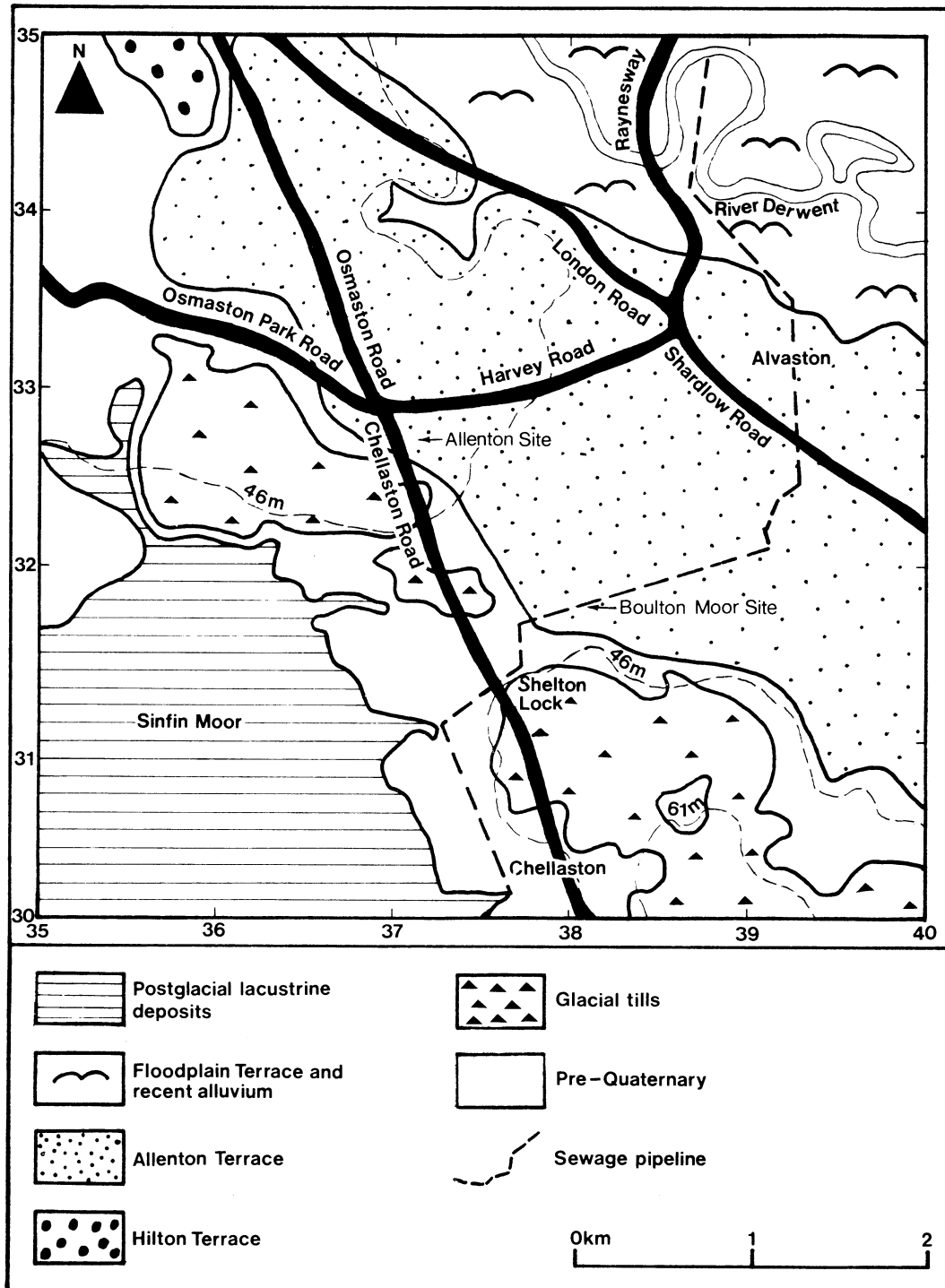
The Allenton Terrace extends on the south side of the River Derwent from Derby (SK 355362) to Elvaston (SK 410325). It forms a prominent morphological feature which has an average altitude of about 42 m O.D., and lies approximately 5.4 m above the present river's flood plain.

Mammalian remains were first reported from the terrace by Bemrose and Deeley (1896). In an excavation at Allenton (SK 372325) these authors recorded an almost complete skeleton of *Hippopotamus* together with the breast bone of *Elephas* and femur of *Rhinoceros* (species not identified). Since that date, however, nothing further had been reported until the recent discoveries at Boulton Moor (SK 382317) only 1 km south-east of the Allenton site (Jones & Stanley, 1974). Here the three genera originally found at Allenton were represented again, together with four new species. The additional presence of brown bear (*Ursus* cf. *arctos* Linnaeus); hyaena [*Crocuta crocuta* (Erxleben)] red deer (*Cervus elaphus* Linnaeus); and ox or bison (*Bos* sp. or *Bison* sp.) gave an overall faunal assemblage which is regarded as being characteristic of the last (Ipswichian) interglacial (Sutcliffe, 1960. 1964, Stuart, 1974). The location of the sites and the distribution of superficial deposits is shown on text-fig.1.

After their extraction, the Allenton bones were repaired and deposited in Derby Museum. Although a report on their discovery, and an account of the geology of the site, was made at the time (Bemrose & Deeley, 1896) no detailed description of the specimens collected has ever been attempted. The recent finds at Boulton Moor, and the subsequent need for comparative material, led to re-examination of the Allenton remains. An important supplement to this examination was a comparison of the material with corresponding specimens from other *Hippopotamus* localities in Britain.

A report on the significance of the Boulton Moor finds has been published elsewhere (Jones & Stanley, 1974). The purpose of this paper is to give a detailed description of all the mammalian remains that have been obtained from both of the bone-bearing localities in the Allenton Terrace.

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pp. 259-271, 1 text-fig. Cover of
this issue, Plates 11, 12 and 13.



Text-fig.1. The superficial deposits in the south-east of Derby showing the location of the Allenton and Boulton Moor Sites.

The mammalian sites

The two mammalian sites occur towards the south-west margin of the terrace (text-fig.1) where a narrow ridge of Keuper Marl capped by 'boulder clay' separates the interglacial deposits from the low level post-glacial lacustrine deposits of Sinfin Moor. The latter have been recently described by Champion (1969).

At Allenton, the mammalian remains were found during excavations for a well in the yard of the Crown Inn (Bemrose and Deeley, 1896). The specimens were obtained from a depth of approximately 2.95 m in a layer of dark-coloured pebbly sand immediately overlying 'river gravel'. The bones were associated with plant remains that seemed indicative of 'a moist meadow or swampy ground and a temperate climate'. An elytron and thorax of a beetle were also found but their identification was not recorded. From an assortment of 127 bones and fragments obtained, it proved possible to reassemble a total of 51 complete, or almost complete, specimens. The large number of bones, their good state of preservation and their only slightly disturbed positions, led Bemrose and Deeley to the conclusion that the *Hippopotamus* skeleton was deposited almost entire at the spot where the bones were found, and made unlikely the possibility that they were derived from an older deposit. These authors envisaged the animal being stranded in an old channel of the River Derwent and quickly covered with sand and clay with only very slight disturbance.

The Boulton Moor mammalian remains were discovered in July 1973 during excavations for a major sewage pipeline which crossed the Allenton Terrace in a north-east to south-west direction. The requisite 6 m depth for the sewage pipes necessitated the trench being cut in two stages; after removal of the topsoil, a wide open-cut was first excavated to a depth of approximately 3 m by drag-line operations and then a narrower central trench was dug by a mechanical excavator. North-east of the mammalian locality this lower trench penetrated glacial till at a total depth of 3.5 m (Jones, 1974). However, as the excavations progressed towards the south-west, the till surface dropped down to below the floor of the trench to give a 6 m thickness of terrace sands and gravels. The majority of the mammalian remains were collected *in-situ* from coarse sandy gravels in the lower part of this exposed section. Although a few bones were picked up from tipped material on the trench sites, their provenance is not in doubt. A total of 56 bones, teeth and fragments was obtained. The material when repaired yielded 24 identifiable specimens and 20 unidentifiable fragments.

Description of the specimens

A complete list of the mammalian remains obtained from the Allenton Terrace is given in table 1. All the specimens are lodged in the Department of Natural History, Derby Museums and Art Gallery. The Museum accession numbers are 298/1895 and 947/1974 for the Allenton and Boulton Moor material respectively. Individual specimen numbers are quoted in the table and are referred to in the text.

The Allenton mammalian remains

The majority of the Allenton bones belong to *Hippopotamus* and are extremely well preserved. At an unknown date (? 1895) several of the bones were repaired with cement filler and wire, and an almost complete vertebral column placed on display in the Museum. In June 1972 the remains were cleaned, treated with a protective coating of polyvinyl butyral (P. V. B.) and then re-displayed.

Hippopotamus amphibius Linnaeus

Mandible (F1030; Cover; Plate 11, fig. 1). This is well preserved, but the right ascending ramus, except for the manibular condyle, is wanting. The left ascending ramus is broken and repaired; the coronoid process is missing. The exterior-anterior parts of

Table 1. List of specimens from the Allenton Terrace

ALLENTON SITE

Map Ref. SK 371325
 Reference Bemrose & Deeley (1896)
 Museum No. 298/1895

BOULTON MOOR SITE

Map Ref. SK 382317
 Reference Jones & Stanley (1974)
 Museum No. 947/1974

Hippopotamus amphibius Linnaeus

F1030 Mandible with two canines
 F1031 Axis (2nd cervical vertebra)
 F1032-1035 3rd-6th cervical vertebrae
 F1036-1039 1st-4th thoracic vertebrae
 F1040-1049 6th-15th thoracic vertebrae
 (F1043 Neural spine of 9th thoracic
 vertebra)
 F1050-1053 1st-4th lumbar vertebrae
 F1054 Sacrum
 F1055 Right innominate
 F1056 Left innominate
 F1057 Left femur
 F1058 Left tibia
 F1059 Left fibula
 F1060 Left calcaneum
 F1061 Left cuboid
 F1062 Right fibula
 F1063 Right calcaneum
 F1064 Right cuboid
 F1065 Right astragalus
 F1066 Left lunare
 F1067 Left scaphoid
 F1068 3rd right rib
 F1069 4th right rib
 F1070 4th left rib
 F1071 Shaft of rib, mid-distal half
 F1072 Shaft of rib, mid-distal half
 F1073 Shaft of rib, mid-distal half
 F1074 Shaft of rib, mid-distal half

Elephas sp.

F1075 Breast bone fragment

Rhinoceros sp.

F1076 Right femur, midshaft

Hippopotamus amphibius Linnaeus

F831 Centrum of a thoracic vertebra
 F832 Left tibia, mid shaft
 F833 Radio-ulna, proximal articulation
 fragment.
 F834 Left lower canine
 F835 Left lower canine
 F836 Left lower canine
 F837 Left lower canine
 F838 Lower jaw, ventral half
 F839 Right lower first incisor
 F840 Right scapula, distal fragment

? *Palaeoloxodon antiquus* (Falconer)

F841 Tusk fragments (4)
 F842 Left scapula, distal fragment

? *Dicerorhinus hemitoechus* (Falconer)

F843 Left scapula, distal half
 F844 Left innominate, mid portion

Ursus cf. arctos Linnaeus

F845 Left femur, distal half

Cervus elaphus Linnaeus

F846 Antler beam
 F847-848 Antler tines

Crocota crocota (Erxleben)

F849 Left tibia, juvenile form

Bos sp. or *Bison* sp. (Bojanus)

F850 Right radius, proximal fragment
 F851 Left radius, proximal fragment
 F852 Left radius, proximal half
 F853 Left metacarpal, proximal fragment
 F854 Left scapula, distal fragment

both horizontal rami are missing exposing the small canine teeth to their roots. A worn but complete left third molar tooth (M₃) and half of a worn right third molar are preserved in the adult tooth row. The two first incisor teeth are missing but their alveoli are prominent in the broken anterior end of the symphysis.

1. Maximum length (mandibular condyle - anterior curve of canines)	590 mm
2. Length of horizontal ramus (behind M ₃ - broken end of ramus)	370 mm
3. Height of left ascending ramus (mandibular angle - condyle)	260 mm
4. Length of symphysis (approx)	179 mm
5. Height of jaw (in front of M ₃)	140 mm
6. Distance between horizontal rami at alveolus of M ₃	88 mm
7. Length of tooth row	270 mm
8. Length of right canine; outside curvature:	390 mm
inside curvature:	285 mm

Cervical vertebrae. The atlas (1st cervical) and the last (7th) cervical are missing and the remainder are highly abraded.

The axis (2nd cervical; F1031) is abraded at the articulating surfaces for the atlas; and the transverse processes are wanting. The area behind the odontoid process has been restored with cement filler. The neural spine has a rounded crest, cranially (transverse diameter 42 mm) and is broad and flat, caudally (transverse diameter 75 mm). The post-zygapophyses and centrum are intact but slightly abraded. The dimensions of the axis are given below.

1. Length (odontoid process - dorso-caudal edge of centrum)	145 mm
2. Max. transverse diameter across articulating surfaces for atlas	145 mm
3. Max. transverse diameter across post-zygapophyses	121 mm
4. Height from base of centrum (caudal end) to top of neural spine	178 mm

The 3rd - 6th cervicals (F1032-1035) are without their neural spines and transverse processes except for the presence of stumps of the right process (4th, 5th, 6th vertebrae) and the left process (5th vertebra). The pre- and post-zygapophyses are missing from the 4th and 5th cervicals. Maximum transverse diameter across post-zygapophyses: 3rd, 133 mm; 6th, 138 mm.

Thoracic vertebrae (F1036-1049). Of the full complement of 15 thoracic vertebrae only the 5th and 9th (except the neural spine) are missing. The neural spine of the 4th vertebra is missing, and all the spines except the 13th, 14th and 15th are abraded. The centrans are complete but those of the 4th, 6th and 8th vertebrae are abraded along their caudal edges. All the transverse processes are abraded; those of the 3rd, 4th (left), 12th (right) and 13th (left) are missing, and only stumps remain on the 6th and 14th vertebrae. The pre-zygapophyses of the 3rd - 10th and post-zygapophyses of the 3rd - 9th vertebrae are lost. In order to mount the skeleton for display the vertebrae were repaired and joined with cement filler.

	1st	11th	15th
Max. transverse diameter across transverse process	244 mm	166 mm	258 mm
Max. transverse diameter across pre-zygapophyses	154 mm	80 mm	97 mm

Lumbar vertebrae (F1050-F1053). All four vertebrae are present. Apart from slight abrasion of the transverse processes and edges of the centnums they are extremely well preserved.

	1st	2nd	3rd	4th
1. Length of centrum (ventral surface)	78 mm	83 mm	85 mm	76 mm
2. Max. trans. diameter across transverse process	369 mm	417 mm	492 mm	522 mm
3. Base of centrum to tip of neural spine (cranial)	220 mm	226 mm	-	181 mm
4. Height of centrum (mid-caudal end)	65 mm	62 mm	56 mm	54 mm

Sacrum (F1054). The Sacrum is complete and excellently preserved. The dimensions are given below.

1. Max. length of sacrum	276 mm
2. Height to top of neural spine (2nd sacral)	110 mm
3. Max. transverse diameter across transverse process (2nd pseudo-sacral)	120 mm
4. Max. transverse diameter across surface which unites with the ilium	309 mm

Pelvis. The right (F1055) and left (F1056; Plate 11, fig.2) innominates were broken at the time of extraction and have been repaired. Both show signs of slight abrasion. The distal half of the right pubis and the distal extremity of the left pubis are missing. With these exceptions the pelvic girdle is complete and excellently preserved. The dimensions of the right innominate are given below:

1. Max. length (iliac border to ischial border)	740 mm
2. Length from acetabulum to mid supra-iliac border	385 mm
3. Max. transverse diameter of ilium	455 mm
4. Min. transverse diameter of ilium	111 mm
5. Max. diameter of acetabulum (iliac to ischial border)	104 mm
6. Min. diameter of mid-pubis (left innominate)	53 mm

Ribs. Only seven specimens of ribs were recovered. Of these, four (F1071-1074) are represented by mid-portions of shaft. The other three specimens comprise a proximal half with head and tubercle of a 4th right (F1069) and 4th left (F1070), and the proximal half with tubercle only of a 3rd right rib (F1068).

Limb bones. With the exception of the fibulae, all the limb bones which were recovered are complete and excellently preserved.

The left femur (F1057, Plate 12, fig.1) is slightly abraded at the outer edges of the head, condyles and trochlear surface.

1. Max. length (head to medial condyle)	529 mm
2. Max. transverse diameter at condyles	179 mm
3. Max. transverse diameter at head	101 mm
4. Thickness (cranial-caudal) at mid shaft	76 mm
5. Max. transverse diameter at mid shaft	86 mm
6. Max. transverse diameter at proximal end	214 mm

The left tibia (F1058) is slightly abraded at the outer edges of the proximal condylar facets. The shaft is triangular in section with a very strong anterior crest.

1.	Max. length (intercondylar eminence to medial malleolus)	389 mm
2.	Max. transverse diameter across condylar facets	191 mm
3.	Max. thickness from notch to top of condylar crest	129 mm
4.	Max. transverse diameter at distal end	117 mm
5.	Max. thickness at distal end	83 mm
6.	Max. transverse diameter at mid shaft	74 mm
7.	Max. thickness at mid shaft	84 mm

The left (F1059) and right (F1062) fibulae both retain a short length of the shaft and the expanded distal end. The maximum diameter (cranial-caudal) at the expanded end is 81 mm.

The left (F1060) and right (F1063) calcaneum, left (F1061) and right (F1064) cuboid, and the right astragalus (F1065) remain of the pes. Bemrose & Deeley (1896) also listed a left and right metatarsal IV, but these bones are now missing.

Right Astragalus

Max. transverse diameter at tibial articulation	95 mm
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Calcaneum

	L.	R.
1. Max length (tuberosity to distal end)	222 mm	223 mm
2. Max. transverse diameter	104 mm	105 mm

Cuboid

1. Max. transverse diameter at distal end	84 mm	85 mm
2. Max. height (proximal-distal)	78 mm	79 mm

The manus (fore extremity) is represented by a perfectly preserved left lunare (F1066) and a slightly abraded left scaphoid (F1067).

Elephant

The breast bone fragment (F1075) recorded by Bemrose & Deeley is still preserved, but the fragment is small and shows signs of strong abrasion. The derivation of this specimen is therefore a matter of uncertainty.

Rhinoceros

Only one specimen (F1076) attributable to *Rhinoceros* was discovered at Allenton. Re-examination has shown this to be the mid-shaft of a right femur with the 3rd trochanter missing. The bone is in a highly abraded condition.

1.	Length of specimen	211 mm
2.	Max. transverse diameter (mid-specimen)	73 mm
3.	Max. thickness at 2.	50 mm

The Boulton Moor mammalian remains

Although the bones and teeth found at Boulton Moor occurred as isolated individuals they were extremely well preserved. The majority were collected wet, placed in self-sealing polythene bags and removed to Derby Museum. Here they were slowly air dried, and then coated or vacuum impregnated with a solution of polyvinyl butyral in isopropyl alcohol (P. V. B.), modifying the technique of Rixon (1961). P. V. B. has proved stronger than an emulsion of polyvinyl acetate (P. V. A.). It produces a similar glossy finish, but cannot be used to treat wet specimens. The bones responded to the conservation treatment well, and with little change. The teeth showed slight crazing or cracking of the enamel and dentine due to the drying out process. However they are all now in a state of good repair.

The identification of the Boulton Moor mammalian remains was facilitated by a comparison of the specimens with material in the Department of Palaeontology, British Museum (Natural History). The willing assistance of the Museum staff is gratefully acknowledged.

Hippopotamus amphibius Linnaeus

Centrum of a thoracic vertebra (F831). The neural spine and transverse processes are wanting. Apart from part of the periosteum being missing on the ventral surface, the specimen shows good surface detail.

Left tibia, mid shaft (F832). The specimen is strongly abraded but retains a triangular cross-section and a strong anterior crest.

Right radio-ulna, proximal articulation fragment (F833). The medial half of the radius articulation and the prominent radio-ulna suture remain.

Left lower canines (F834-837). Four separate teeth were recorded all of which show signs of wear on their upper anterior surfaces. This is attributable to friction with the respective left upper canines and is quite normal in *Hippopotamus*. Specimens F834, and F836 are small but fairly complete teeth. Their dimensions are given below:

F834	Outside curvature	376 mm	Inside curvature	270 mm
F836	" "	340 mm	" "	261 mm

Specimen F835 (Plate 12, fig.2) is very large, and almost certainly from an adult male. Unfortunately the anterior end was broken during extraction of the tooth from the gravels and is missing. The reconstructed outside curvature (750 mm) slightly exceeds that recorded for the largest isolated tooth found at the important *Hippopotamus* site of Barrington, Cambridge-shire (Reynolds, 1922 p.16). Specimen F837 is a small tooth, but only the interior half is preserved.

Lower jaw, ventral half (F838). This specimen was in a fragmentary condition and has been repaired. The size is compatible with the large canine (F835) and incisor (F839) teeth.

Right lower first incisor (F839). A very large tooth showing signs of normal wear on the upper surface as a result of friction with the corresponding upper first incisor.

Length: 423 mm Circumference at alveolar end: 206 mm.

Right scapula, distal fragment (F840). The acromion of the spine and the coracoid process are missing; the glenoid cavity is abraded.

1. Length of specimen	157 mm
2. Max. transverse diameter at neck	81 mm
3. " " " of glenoid cavity	79 mm
4. Max. thickness at 3.	61 mm

Elephant ? *Palaeoloxodon antiquus* (Falconer)

Elephant is represented by distal fragments of a left scapula (F842) and four fragments of tusk (F841). The glenoid cavity of the scapula is incomplete; the post-spinous fossa is wanting but part of the narrow pre-spinous fossa remains. It is not possible to determine the species from the remains found. However, the associated fauna suggests that *Palaeoloxodon antiquus* (straight-tusked elephant) is the most likely possibility (Sutcliffe, 1960).

Rhinoceros ? *Dicerorhinus hemitoechus* (Falconer)

Rhinoceros is represented by the distal half of a left scapula (F843; Plate 13, fig. 2) and the mid portion of a left innominate (F844; Plate 13, fig. 1).

The acromion of the scapula is indistinguishable and the mid-spinous process is broken above the post-scapular fossa. The coracoid process is wanting but the glenoid cavity is almost perfect. The specimen has excellent surface detail with only slight abrasion along the edges of the glenoid cavity.

1. Length of specimen (mid-spine to glenoid cavity)	279 mm
2. Max. transverse diameter at neck	96 mm
3. Thickness at 2.	28 mm
4. Max. transverse diameter at cavity	83 mm
5. Thickness at right angle to 4.	69 mm

The left innominate shows good surface detail with only slight abrasion at the edges of the acetabulum. The ilium, ischium and pubis are incomplete.

1. Max. transverse diameter of acetabulum	91 mm
2. Width of acetabular notch	25 mm

It is difficult to determine the precise species of rhinoceros from these two bones. *Dicerorhinus hemitoechus* (narrow-nosed rhinoceros) is however the most likely possibility on account of the associated fauna (Sutcliffe, 1960).

Ursus cf. *arctos* Linnaeus

The distal half of a left femur (F845; (Plate 12, fig. 3) was found. Although broken and subsequently repaired, the specimen shows excellent surface detail with only slight abrasion at the edges of the articulation surface. The dimensions (given below) indicate a bear of large size.

1. Length of specimen (half of whole femur)	247 mm
2. Max. transverse diameter at proximal end (mid shaft)	46 mm

3.	Max. anterior-posterior diameter at 2.	40 mm
4.	Max. transverse diameter at tuberosity above condyles	115 mm
5.	Max. transverse diameter at condyles	103 mm

Cervus elaphus Linnaeus

Red deer is represented by an antler beam (F846) together with the separated bay (F847) and brow (F848) tines. The beam is rough with prominent gutters and no palmation.

Crocuta crocuta (Erxleben)

Hyaena is represented by a left tibia (F849) which lacks the distal and proximal epiphyses. The small size of the specimen, together with the absence of epiphyseal fusion, is indicative of a juvenile animal.

1.	Max. transverse diameter at mid shaft	17 mm
2.	Anterior - posterior diameter at 1.	20 mm

Bos. sp. or *Bison sp.* (*Bojanus*)

Specimens F850-854 are attributable to ox or bison. The determination of the exact species is difficult from the bones present. Specimen F852 (proximal half of a left radius) compares favourably with a left radius of *Bison priscus* Bojanus found at Windy Knoll, near Castleton, Derbyshire and now in the care of Sheffield Museum. However there is little difference between the radii of *Bos* and *Bison* and consequently a positive identification is not possible. Both bovids have been recorded as members of Ipswichian faunas. (Sutcliffe 1960).

Discussion

The mammalian remains recovered from the two sites in the Allenton Terrace amount to 71 identifiable specimens (table 1, p. 262). Of these, the majority (55 specimens) belong to *Hippopotamus*. The remainder are attributable to a minimum of six additional taxa, most of which were represented by only one or two isolated specimens. Many of the unidentifiable fragments recovered from Boulton Moor also probably belong to *Hippopotamus*. Several of these appear to be pieces of the mandible which was found broken and, although subsequently repaired, is still incomplete.

The *Hippopotamus* remains represent at least five separate animals. The four left lower canines found at Boulton Moor must have been derived from four different individuals which varied markedly in size. A fifth individual is clearly indicated by the almost complete mandible discovered at Allenton which retained both the left and the right lower canines (Plate 11, fig.1; cover of this issue).

The large canine (F835) and incisor (F839) teeth from Boulton Moor indicate large animals, probably old males. Their size is compatible with the reconstructed ventral half of the mandible (F838) and it is possible that all three specimens are from the same animal. The other canines from Boulton Moor are smaller, and appear to be representative of juveniles or young adults.

The dimensions of the mandible and its associated teeth (F1030) from Allenton are certainly comparable with those of a young adult (cf. Reynolds, 1922, p.9). The size of the axial skeleton supports this contention, although the limb bones are disproportionately larger than the equivalent specimens listed by Reynolds (1922).

It is also notable that the Allenton limb bones were more heavily mineralised than both the mandible and the axial skeleton found at the same site. Furthermore all the bones were reported as being randomly distributed in the original excavation (Bemrose & Deeley, 1896).

On this basis, it might be tentatively suggested that the Allenton *Hippopotamus* remains are attributable to two separate animals and not one as was previously assumed (Bemrose & Deeley, 1896). However, there is an unfortunate lack of available information on size variation within the Pleistocene *Hippopotamus*. It is known that the modern African species is very variable (Hooijer, 1950) and Coryndon (1970) has recently expressed the opinion that any variation seen between one specimen and another may just be indicative of normal intraspecific variation. In the present state of knowledge, therefore, the evidence for two hippopotami at Allenton is inconclusive.

It is notable that the excavation which led to the discovery of the Allenton *Hippopotamus* remains was stopped prematurely by water seepage before an area of more than approximately 9 m² (11 feet by 9 feet) had been examined (Bemrose & Deeley, 1896). Several large bones were in fact recovered some 18 years previously during excavation of cellars at the same locality, but unfortunately the specimens were not preserved. The bones described in this paper, therefore, do not represent the full extent of the Allenton remains and it is extremely likely that further specimens still await discovery.

The apparent dominance of *Hippopotamus* in the overall faunal assemblage from the Allenton Terrace may be largely due to environmental factors. As stressed by Stuart (1974) the composition of an assemblage reflects not only the relative population density and life span of each taxon but also the distance of its habitat from the depositional site. Thus in many fluviatile deposits the over-representation of amphibious vertebrates, such as *Hippopotamus*, is only to be expected. Such animals which died in the water would also be more likely to have their skeletons preserved intact, except under swift-flowing and turbulent riverine conditions. In such circumstances the remains of terrestrial vertebrates would be rarer and complete skeletons unlikely as these would be washed in from the river's flood plain as the banks were eroded. The nature of the deposits seen at Boulton Moor (Jones & Stanley, 1974) and the faunal assemblage described in this paper, would appear to be in accordance with these views.

Mammalian remains are not normally the most useful for stratigraphical purposes. Bones and teeth are relatively resistant to abrasion and there must always be a danger that isolated specimens have been derived from an older deposit. Furthermore, the discovery of such remains tends to be a relatively rare occurrence and faunal assemblages are usually only built up over a long period of time. In addition, unless precise details of the provenance of the finds are recorded at the time, the age and ecological relationships of the specimens will always be in doubt. Many previous finds in river terraces are in fact difficult to relate to the stratigraphical sequence since the specimens were picked up from tipped material in gravel workings or from the conveyor belt and screens of the processing plants. The mammalian assemblage described in this paper is particularly notable for the following reasons:

1. the unusually large number of specimens that was obtained from a relatively small area in each of the two closely spaced localities,
2. the exceptional state of preservation and well defined surface detail of the majority of the specimens indicating that their transportation must have been minimal and burial relatively rapid,
3. the fact that almost all the specimens were collected *in situ* with the result that the precise details of the provenance of each are known.

In a recent study of the Pleistocene history of the British vertebrate fauna (Stuart, 1974) it has been suggested that certain faunal elements appear to be characteristic of each subdivision of the British Pleistocene time-scale. The stages of the Pleistocene are in fact defined on the basis of climatic change (Shotton, 1973), and the progressive fluctuation of climates through a succession of cold and temperate stages had a marked effect on the contemporary vertebrate faunas.

Stuart (1974) has shown that the intensified climatic fluctuations of the Middle and Upper Pleistocene accelerated the faunal changes so that temperate vertebrates were replaced relatively rapidly by 'steppe-tundra' faunas. It is also Stuart's contention that the subsequent return to temperate conditions did not result in an identical temperate fauna. This supports the earlier views of Sutcliffe (1960, 1964) who, with particular reference to *Hippopotamus* maintained that there were significant differences between the mammalian faunas of the penultimate (Hoxnian) and last (Ipswichian) interglacials. His suggestion that *Hippopotamus* was abundant in Britain during the Ipswichian interglacial (Sutcliffe, 1959) but absent during the earlier Hoxnian interglacial (Sutcliffe, 1960, 1964) as well as the post-glacial period has so far stood the test of time.

Nevertheless, it has been stressed by Sparks and West (1972) that lack of records does not necessarily imply complete absence and the possibility must always be borne in mind that the next Hoxnian site might well yield *Hippopotamus*.

The faunal assemblage from the Allenton Terrace is comparable with assemblages obtained from various Ipswichian localities in Britain (Sutcliffe 1960, 1964). It should be noted however, that the majority of the taxa, with the particular exception of *Hippopotamus* were represented only by isolated specimens and many are known to have quite long individual time ranges in the British Pleistocene (Stuart, 1974). If the currently accepted views on the Pleistocene history of *Hippopotamus* are correct (Sutcliffe 1959, 1964; Stuart 1974) then the presence, and the numerical abundance, of *Hippopotamus* in the Allenton Terrace fauna is of considerable stratigraphical significance.

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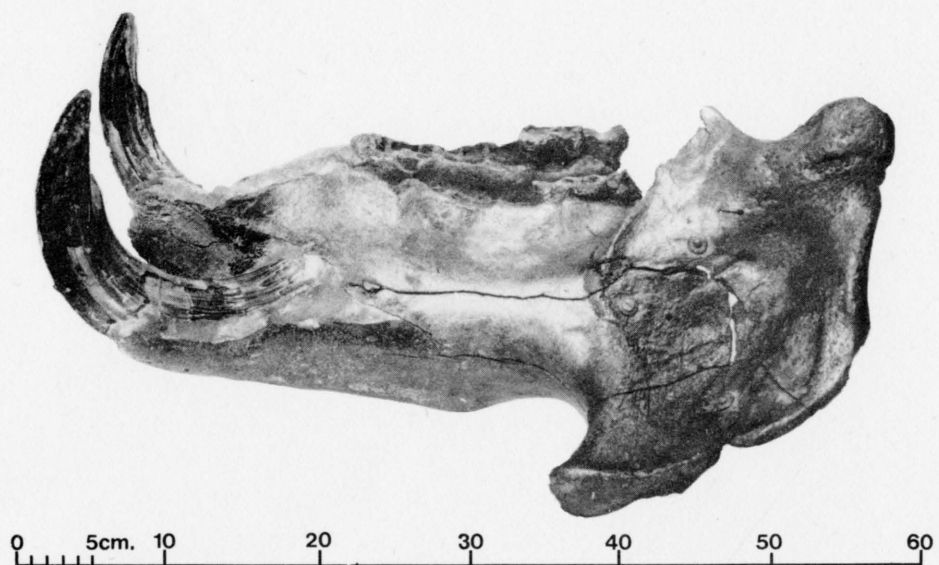


Fig. 1 *Hippopotamus amphibius* Linnaeus, Allenton
Left lateral view of repaired mandible (F1030)



Fig. 2 *Hippopotamus amphibius* Linnaeus, Allenton
Ventral view of repaired left innominate (F1056)

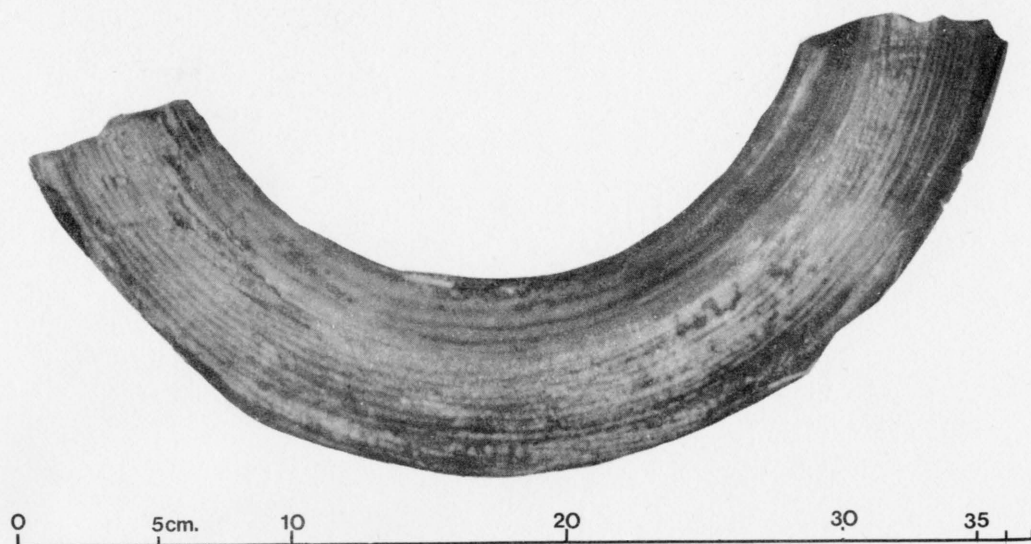


Fig. 1 *Hippopotamus amphibius* Linnaeus,
Left lateral view of left lower canine (F835) from Boulton Moor.



Fig. 2 *Hippopotamus amphibius* Linnaeus
Anterior view of left femur (F1057) from Allenton

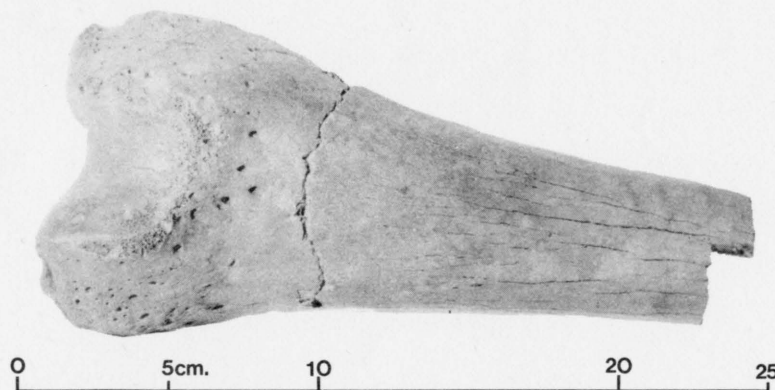


Fig. 3 *Ursus* cf. *arctos* Linnaeus, anterior view of distal half
of left femur (F845) from Boulton Moor

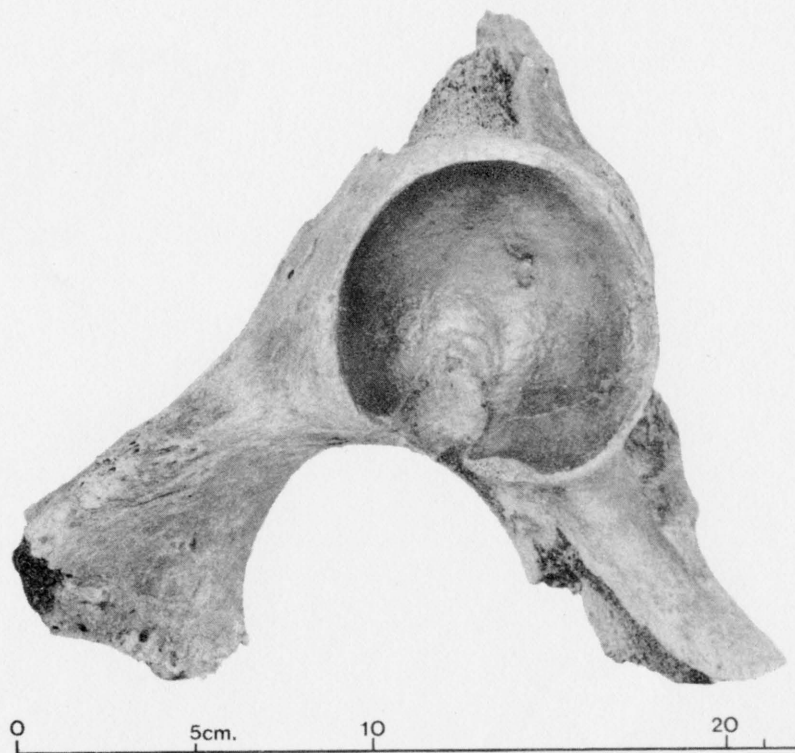


Fig. 1 ? *Dicerorhinus hemitoechus* (Falconer), Boulton Moor.
Left lateral view of left innominate, mid portion (F844)

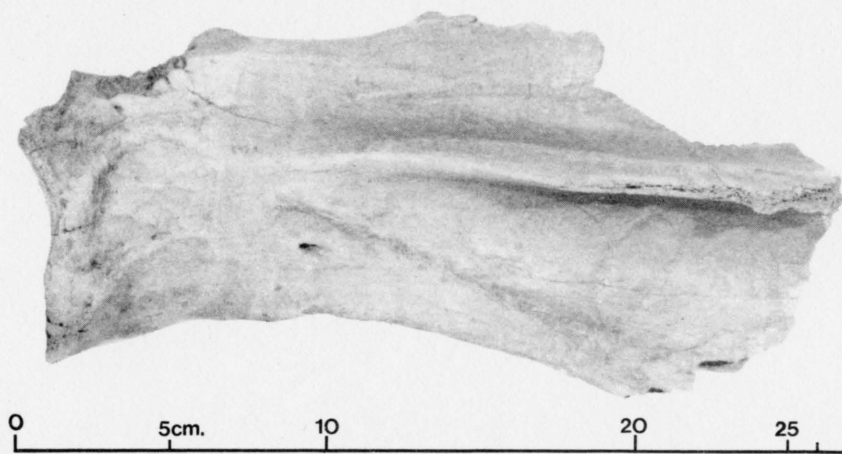


Fig. 2 ? *Dicerorhinus hemitoechus* (Falconer), Boulton Moor,
Lateral view of left scapula (F843)

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