

## **APPENDICES**

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# VEGETABLE REMAINS

BY HARRY F. TAGG, F.L.S.

THE following constitutes a report based upon the examination of material submitted from time to time by Mr. James Curle, of Priorwood, Melrose, during the excavation of the site of the Roman Military Station at Newstead, Melrose.

The nature of the material which was sent to the Royal Botanic Garden, Edinburgh, for investigation was of two kinds:

- (1) Samples of the deposits from the various pits and trenches opened during the work of excavation;
- (2) Definite articles of interest such as implement shafts.

The samples of earths from the pits gave numerous twigs of trees, pieces of bark, branches, chips of wood, and seeds, which had found their way into the pits at the time the latter were being filled with refuse at the station. From the pits and trenches, and mixed with the vegetable debris, came many of the important finds of Roman implements and other articles, and one is justified in assuming that the vegetable remains from the same levels represent species of plants which were contemporaneous with the occupation of the site. In the case of the woods associated with tools as handles, one has, of course, no direct evidence as to their origin.

The general character of the various samples of earths from the pits and trenches, with the vegetable remains identified in each sample, is given in Table I.

Table II gives the results of my identification of the separate objects, such as tool handles.

In Table III I give a summary of the plant remains, arranged systematically according to the various natural orders to which the identified species belong.

## GENERAL REMARKS UPON THE MATERIAL INVESTIGATED

### I. Examination of Samples of Deposits from the Pits and Trenches

(For detailed descriptions of the deposits *see* Table I)

The plant remains identified among the samples are of three kinds:

- (1) Specimens of woods and twigs identified by microscopic examination of their wood structure;

(2) Leaves and bark fragments recognised by their external appearance

(3) Seeds and fruits.

1. The results obtained by the examination of the numerous twigs and branches are somewhat disappointing. As an analysis of Table I shows, these results tend more to indicate the general prevalence of certain well-known indigenous trees—some probably pre-glacial—than to afford evidence of the presence in Britain at the period of the Roman occupation of this station of species of exceptional interest. Thus, although a great number of twigs and branches have been examined, and the species of plant to which they belong ascertained, I am only able as a result to tabulate some seven separate species of trees, and these are kinds which have always been considered to be indigenous.

The number of specimens which turned out to be hazel was remarkable. The bulk of the twigs and branches among the material from the pits were of this tree, although twigs and branches of birch also were fairly common. Oak was less frequently found, and in most instances the specimens of this wood were in the form of chips of large timber. This is interesting, because while hazel fruits and birch catkins were found, no acorns or small twigs of oak were discovered among the material submitted. It may be noted that pieces of oak bark were recognised, and Mr. Curle, in a letter to me, says that 'oak must have been fairly plentiful, I think, at Newstead. All along the west side the early rampart appeared to lie on a double layer of oak branches.' As Table II shows, ash was employed as shafts and handles of implements, but there is no evidence that it was procured locally. In two cases only was ash wood found not associated with implements. A piece of wood from Pit XVI<sup>[1]</sup> proved to be ash, and a portion about two inches long of a branch about an inch in diameter, without bark, was found among the earliest material received. These may have been pieces of broken or discarded implement handles. A few specimens of branches of the rowan (*Pyrus Aucuparia*) and of the white beam (*Pyrus Aria*) were found, and there seems little doubt that these trees have been wild in Scotland from very early times. One or two specimens of the wood of alder were encountered, and similarly a few of poplar (or willow).

Thus it will be seen that the trees, recognised by the wood anatomy of twigs and branches, with portions of bark, which one may regard as growing locally at Newstead at the time of the occupation of the Roman Camp, number seven only: oak, birch, hazel, willow or poplar, alder, rowan, white beam.

2. Leaves and the soft parts of plants were not sufficiently well preserved in most cases to enable one to identify them. However, a few remains of this nature were in fairly satisfactory condition, and among them I was able to identify leaves of hazel, leaves of birch, the stem and leaf-base of an umbelliferous plant, leaves of various grasses and sedges, leaves and flower parts of the common ling, stems and flower parts of nettles, the stems and leaves of a species of dock, a frond of the common bracken, the rhizome and leaf rhachis of a fern, probably the species just mentioned, and several

1 See Table II, Spec. No. 9.

mosses and liverworts. The stem and leaf-sheath of the umbelliferous plant, I have every reason to believe, is that of cow parsnip (*Heracleum Sphondylium*), but a search for remains of fruits of this plant, the discovery of which would have done much to confirm my diagnosis) proved unsuccessful.

The pieces of bark recognised belong to the following species oak, birch, hazel, rowan.

My attention has been directed by Professor Bayley Balfour to a report on the vegetable remains found at the Lochlee Crannog, Tarbolton, Ayrshire, investigated by Dr. Robert Munro.

Dr. Munro's account of the excavations of this Crannog is in the *Proceedings of the Society of Antiquaries of Scotland*, vol. xiii., and the report upon the vegetable remains by Professor Bayley Balfour supplies what appears to me to be some interesting comparisons between the plant remains of that site and those of the Newstead Roman Station.

The brushwood from below the log-pavement of the Lochlee Crannog was, it appears, composed of woods belonging to one or other of the following trees: birch, hazel, alder) willow. The twigs and branches of the nature of brushwood found in the material from the Newstead site are chiefly hazel and birch) while twigs of alder and willow) although not plentiful) were also found.

Alder and willow are trees preferring damp situations, so that their occurrence, perhaps in some quantity, in the vicinity of the Lochlee Crannog at the time of its occupation is easily understood. Hazel and birch, with alder and willow more plentiful perhaps in moist situations, I am inclined to believe) were somewhat dominant trees in the primeval woods of North Britain.

This opinion is supported not only by the results of the examination of the material from Newstead and the records from the Lochlee Crannog, but also by the results of similar investigations which at various times I have made of the plant remains of other sites of Roman and pre-Roman occupation. Thus, to quote the result of one such investigation<sup>1</sup> only: of a number of logs from a pre-historic pile-structure in Wigtownshire which I examined in 1903, seven were, I found, birch, five alder, three hazel, one poplar (or willow), and one oak.

Oak recorded from Newstead, from the Lochlee Crannog, from the Wigtownshire pre-historic dwelling, and from many other Roman stations, appears to have occurred plentifully in primeval woods of North Britain, in which were also scattered trees of rowan and white beam.

It is rather remarkable that no specimens of coniferous wood have been found in the brushwood deposits either at Newstead or at the Lochlee Crannog) and the absence of beech wood from material from both stations is worth noting.

1 Ludovic Maclellan Mann, Pre-historic Pile-Structures in Pits, *Proceedings of the Society of Antiquaries of Scotland*, 1903.

Other plant remains mentioned in the summary of plant remains from Newstead, and recorded also from the Lochlee Crannog, are portions of bracken fern, stems of heather, rhizomes of ferns, bark of birch, and hazel-nuts.

3. The number of seeds and fruits obtained from the Newstead deposits is not, I think, inconsiderable, especially when it is remembered that their occurrence in the material examined was to a certain extent accidental, and that it was impossible to select for seeds any special seed-bearing deposits.

Among the samples which contained grain, the associated weed-seeds belong to plants characteristic at the present time of cultivated fields. The occurrence of seeds of *Lychnis Githago* in considerable quantity among the wheat-chaff (Sample C, Table I) is interesting, in that it indicates that a troublesome weed of cornfields in certain districts at the present day was also a pest in the corn crops of the Romans. The plant is essentially a weed of cultivation, and as such is usually considered to be a weed introduced into Britain with the cultivation of grain crops. In the east of Scotland, even at the present time, it is more a casual in cultivated areas than anything else, so that the occurrence of the seeds among the wheat-chaff from the Newstead station fixes its introduction as far back at least as the Roman occupation of this site. Other weeds of the same natural order associated with the cultivation of crops at the present day, and represented by seeds among the material examined containing grain or wheat-chaff, are those of *Stellaria media*, *Lychnis vespertina*, *Arenaria serpyllifolia*, and what I believe to be a species of *Cerastium*. These plants at the present day are not so completely limited to cultivated fields as is *Lychnis Githago*, and some of them are probably indigenous. It is interesting to note that Mr. Reid, in his recent paper before the Linnean Society of London on the Pre-glacial Flora of Britain, figures and describes seeds of *Stellaria media* and *Arenaria serpyllifolia* from the pre-glacial deposits on the Norfolk and Suffolk coasts.<sup>1</sup>

From the material containing wheat grains, fruits of three species of *Compositae* were also found. Two of these I have identified as *Cnicus arvensis* and *Picris hieracioides*. Both are species common at the present day, and the latter is recorded as pre-glacial.<sup>2</sup> *Ranunculus repens* and *Ranunculus bulbosus* are likewise common wayside and meadow plants occurring at the present day in cultivated areas, and both the species were represented by fruits in the samples containing grain. Fruits of a third species of *Ranunculus* were found, but I have not so far been able to identify it. Among the same grain-yielding samples were found fruits of *Polygonum aviculare*, seeds of *Geranium* sp., *Medicago lupulina*, *Chenopodium album*, and fruits of a species of *Rumex*, probably *R. Acetosella*. The absence of seeds and fruits of common trees, with the exception of those of hazel, finds its explanation probably in the character of the deposits examined. These were, I feel sure, in most cases the debris collected in refuse pits, and although small

1 Reid, in *Jour. Linn. Soc.* vol. xxxviii. (1908), p. 206.

2 Reid, *l.c.*

twigs and wood-chips are present, such are but a small proportion of the total débris, and represent, doubtless, scraps from clearings.

The plants represented by seeds and fruits in certain of the deposits are essentially those weeds which would quickly cover embankments and ditches of fortifications. Thus in some of the deposits we have fruits and seeds of many grasses and sedges, and of common weeds of waste places, such as *Stellaria media*, *Arenaria serpyllifolia*, *Polygonum* sp., *Chenopodium* sp., *Potentilla Tormentilla*, and the two species of *Ranunculus* already referred to. Other weeds of this nature are *Sinapis arvensis*, *Geranium* sp., *Mysotis* sp., *Urtica dioica*, and various species of *Rumex*.

The seeds and fruits of other samples are of plants characteristic of thickets, and the presence of many twigs confirms the view that the deposits containing these are largely the scraps from forest clearings. Among such deposits I have recognised seeds of *Solanum Dulcamara*, *Pedicularis palustris*, fruits of *Galeopsis Tetrahit*, *Urtica dioica*, *Rumex* sp., and the fruits of many sedges. The fern remains also belong to these deposits.

Attention may be directed to the deposits containing brushwood in layers. In one instance a deposit of this character (Sample J, Table I) yielded seeds of characteristic moor-plants. Thus besides seeds of *Calluna vulgaris*, twigs of which formed the bulk of the brushwood in the deposit under review, I found the fruit parts of an *Erica*, berries and seeds of *Empetrum nigrum*, fruits of *Rumex Acetosa*, and those of several species of *Scirpus* and *Carex*. Besides the seeds mentioned, I found in this deposit leaves of a narrow-leaved grass, possibly *Festuca ovina*.

Where the brushwood laid on the clay was birch (Sample G, Table I) the seeds found were more varied in character, representing doubtless species that would form pioneers on freshly-made fortifications and embankments.

## II. Woods of Implement Handles and other Articles

(For detailed identifications, see Table II)

Turning to the table giving the kinds of woods used for tool handles and other articles, one finds that those perhaps most commonly employed were ash and hazel. The latter wood figures as the shaft of a spear, as the shaft of an arrow, and as handles to tools. It doubtless recommended itself for these purposes on account of the clean and straight stems of moderate diameter and light weight obtainable. Hazel, though not durable, is fairly elastic. The value of ash for tool handles and the like is recognised at the present day.

*Pyrus Aucuparia*, used as a shaft for a hammer (No. 1, Table II), and also as a shaft for a gouge (No. 3, Table II), was probably procured locally, for twigs of this species were found, in some cases with bark attached, among the material from the refuse pits. It is probable also that the birch used as a pick handle (No. 2, Table II) was similarly derived. Both birch and rowan are hard and tough woods which do not readily split.

One of the most interesting specimens submitted was a piece of basket-work made of the cleaned cores of stems of the hair-moss *Polytrichum* (commune) ([Plate XV. supra](#)). The stems of this moss are commonly a foot to eighteen inches long, and often attain a length considerably greater. The central stele, when cleaned, forms, as I have proved for myself, a tough pliable strand easily plaited, and quite suitable for the formation of such articles as baskets. When freshly cleaned, the core has a reddish colour and glossy surface, and basket-work of the material would not only be quite strong, but would, at least at first, have an attractive appearance. I am indebted to Mr. J. Masters Hellier, the curator of the Kew Museums, for particulars of articles made of this moss in the Kew Collections, and I give his list, as it supplies one with an idea of the use made of the moss in recent times.

**LIST OF ARTICLES IN THE KEW MUSEUMS MADE OF HAIR MOSS,  
POLYTRICHUM COMMUNE, L.**

1. Basket from near Wallington, Northumberland, 1851.  
received at Kew
2. Broom and brush, from Munich, received at Kew, 1858.
3. Hassock, from Yorkshire, " " 1852.
4. Broom, from Sussex, " " 1852.
5. Broom used by people at Hawkhead, near 1855.  
Windermere, received at Kew

'A four-plyed plaited object made of the long stems' of this hair-moss, and a 'fringe-like structure made by plaiting together at one end' the long strands of the same moss, were found at the Lochlee Crannog.<sup>1</sup>

These records seem to indicate that a knowledge of the pliable and tough nature of the stems of this moss and of its usefulness as a strand in the manufacture of plaited articles—a craft which the basket work from the Newstead Roman Station would indicate to have been appreciated, if not practised, by the Romans—must have been of greater antiquity than the period of the Roman occupation.

**TABLE I  
SAMPLES OF EARTH AND VEGETABLE REMAINS FROM PITS AND  
OTHER SITUATIONS**

*Sample A.*—A dark vegetable earth containing a considerable number of pieces of chipped oak, evidently chippings of timber of some size. Mixed with other vegetable remains are twigs of hazel and birch in some quantity, the former being particularly numerous, while pieces of hazel bark are plentiful, some of the pieces being from trees of fair size. There is also a certain amount of charcoal and a piece of burnt bone. This sample yielded twigs of *Pyrus Aucuparia* with bark.

*Sample B.*—From this I obtained wood of *Pyrus Aria*, some of the branches being of fair size. The great bulk of the material consists of leaves of grasses matted and pressed together. The deposit is almost entirely of a vegetable nature, but the material is too much decomposed to determine its character. Many small wood chips, chiefly birch, are present, and pieces of birch bark.

1 Munro, in *Proceedings of the Society of Antiquaries of Scotland*, vol. xiii.

*Sample C.*—This is a closely-caked mass of vegetable remains composed almost entirely of wheat-chaff. It appears to be the discarded refuse after winnowing and cleaning the grain, and indicates that the cleaning of the grain was carried on at Newstead. Among the chaff occur numerous seeds of *Lychnis Githago*, a troublesome weed of corn fields in some parts of Britain at the present time. Other weed-seeds from this sample are *Stellaria media*, *Cerastium* sp., *Geranium* sp., *Medicago lupulina*, fruits of *Potentilla Tormentilla*, *Rumex Acetosella*, *Polygonum* sp., and the fruits of several grasses.

*Sample D.*—A black deposit with numerous twigs leaves. Leaves of hazel were identified, and several hazel nuts and pieces of hazel-nut shell were found, also catkins of hazel. The rhizome of a fern and the leaf rachis of a fern were identified. Grasses matted together form a large part of the deposit. The twigs and woods identified were hazel and birch.

*Sample E.*—This sample consists of a light-coloured clay with layers of a darker vegetable deposit running through it. Many grains of wheat a little wheat-chaff were found. The sample proved one of the best for weed-seeds. It was carefully washed the vegetable remains separated from the clay sand. The fruits and seeds identified were those of *Picris hieracioides*, *Cnicus arvensis*, *Ranunculus reperis*, *Rariurculus bulbosus*, *Polygonum* sp., *Polygonum aviculare*, *Rumex Acetosa*, *Urtica dioica*, *Chenopodium album*, *Potentilla Tormentilla*, *Lychnis Githago*, *Cerastium* sp., *Lychnis vespertina*, *Arenaria serpyllifolia*, *Stellaria media*, several grasses, and a *Carex*. In addition there were present a number of small pieces of charcoal, some small chips of oak, and a few twigs of birch and hazel. An interesting feature was the presence of the remains of a large number of beetles.

*Sample F.*—A compost of vegetable matter much decomposed. It is made up almost entirely of a moss, probably a species of *Hypnum*. Birch-bark and hazel-bark, a branch of hazel, and hazel-nuts were identified. The material gave fruits of a *Polygonum*, fruits of a *Carex*, and fruits of one or two grasses. Seeds of *Solanum Dulcamara*, fruits of *Urtica dioica*, and fruits of *Juncus effusus* (?) were also identified.

*Sample G.*—A light-coloured clay with a definite layer of twigs all running one way, and for the most part all about  $\frac{1}{4}$  of an inch in diameter. The twigs prove to be hazel and birch one of the latter twigs with a catkin still attached. The clay on washing yielded the following Fruits of *Ranunculus bulbosus*, *Ranunculus repens*, *Potentilla Tormentilla*, seeds of *Lychnis vespertina* or allied species, *Pedicularis palustris*, fruits of *Rumex obtusifolius*, *Rumex sanguineus*, *Polygonum Convolvulus*, *Urtica dioica*, *Scirpus setaceus*, *Scirpus sylvaticus*, *Carex* sp., and several grasses, seeds of *Atriplex* sp., and *Chenopodium* sp.

*Sample H.*—A black earth with nothing sufficiently well preserved to permit of identification. (Pits in fore-ends.)

*Sample I.*—A black vegetable deposit. Chips of oak, twigs of birch, pieces of birch-bark, and a branch of rowan were identified. (Pits in fore-ends.)

*Sample J.*—This consists of masses of small twigs in a thick layer among light-coloured clay. The twigs are bundles of ling (heather) evidently brushwood cut laid on the clay. Among the twigs were found flower-heads, leaves, and fruits of the heather. Other fruits or flower parts identified were those of *Rumex Acetosa*, *Scirpus caespitosus*, *Scirpus sylvaticus*, *Carex* sp., and *Empetrum nigrum*. Leaves of a grass, possibly *Festuca ovina*, were found.

*Sample K.*—A black vegetable deposit consisting almost entirely of moss. A few small pieces of birch-bark were noticed. From this sample came fruits of *Urtica dioica*, *Rubus* sp. (?), *Galeopsis Tetrahit*, *Scirpus sylvaticus*, *Rumex* sp., leaves and fruits of several grasses. (Pits in fore-ends.)

*Sample L.*—A black deposit of vegetable origin. The remains were much decomposed, and nothing of interest sufficiently well preserved to be identified was discovered. (Pits in fore-ends.)

*Sample M.*—Clay soil, with a little dark earth, indicating vegetable remains. This was carefully washed and searched for seeds. Besides small bits of twigs and pieces of wood, fruits or seeds of the following were found *Ranunculus bulbosus*, *Ranunculus repens*, *Sinapis arvensis*, *Stellaria media*, *Stellaria Helostea*, *Potentilla Tormentilla*, *Polygonum sp.*, *Rumex Acetosa*, *Rumex sanguineus*, *Scirpus sylvaticus*, *Urtica dioica*, *Chenopodium album*, and another species of the last genus which was not identified. The sample yielded a few grains of wheat and one or two grains of what I believe to be barley.

*Sample N.*—A small cake of vegetable earth with a well-preserved frond of the common bracken. (Pit IX, beneath east wall of Block XIV.)

*Sample O.*—A clay soil with a dark-coloured earth mixed with it. No vegetable remains of any size. The sample, after careful washing, gave fruits or seeds of the following *Geranium sp.*, *Myosotis sp.*, *Polygonum Fagopyrum*, *Scirpus caespitosus*, *Scirpus setaceus*, *Rumex Acetosa*, *Rumex sp.*, *Carex* (several species), and fruits of several grasses.

*Sample P.*—A clay soil with a fair amount of vegetable earth. Seeds or fruits of the following were obtained after careful washing *Ranunculus sp.*, *Lychnis vespertina*, *Arenaria serpyllifolia*, *Pedicularis palustris*, *Potentilla Tormentilla*, *Rumex sanguineus*, *Rumex sp.*, *Atriplex sp.*, *Chenopodium sp.*, *Urtica dioica*, *Urtica urens*, *Scirpus sylvaticus*, and fruits of several species of *Carex*.

## TABLE II DEFINITE OBJECTS RECEIVED FOR IDENTIFICATION

No. 1. Shaft of hammer from Pit XVI	Rowan ( <i>Pyrus Aucuparia</i> ).
2. Shaft of hoe from Pit XIV	Birch ( <i>Betula alba</i> ).
3. Shaft of gouge from Pit XVI	Rowan ( <i>Pyrus Aucuparia</i> ).
4. Fragment of a spear shaft from Pit XVI	Hazel ( <i>Corylus Avellana</i> ).
5. Shaft of an axe from Pit XVI	Hazel ( <i>Corylus Avellana</i> ).
6. Shaft of a large hammer from Pit XVI	Hazel ( <i>Corylus Avellana</i> ).
7. Handle of a chisel from Pit XVI	Hazel ( <i>Corylus Avellana</i> ).
8. Shaft of a dolabra from Pit XVI	Ash ( <i>Fraxinus excelsior</i> ).
9. Wood from Pit XVI	Ash ( <i>Fraxinus excelsior</i> ).
10. " "	Oak ( <i>Quercus Robur</i> ).
11. Lining of a helmet from Pit XXII	Wool mixed with fine clay.
12. End of a shaft taken from the socket of an arrowhead of iron, from ditch of the early fort	Hazel ( <i>Corylus Avellana</i> ).
13. Basket work made of the stems of	Hair moss ( <i>Polytrichum commune</i> ).
14. Bast twisted as rope from Pit XXIII	(Not identified).

## TABLE III SUMMARY OF PLANT REMAINS IDENTIFIED IN THE SAMPLES OF DEPOSITS FROM THE NEWSTEAD ROMAN STATION

Ranunculaceae.	Resedaceae.
<i>Ranunculus repens</i> —fruits	<i>Reseda lutea</i> ?—seeds.
" <i>bulbosus</i> —fruits.	Caryophylleae.
" sp.—fruits.	<i>Lychnis Githago</i> —seeds.
Cruciferae.	" <i>Vespertina</i> —seeds.
<i>Sinapis arvensis</i> —seeds.	<i>Stellaria Holostea</i> —seeds.

- Stellaria media—seeds.  
 Arenaria serpyllifolia—seeds.  
 Geraniaceae.  
 Geranium molle ?—seeds.  
     "    dissectum ?—seeds.  
 Leguminosae.  
 Medicago lupulina—seeds.  
 Rosaceae.  
 Alchemilla vulgaris—fruits.  
 Potentilla Tormentilla—fruits.  
     "    argentea—fruits.  
 Fragaria vesca ?—fruits.  
 Rubus sp.—fruits.  
 Pyrus Aria—wood.  
 Aucuparia—wood.  
 Umbelliferae.  
 Heracleum Sphondylium ?—stem and leaf base.  
 Compositae.  
 Pieris hieracloides—fruits.  
 Cnicus arvensis—fruits.  
 Ericaceae.  
 Calluna vulgaris—stems, leaves, flowers, fruits.  
 Erica sp.—fruit parts.  
 Oleaceae.  
 Fraxinus excelsior—wood.  
 Boragineae.  
 Myostis sp. i—fruits.  
 Litbospermum sp. ?—fruits.  
 Solanaceae.  
 Solanum Dulcamara—seeds.  
 Scrophularineae.  
 Pedicularis palustris—seeds.  
 Labiatae.  
 Galeopsis Tetrahit—fruits.  
 Chenopodiaceae.  
 Chenopodium album—seeds. sp.—seeds.  
  
 Atriplex sp.—seeds.  
  
 Polygonaceae.  
 Rumex sanguineus—Perianth and fruit parts.  
 Rumex obtusifolius—Perianth parts and fruits.  
     "    Acetosella—fruits.  
     "    Acetosa—fruits.  
 Polygonum aviculare—fruits.  
     "    Convolvulus — Perianth parts and fruits.  
  
 Polygonum Fagopyrum ?—fruits.  
     "    sp.—fruits.  
 Empetraceae.  
 Empetrum nigrum—seeds and fruit wall.  
 Urticaceae.  
 Urtica dioica—fruits.  
     "    urens—fruits.  
 Salicineae.  
 Willow or Poplar—wood.  
 Cupuliferae.  
 Betula alba—catkins, bark, wood.  
 Corylus Avellana—nuts, catkin, bark, wood.  
 Quercus Robur—wood.  
 Alnus glutinosa—wood.  
 Juncaceae.  
 Juncus effusus ?—fruits.  
     "    squammosus ?—fruits.  
 Cyperaceae.  
 Scirpus sylvaticus—fruits.  
     "    caespitosus—fruits.  
     "    setaceus—fruits.  
 Carex (3 species not identified)—fruits.  
 Gramineae.  
 Several grasses, species not identified—fruits.  
 Festuca ovina ?—leaves.  
 Filices.  
 Pteris aquilina—portion of frond.  
 Fern sp.—portion of rhizome.  
 Musci and Hepaticae.  
 Several kinds of Musci and Hepaticae were found, but the species were not identified.  
 One moss was undoubtedly a Hypnum, and Polytrichum commune was used in the making of basket—work.



# **ANIMAL REMAINS**

BY PROFESSOR J. C. EWART, F.R.S.

THE Roman military station at Newstead, Melrose, has yielded a very large number of bones of domestic animals and portions of the skeletons of a number of wild animals. The smaller bones found during the excavations were usually at once forwarded to the Natural History Department of the University of Edinburgh, but the remains of horses, oxen, and other large mammals were inspected from time to time at Newstead, only the bones that required special study being sent to Edinburgh.

The majority of the bones were found in pits, wells, or ditches. From the contents of these pits, wells, and ditches, and especially from the relation of the animal remains to coins, altars, pottery, and other objects, the age of which is approximately known, it may be safely assumed that the majority of the bones unearthed belonged to domestic animals in the possession of the auxiliaries who occupied the Roman fort in the vicinity of the Eildon Hills during the latter part of the first or the middle part of the second century of the present era.

It may be mentioned that nearly all the bones are extremely well preserved. Many of the skulls are so complete that exact measurements can be taken of the face and teeth as well as of the cranium. In Neolithic times the long bones were usually broken up for the sake of the marrow, and sometimes the skull cap was fractured that the brain might be removed, but there is little evidence that either marrow or brains formed part of the diet of the Newstead garrison. Whether horses as well as the domestic oxen, sheep, goats, and pigs were used as food it is impossible to say, but seeing that the majority of the horse skulls examined belong to aged animals, it may perhaps be inferred that the practice of eating horseflesh so common in Europe during the Early Stone age was not followed during the earlier centuries of the Christian era. That horses were used as food in the north of Europe at a later period is made sufficiently evident by the Icelandic sagas.

## **EQUIDAE**

Recent enquiries indicate that in prehistoric times at least four species or races of wild horses inhabited Western Europe.



1. Head of a Prejvalsky stallion: steppe type  
Note long narrow face



2. Iceland pony: forest type  
Note elk-like nose



3. Celtic pony in winter coat: plateau type  
Note 'beard' and taillock

PLATE XCIV. EQUIDAE.

Drawings and carvings by Palaeolithic man taken along with bones and teeth afford ample evidence of the existence in various parts of Europe of a horse with long-pillared molars and a coarse head (Fig. 51), but with fine limbs) *i.e.* a horse allied to if not identical with the wild 'Steppe' horse (*Equus przewalskii*) (Fig. 52 and Plate XCIV., Fig. 1), which still survives in Mongolia.

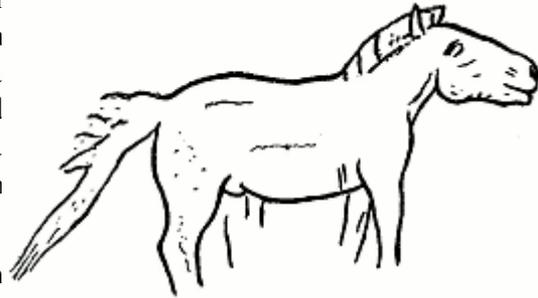


FIG. 51. STONE AGE HORSE: STEPPE TYPE

Teeth and limb bones from French and English Pleistocene deposits point to the existence of a fine-headed race from 12 to 13 hands high, with limbs slender as in the desert Arab and molars characterised by short internal pillars. Some of the drawings in the Combarelles cave (Fig. 53) apparently represent this slender-limbed 'plateau' race which I have named *Equus agilis*. [1]

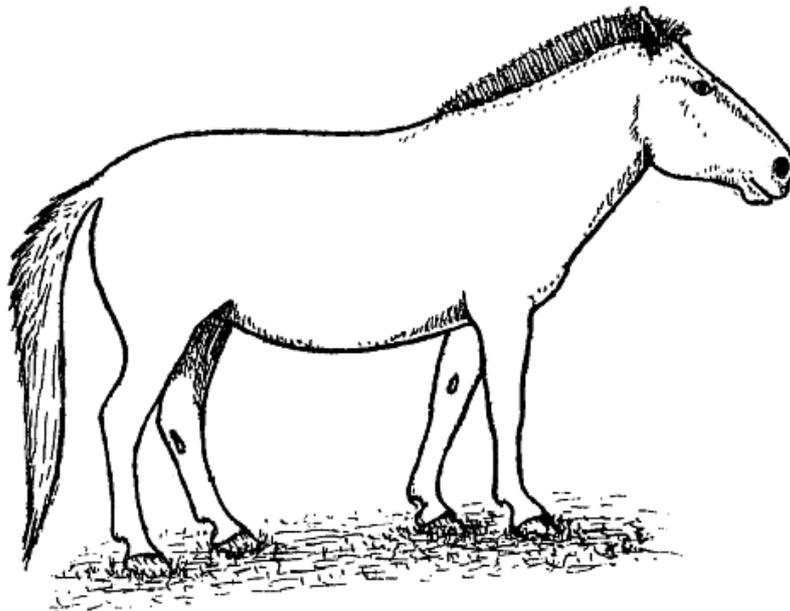


FIG. 52. OUTLINE OF THE STEPPE TYPE  
A Prejvalsky Mare imported from Mongolia. From a photograph

In the 'Elephant Bed' at Brighton and in the vicinity of the large Palaeolithic settlement at Solutré to the north of Lyons, there is evidence of the existence of a long low 'forest' race, probably characterised by a short broad dished face, long-pillared molars, short broad cannon bones, and wide hoofs.

1 *E. agilis* includes a northern ('Celtic') and a southern ('Libyan') variety.

A drawing of a stout elk-nosed horse in the Combarelles cave (Fig. 54) probably represents the 'horse of Solutré,' which is best known as *Equus robustus* (Plate XCIV, Fig. 2).

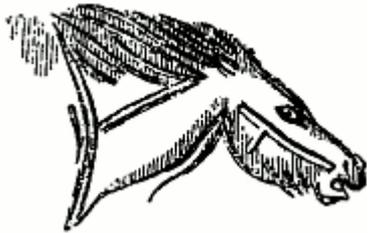


FIG. 53. STONE AGE PONY  
PLATEAU TYPE

The fourth race includes broad-browed horses, with the face long and tapering and bent downwards on the cranium, as in some of the modern thoroughbreds and in certain Kirghiz breeds. This race, characterised by fine limbs and short-pillared teeth, probably represents *Equus sivalensis*, the 15-hands horse, whose remains are found in the Siwalik Hills of India.

An engraving from the cave of La Mouthe (Fig. 55) probably gives us the Palaeolith's conception of the ancient 'Siwalik' race.

Newstead has afforded no evidence of the existence in Scotland in olden times of a horse of the 'Steppe' or Przewalsky type, but it has yielded skulls which might very well have belonged to almost pure members of the 'plateau,' 'forest,' and 'Siwalik' types.

Two of the skulls from Newstead probably belonged to unimproved British native breeds, one of which certainly did not exceed 44 inches in height, while the other



FIG. 54 STONE AGE HORSE FOREST  
TYPE



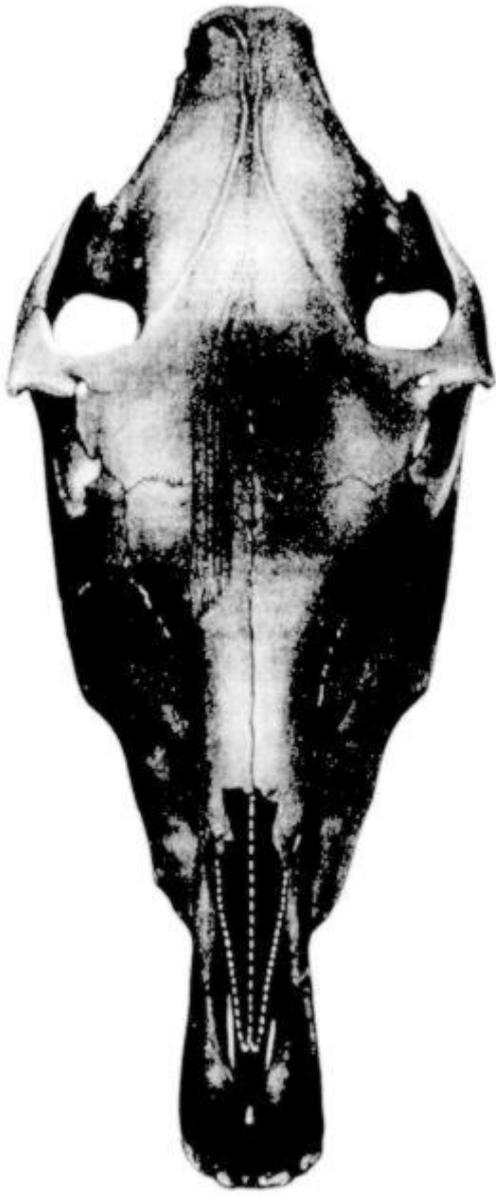
FIG. 55. STONE AGE  
HORSE SIWALIK TYPE (?)

measured between 11 and 12 hands at the withers. The smaller one (Plate XCV, Fig. 1) evidently belonged to a broad-browed 'forest' pony, built on the lines of the strong thick-set modern Shetland ponies; the other is best represented to-day by small slender-limbed Exmoor ponies, and by ponies of the 'Celtic' type (Plate XCIV, Fig. 3) occasionally met with in the North of Iceland.

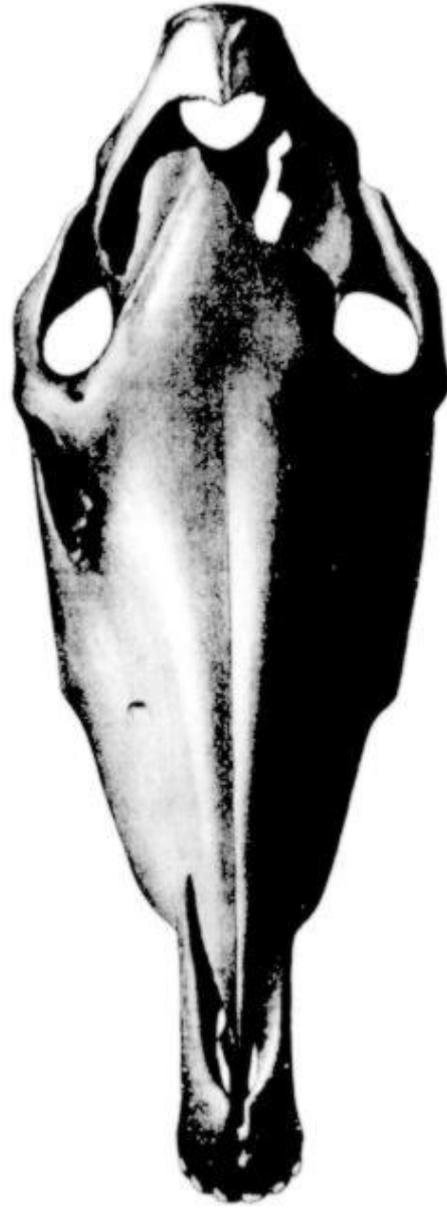
From Caesar we learn that the small horses yoked to the British war-chariots were so active and well trained that they could be checked and turned in a narrow space or pulled up when at full speed on a steep declivity, or made to stand while the charioteers ran out on the pole and stood on the yoke. From what Caesar says of the horses of South Britain and from the statements of Dio Cassius as to the horses of the Caledonians,

#### PLATE XCV. SKULLS OF EQUIDAE.

1. Upper view of skull of coarse-limbed pony of the 'forest' (Solutré) type, from Newstead. Owing to the great width of the face the frontal index is 61; in a broad-browed Shetland pony with a short-dished face the frontal index may be 63; but in the long-faced wild horse of Mongolia it may be only 50.
2. Upper view of a slender-limbed horse of the 'plateau' type, about 12.2 hands high, from the Roman fort at Newstead. Length from occipital crest to alveolar point (*i.e.* point between central incisors, 494 mm; length from line connecting supra-orbital foramina to alveolar point, 338 mm; frontal (greatest) width, 185 mm. Owing to the face being long and narrow, the frontal index ( $185 \times 100 \div 338$ ) is 54, as in high-caste Arabs.



1. Skull Newstead horse: Forest Type



2. Skull Newstead horse: Plateau Type

it may be taken for granted that up to the end of the first century the horses harnessed to the British war-chariots, like the horses of the Sigynnae so graphically described by Herodotus, belonged to the fine-limbed Celtic race or to a blend of the 'Celtic' and 'forest' types.

In addition to 'Celtic' and 'forest' ponies under 12 hands at the withers, there were in Newstead slender-limbed and coarse-limbed ponies between 12 and 13 hands. The skull of a 12.2 hands slender-limbed Newstead pony is represented in Plate XCV., Fig. 2 and Plate XCVI., Fig. 1, and Fig. 56 represents one of the slender metacarpals. From the size of the cranium, the dimensions of the narrow, tapering and only slightly deflected face, and from the slenderness of the limbs, it is evident that this pony was built on the lines of the smaller kinds of modern Arabs. Further, the relatively large cranium indicates that it was probably as intelligent and docile as Arabs are.

It may be here mentioned that the members of the Equidae family differ mainly in the form and relations of the face, in the size of the metacarpals (cannon bones), and in the teeth. In the 'forest' type, e.g., the face is short and dished, and nearly in a line with the cranium (Plate XCVI., Fig. 2), the frontal index is over 60, the first premolar is absent, and the grinding surface of the internal pillar of the last premolar and of the first molar is at least half the length of the crown (Fig. 58), while the length of the metacarpal (Fig. 57) is about 5.5 times the width at the centre of the shaft. In the 'plateau' type, on the other hand, the face is narrow (Plate XCV., Fig. 2) and tapering, and deflected (Plate XCVI., Fig. 1) to form an angle of about 80 with the cranium, the frontal index is 54 to 56, the first premolar is present, and the internal

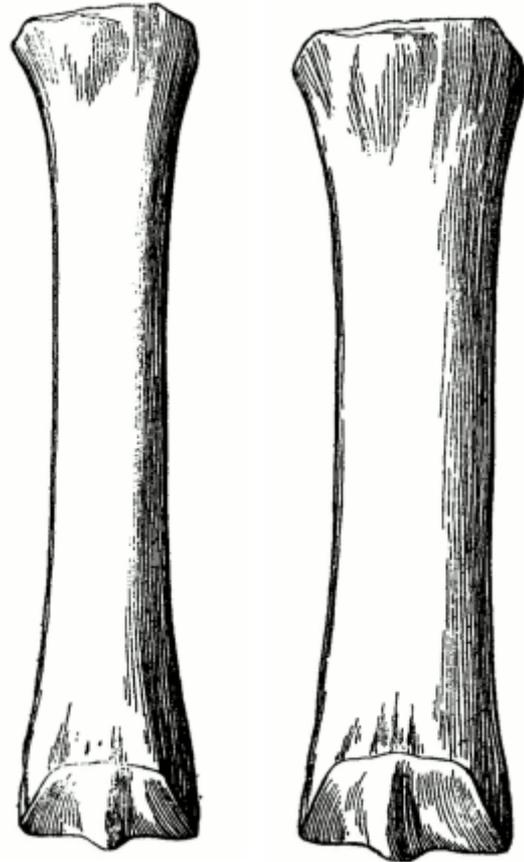


FIG. 56. CANNON BONE: PLATEAU TYPE Metacarpal ( $\frac{1}{2}$  nat. size) of a 12.2 hands slender-limbed horse of the 'plateau' or *F. agilis* type. The total length is 7.5 times the width at middle of shaft.

FIG. 57. CANNON BONE FOREST TYPE Metacarpal ( $\frac{1}{2}$  nat. size) of a 12.3 hands coarse-limbed horse of the 'forest' or *E. robustus* broad type. The length is 5.5 times the width of shaft.

pillar of the last premolar and first molar is only about one-third the length of the crown (Fig. 59), while the length of the metacarpal instead of being 5.5 is 7.5 times the width at the middle of the shaft (Fig. 56).

As it happens, the slender-limbed 12.2 hands Newstead pony, in its molars and metacarpals, agrees with a race which in Pleistocene times ranged from Algiers to the South of England. It is hence possible that the Arab-like 12.2 hands ponies were brought to Scotland by 'Gaulish' cavalry from a district where the native breeds had been improved by foreign horses originally brought from Spain or North Africa, i.e. by horses belonging to Prof. Ridgeway's variety, *Equus caballus libycus*. The chief differences in the skull, teeth, and metacarpals of the 12.2 hands Newstead pony of the 'forest' type and the 12.2 hands slender-limbed pony of the 'Celtic' or 'Libyan' type will be made evident by comparing Figs. 1 and 2 (Pl. XCV.) and Figs. 56 to 59.

Long, low, 12.2 hands ponies, with rounded hind quarters, a heavy mane, a low set-on tail, a short broad dished face, and short stout limbs are still often met with in Iceland. These modern representatives of the Elephant Bed and Solutré variety especially differ from the slender-limbed 'plateau' race in having four ergots and four chestnuts—in typical 'Celtic' and 'Libyan' ponies the hind chestnuts are absent as in asses and zebras, and there are no callosities at the fetlocks.

The slender-limbed 12–13 hands Newstead ponies are especially interesting, because they form a connecting link between modern ponies of the Celtic and Libyan types and the slender-limbed prehistoric races represented by teeth or limb-bones from the Pleistocene deposits of North Africa, Central France, and the South of England, and from Neolithic deposits. In the same way the 12–13 hands coarse-limbed Newstead ponies form a connecting link between the robust, long, low broad-

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FIG. 58. Upper cheek teeth (nat. size) of an Iceland pony of the 'forest' type, with teeth practically identical with those of the Solutré horse (*Equus robustus*). The first premolar is absent; the internal pillar (p) of the third and fourth premolars and the first molar is long; the crown of p.m. 4 is twice the length of its pillar, and the crown of m. 1 less than twice the length of its pillar. Hence p.m. 3, p.m. 4, and m. 1 of the Iceland pony are more specialised than the corresponding teeth in a pony (Fig. 59) of the 'plateau' type.

FIG. 59. Upper cheek teeth (flat. size) of a Newstead pony ('plateau' type), about 12.2 hands high (for skull see Figs. 2, Pl. XCV., and 1, Pl. XCVI.). The two last molars (m. 2 and m. 3) closely resemble the two molars from Oreston, which formed the type of Owen's *Asinus fossilis*; the first molar (m. 1) is slightly more complex than m. 1 from Oreston, and still more complex than a molar from Lake Karar, Algiers; in the fourth premolar (p.m. 4), which resembles p.m. 4 of 'Eric,' a Shetland pony, and p.m. 4 of *Equus sivalensis*. (Fig. 60), the crown is nearly three times the length of its pillar instead of less than twice the length, as in *Equus fossilis* and modern cart-horses. The first premolar is about half the size of p.m. 1 in *Equus sivalensis*.

FIG. 60. Upper cheek teeth (nat. size) of *Equus sivalensis*. The first premolar (p.m. 1) is large and lying in front of pm. 2; the pillar of pm. 4 is shorter than the pillar of m. 2, but larger than the pillar of m. 1. Premolar 4, in having the pillar shorter than m. 2, agrees with the Newstead pony (Fig. 59) and horses of the 'plateau' type, but differs from the Iceland pony (Fig. 58) and horses of the 'forest' and 'steppe' types. Though *Equus sivalensis* is the oldest true horse known, it has more highly specialised teeth than the Oreston and Newstead ponies. After Lydekker. *Palaeontologia Indica*, Ser. x. vol. ii.

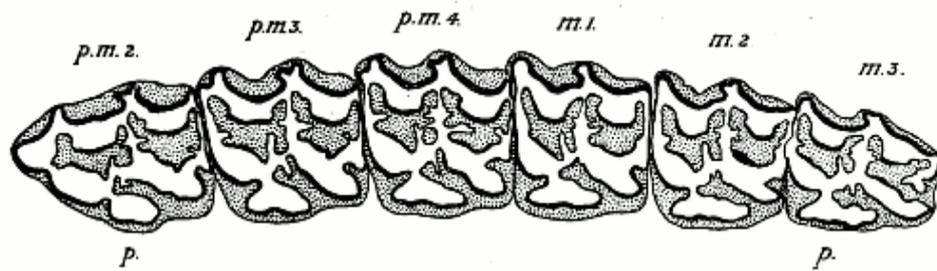


FIG.58. MOLARS. ICELAND PONY: FOREST TYPE

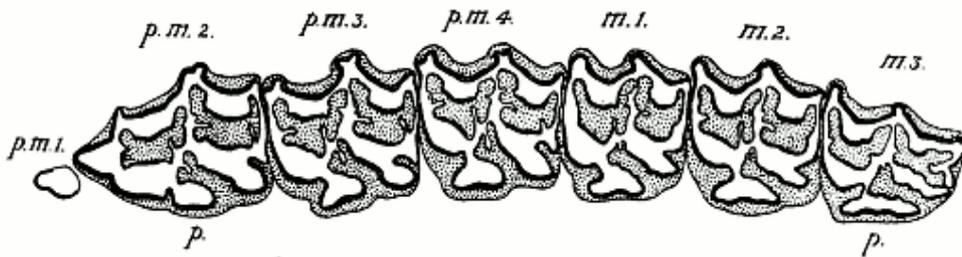


FIG.59. MOLARS. NEWSTEAD HORSE: PLATEAU TYPE

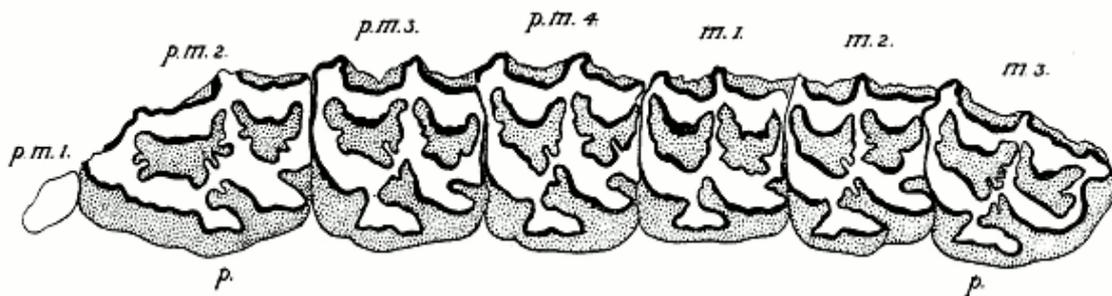


FIG.60. MOLARS OF SWALIK HORSE.  
(p. The first and last internal pillars)

browed modern ponies of the 'forest' type and the small horses represented in the 'Elephant Bed' at Brighton and in the Palaeolithic settlement at Solutré.

In addition to well-bred ponies under 13 hands at the withers, the auxiliaries who held the Border fort during the first century had 14 hands horses as fine in head and limbs as modern high-caste Arabs. The skull of one of these slender-limbed 14 hands horses is almost identical with the skull of an Arab mare (Jerboa, by Maidan out of Jerud) in the British Museum. That they closely agree is especially suggested by the frontal index.

In the 'steppe' or Prejvalsky type the face is so long and narrow that the frontal index<sup>1</sup> may be only 50, while in the 'forest' type (which, like the 'steppe' type, is characterised by long-pillared molars) the face is so short and broad that the frontal index may be over 60. But in a typical member of the 'plateau' type the frontal index is 54. In the Arab mare Jerboa the face has a length of 368 mm. and a width of 205 mm., hence the frontal index is 55.7; in the Newstead 'Arab,' the length of the face is 372 mm. and the width 201 mm., which gives an index of 54. This implies that in the first century, in a 14 hands horse of the 'Libyan' type, the head was as fine as in modern Arabs. It may be added that the fine-limbed 14 hands Newstead horse of the Libyan. type, though smaller, was built on the same lines as the thoroughbred 'Orlando,'<sup>2</sup> but decidedly differed in make from 'Stockwell,'<sup>2</sup> the grandson of the 'fiddle-headed' Echidna. The skulls and limb-bones already referred to show that the garrison of the Newstead Fort had in their possession (1) broad-browed big-boned ponies of the 'forest' or robustus type from 11 to 12.2 hands; (2) slender-limbed ponies of the 'Celtic' variety, of the 'plateau' type) from 11.2 to 12.2 hands, and 14 hands ponies of the 'Libyan' variety of the 'plateau' type built on the lines of the finer kinds of desert Arabs.

A second series of skulls point to the presence in Newstead of horses of the *Equus stenonis* or *Equus sivalensis* type, i.e. of horses with short-pillared molars, and the face forming an angle of from 150 to 180 with the cranium. In the account of the 'Siwalik and Narbudda Equidae,' Lydekker points out (1) that in *Equus sivalensis* 'the grinding surfaces of the anterior "pillars" of the premolars are not longer than those of the later true molars, and are frequently shorter than in the corresponding surface of the first true molar' (Fig. 60); (2) that in *Equus caballus* he had failed to 'discover any instances where the anterior "pillar" is as small as it frequently is in *Equus sivalensis*.'<sup>3</sup> Elsewhere Lydekker states that *Equus stenonis* is also characterised by short-pillared molars. Writing of the Forest Bed and Crag periods, Lydekker says 'In addition to

1 The frontal index is obtained by dividing the width across the orbits by the distance from the centre of a line connecting the supra-orbital foramina and the alveolar point which lies between the bases of the central incisors.

2 The skeleton of 'Orlando' is preserved in the Royal College of Surgeons' Museum, London; that of Stockwell is in the British Museum.

3 *Indian Tertiary and Post-Tertiary Vertebrata*, vol. ii. p. 88. 22, 1882.



1. SIDE VIEW OF SKULL OF 12.2 NEWSTEAD PONY OF  
THE 'PLATEAU' TYPE

The face forms an angle of  $8^{\circ}$  with the cranium



2. SIDE VIEW OF NEWSTEAD HORSE  
SKULL: FOREST (STRAIGHT) TYPE

The face is in a line with the cranium



3. SIDE VIEW OF NEWSTEAD HORSE  
SKULL: SIWALIK (BENT) TYPE

The face forms an angle of  $18^{\circ}$  with the cranium

PLATE XCVI. SKULLS OF EQUIDAE

the Common Horse (*Equus caballus*), there was an extinct species known as Steno's Horse (*Equus stenonis*), and distinguished by the small size of the so-called front inner pillar of the upper molar teeth' (Fig. 61). 'In this respect the species in question was less specialised than the Modern Horse, and makes a step in the direction of the under-mentioned Hipparion.'<sup>1</sup> From these and other statements it is evident that Lydekker believed that the modern horse (*Equus caballus*) (Fig. 58) differed from *Equus sivalensis* of the Indian Pliocene, and from the extinct species *Equus stenonis* of the upper Pliocene and lower Pleistocene of Europe, in having long-pillared upper molars, more especially in having the 'pillar' of the last premolar longer than that of the second molar.



FIG. 61. MOLAR TOOTH (NAT. SIZE) OF STENO'S HORSE (*E. stenonis*), with a short pillar (p).

Hitherto molars with a short 'pillar' from Pliocene and Pleistocene deposits of Europe and North Africa have been regarded as belonging to the extinct species *Equus stenonis*. Further, it has been generally assumed that domestic horses are descended from a variety of *Equus stenonis*, which acquired long-pillared molars.

In 1907 I pointed out that one of the Newstead skulls differs from the skull of a horse of the 'forest' type (i.e. from a typical member of the species *caballus*) in having the face bent downwards on the cranium (Fig. 3) Pl. XCVI.), the premaxillae long and narrow, the first premolar (wolf tooth) large, and the three large premolars and the three molars smaller than in the common horse.<sup>2</sup>

Recently Mr. Lydekker has pointed out that some Arabs have the face bent downwards on the cranium, the premaxillae long, the first premolars large, and the anterior pillar of the upper molars unusually short.<sup>3</sup>

In other words, Lydekker now realises that all the modern breeds are not characterised by long-pillared molars, and says that there is a probability that Barbs, Arabs, and Thoroughbreds are descended from *Equus sivalensis*.

Hence, in considering the modern horses it need no longer be assumed that they are all descended from a variety of *Equus stenonis* characterised by long-pillared molars.

Of the skulls from Newstead with short-pillared molars and face bent downwards on the cranium, the one represented in Plate XCVI., Fig. 3, is the most characteristic. The total length of this skull is 560 mm., and the frontal index is 53.38. Though only 2 mm. shorter than the skulls of the thoroughbreds 'Orlando' and 'Bend Or,' the bent Newstead skull (if one may judge from the dimensions of the metacarpals) belonged to a horse which measured little more than 14 hands at the withers.

While the bent Newstead skull is of nearly the same length as the skull of Orlando,' it differs from 'Orlando's' skull and from the skull of the Arab

<sup>1</sup> Lydekker, *British Mammals*, p. 310, 1895.

<sup>2</sup> Ewart, *Trans. Royal Soc. Edin.* 1907, pp. 565-6.

<sup>3</sup> Lydekker, *Guide to the Equidae in the British Museum*, pp. 19-21, 1907.

'Jerboa' in the relation of the face to the cranium. The palate in the bent Newstead skull (Plate XCVI., Fig. 3)—instead of being in a line with the base of the cranium as in a typical 'forest' horse, or forming with the cranial base an angle of about 80 as in certain Arab and Thoroughbred strains—forms an angle of 18.60 with the cranium. To what extent the face was bent downwards in *Equus sivalensis* it is difficult to say, but, judging by the imperfect skulls hitherto discovered, the deflection was probably between 180 and 200; while in the relation of the face to the cranium the Newstead skull probably closely agrees with *Equus sivalensis*, it very decidedly differs in the size of the cheek teeth. On the other hand, the Newstead horse very closely agrees in its teeth with *Equus stenonis*.

As it happens, the bent Newstead skull is almost identical in its dimensions and its teeth with a skull in the St. Petersburg Museum of a horse from the Kirghiz steppe, in which the face is strongly deflected. It may hence be assumed that the bent Newstead skull belonged to an ancient race allied to *Equus sivalensis* of the Indian Pliocene, and to one or more of the varieties of *Equus stefflonis* widely distributed over Europe at the beginning of the Pleistocene period.

The Newstead horse, with a decided fronto-nasal prominence, is especially interesting, because it forms a connecting link between *Equus sivalensis* and certain strains of the modern English racehorse. In all probability in Echidna, the 'fiddle-headed' grand-dam of 'Stockwell,' the face was strongly deflected on the cranium. In 'Stockwell' the face forms an angle of nearly 140 with the cranium; in his descendant, 'Persimmon, the angle is about 120. In some broad-browed Oriental horses with a long, tapering face the deflection is probably as pronounced as in 'Stockwell,' but in broad-browed Arabs with a short face the deflection may be only 40 or 50, and in narrow-browed Arabs with a nearly straight profile and a fine muzzle it probably rarely exceeds 100. As in 'Stockwell' the face was long and narrow as well as deflected, it may be assumed that this famous racehorse had in part sprung from Oriental ancestors of the 'Siwalik' type and in part from narrow-browed ancestors of the 'plateau' type evolved in North Africa, i.e. in part from Prof. Ridgeway's *Equus caballus libycus*.

In addition to almost perfect skulls belonging to horses which fairly accurately represented 'forest,' 'plateau,' and 'Siwalik' types, Newstead yielded a considerable number of skulls in a more or less perfect state of preservation, which evidently belonged to cross-bred animals. Two of these skulls belonged to broad-browed horses with a decidedly dished but somewhat long face, i.e. to horses which may have been a blend of the 'steppe' and 'forest' varieties. Similar skulls have been recorded from Swiss lake-dwellings, and there is still an ancient race of horses characterised by a broad forehead and a concave profile in the vicinity of Schlettstadt, in Upper Alsace. It is conceivable that members of the ancient race now represented by the Schlettstadt horses, recently described by Dr. Max Helzheimer, were brought to Newstead by German auxiliaries. The majority of the remaining skulls belonged to coarse-headed animals, which may very well have been a blend of the 'Siwalik' and 'steppe' types.

As a rule they were broad-browed like *Equus sivalensis*, but instead of having a marked prominence between the orbits, as in Thoroughbreds of the 'Persimmon' type, they were flat or slightly concave between the orbits, but prominent below the level of the orbits, i.e. they were like many modern Shires and Clydesdales, more or less 'Roman-nosed'; decidedly convex where Arabs and Thoroughbreds are usually concave.

In their molar teeth these coarse-headed, cross-bred animals very closely agree with the wild horse (*Equus przewalskii*) of Mongolia, but in two cases the wolf teeth (first premolars) are as well developed as in *Equus sivalensis*. Though in some cases the skulls of the cross-bred horses are as large as the skull of a well-bred 15 hands horse, they probably as a rule belonged to animals barely 14 hands at the withers.

The largest horse skull found during the excavations has a total length of 582 mm. When the skull of a Thoroughbred measures 582 mm. one may safely assume that it belonged to an animal measuring 16 hands at the withers, but as in a 16-hands horse of the Shire breed the skull may measure 680 mm. one may assume that a cross-bred animal with a skull 582 mm. in length measured under 15 hands at the withers.<sup>1</sup>

It may hence be assumed that while some of the horses belonging to the auxiliaries who garrisoned the Newstead Fort measured nearly 15 hands, the majority were below rather than above 14 hands. In all probability the better bred horses, measuring about 14 hands, belonged to the cavalry and the mounted men (about one in four) attached to the infantry regiments, while the coarse-headed animals were as a rule used for transport. As the Gauls, from the second century onwards, had been improving their horses by means of well-bred stallions imported at great cost from the South of Europe, the majority of the horses belonging to the cavalry and mounted infantry probably came originally from Gaul. The more powerful large-headed animals) on the other hand, probably came from Germany—belonged, in fact, to the 'bad and ugly' native German breeds referred to by Caesar.

The last lot of horse bones received from Newstead included the skull of an ass, which measured about 13 hands at the withers. For some reason or other the ass has never been as popular in Britain as on the Continent. This is evidently not because it was late in reaching Britain, but probably because the inhabitants of these islands—for agricultural purposes as well as for sport and war—preferred from the first a tractable high-spirited courageous animal.

## **BOVIDAE**

### **I. SHEEP AND GOATS**

Very few sheep bones were found at Newstead. Whether this was due to sheep being seldom used as food, or to few bones being preserved, it is impossible to say. The

<sup>1</sup> Frequently in crosses between Arab and Highland ponies the head is decidedly longer than in either of the parents, probably owing to reversion to a large-headed ancestor,

remains received represent two types, one with nearly upright horns, the other with large curved horns. The first apparently represents the race found in the Swiss Lake-dwellings characterised by 'thin tall legs and horns like those of a goat,' *i.e.* the 'turbary' sheep (*Ovis aries palustris*) of Rutimeyer; the second apparently represents the large-horned sheep found in the pile-dwellings of Lake Biemme, *i.e.* Studer's sheep (*Ovis aries studeri*).

Up to about the end of the eighteenth century, the sheep all over the Highlands and Islands of Scotland were, according to Walker,<sup>1</sup> small, of a thin lank shape, with straight horns, an extremely short tail, and of a black, white, brown or deep russet colour, or 'blotched with two or three of these colours.' It is possible that the short-tailed sheep with straight horns common in the Western Islands and Highlands at the beginning of the nineteenth century belonged to the same race as the Newstead variety with goat-like horns.

In Neolithic times, there occurred in various parts of England the 'turbary' sheep (*O. aries palustris*), and Studer's sheep (*O. aries studeri*), and probably also a 'four-horned' sheep. When the 'turbary' race first found its way to Scotland it is impossible to say. Walker says the Caledonians probably acquired their straight-horned breed during the Roman invasion, or from Norway during the ninth century. These sheep may very well have found their way into the Highlands from England during the first or second century, and into the northern and western islands from Norway during later centuries.

The Newstead sheep with curved horns agree in their metacarpal (cannon) bones with *Ovis aries studeri* from the Swiss pile-dwellings and from deposits believed to be of Neolithic age in the Thames valley and other parts of England.

At the end of the eighteenth century a race of 'four-horned' sheep, with a short tail and slender limbs and coarse wool, occurred in the Hebrides (on certain 'mountainous islands'),<sup>2</sup> but there is no record of two-horned sheep of the *O. aries studeri* type for either the Hebrides or the mainland. But short-tailed sheep with large curved horns occurred in Orkney half a century ago, and some of the short-tailed, mooret-coloured sheep still found in Shedand, in their horns as well as their limbs, closely agree with Studer's race.

Of more interest still, the sheep on the small island of Soay, near St. Kilda, are identical in the skull and limb-bones with the large-horned race widely distributed over England and the South of Scotland in Roman times. Hence, we may assume that the Newstead sheep with curved horns occurred half a century ago, in a nearly pure form in Orkney, and are now faithfully represented by the Soay race, and, though in a less pure form, by some of the short-tailed mooret sheep of Shetland.

The chief points of the Soay sheep are brought out by Plate XCVII., Fig. 3. The uninhabited island on which these almost deer-like sheep have lived 'from time immemorial' is only about three miles in circumference, and owing to the difficulty of landing, this 'sheep' island is rarely visited. As alien blood has not reached Soay for over

1 *History of the Hebrides*, vol. ii. pp. 68 and 69.

2 Walker, *loc. cit.* vol. ii. p. 69.



1. FRAGMENT OF SKULL OF POLLED  
OX: GALLOWAY TYPE



2. SKULL OF NEWSTEAD OX  
WITH MESIAL HORN-LIKE  
PROJECTION



3. SOAY SHEEP



4. HEAD OF RESTORED CELTIC  
SHORTHORN

a century, and as the number of the three flocks which inhabit the island is mainly kept down by the white-tailed eagle) the raven, and the black-backed gull, the Soay sheep may be said to have long lived under nearly natural conditions.<sup>1</sup>

Some years ago, General Pitt Rivers arrived at the conclusion that the slender-limbed race of sheep represented in Roman camps and Romano-British villages belonged to the same race as the Soay sheep.<sup>2</sup> Recently, Professor T. H. Bryce pointed out that some of the bones from the Roman forts on the Bar Hill exactly correspond with those of the Soay sheep,<sup>3</sup> and Mr. J. G. Millais, in his work on *The Mammals of Great Britain*, states that the Soay sheep may be the direct descendants of *Ovis aries studeri* of the Swiss Lake-dwellings.

By a comparative study of fossil, subfossil, and recent bones I have arrived at the same conclusion—that the sheep now living on the Island of Soay represent the large-horned race of Roman camps and Romano-British villages and the Swiss Lake-dwellings.

At the present day there are three kinds of true wild sheep, viz.: (1) the Mouflons (Europe and Asia), characterised by curved horns, a small shallow pit below the orbit for a face gland such as occurs in deer, arid by four interdigital glands; (2) the Urials (Asia), characterised by curved horns, four interdigital glands, and a large deep pit below the orbit; and (3) sheep of the Argali type (Asia) and of the Bighorn type (Asia and America), characterised by a face pit and interdigital glands, but especially by spiral horns.

Some naturalists seem to assume that all the domestic sheep are descended from the Mouflon, others derive them from the Urial (*Ovis vignei*) or the Argali (*Ovis ammon*), or from both of these species, but many writers on sheep assert that the domestic breeds are descended from a wild species not only extinct but totally unknown.<sup>4</sup> In all true wild sheep the tail is very short, in the majority of the improved Occidental as well as in some of the ancient Oriental breeds the tail is long—sometimes long enough to reach the ground. Perhaps the long tail has induced some naturalists to assume that domestic breeds cannot have sprung from any of the modern short-tailed wild species.

In the skeleton, horns, and throat fringe the Soay sheep (Plate XCVII., Fig. 3) agrees with the Mouflon, but it differs from both the Asiatic and European varieties of the Mouflon in having during winter a short but thick coat of fine wool. But as there is an undercoat of wool in the Mouflon this difference is one of degree not of kind—it is a modification necessitated by the cold northern environment. The Soay sheep may hence be regarded as a variety of *Ovis orientalis* adapted originally for a moorland life. As it seems to have lived in Neolithic and later times with the Celtic ox and the Celtic pony, it may be familiarly known as the Celtic sheep. A more appropriate name than

1 To the late John T. Mackenzie, long factor to Macleod of Macleod, I was indebted for much information about the Soay sheep. Soay is a Norse word meaning Sheep Island.

2 *Excavations in Cranbourne Chase*, vol. ii., pp. 226 ff.

3 *The Roman Forts on the Bar Hill*, p. 127.

4 See Lydekker, *Wild Oxen, Sheep, and Goats*, 1898.

*Ovis aries studeri* for the large-horned Neolithic sheep would be *Ovis orientalis celticus*. Some of the mooret-coloured short-tailed Shetland sheep in their skull and limbs very closely agree with the Soay race, hence it may be assumed that the Mouflon has contributed to the making of the small semi-wild short-tailed Shetland breed.

Since Neolithic times 'four-horned' sheep (i.e. sheep with from three to eight horns) have existed in Europe. As the purer bred 'four-horned' sheep in their limbs and tail agree with Soay sheep they also may include the Mouflon amongst their ancestors.

That long-tailed breeds are descended from short-tailed ancestors allied to one or more of the living wild species is suggested by the fact that in black-faced herds short-tailed lambs occasionally make their appearance. If the short tail is due to reversion, it is conceivable that some of the breeds with spiral horns are in part descended from ancestors allied to the Argali (*Ovis ammon*). Further inquiries and experiments may even indicate that the long tail of the improved Occidental breeds is a useless inheritance from fat-tailed Oriental ancestors.

Goats were apparently even less common than sheep in the Newstead Fort. The remains found belonged to a race evidently allied to the Ibex (*Capra ibex*), once common on the Swiss Alps.

## II. OXEN

A very large number of bones of oxen were found in the Newstead pits, wells, and ditches. The majority of the bones from the older deposits belong to the Celtic ox (the so-called *Bos taurus longifrons*), but many of the bones belong to cross-bred animals decidedly larger than the Celtic short-horn. The Urus (*Bos taurus primigenius*), once common in Britain, is not represented among the bones from Newstead.

If, as naturalists generally assume, the Urus (Auroch of the Germans) was never domesticated in Britain, and if, as Prof. Hughes believes, the only ox in Britain when the Romans came was the small Celtic short-horn (*Bos taurus longifrons*), it follows that all the modern British breeds of cattle (the Chillingham and other 'wild' cattle included) are descended from domesticated races or breeds brought from the Continent before, during, or after the Roman occupation.

It might be said that as the wild Urus and the Celtic short-horn were contemporaries in Scotland, they may have interbred. There is, however, no evidence of this from Newstead, or, as far as I can ascertain, from any other Roman or Romano-British settlement.

When and where *Bos taurus primigenius* was first tamed, and from which wild races the small Celtic short-horn is descended will probably never be known.

Many of the oxen bones belong to quite young animals which had doubtless served as food; others belonged to heavily built animals probably used for transport. Several of the small skulls have all the characteristics of the Celtic short-horn of Continental

Lake-dwellings, the horn cores curve forwards without either bending downwards or upwards, and the frontal region is long and relatively flat. As the cannon bones from Newstead are shorter and finer than those from Schlossberg and certain other Neolithic settlements on the Continent, the Scottish variety of the Celtic ox was probably unusually small.

At Newstead, as at Bar Hill, there were polled cattle. One of the Newstead skulls without horn cores might have belonged to a small race allied to the modern Galloway breed (Plate XCVII., Fig. 1); in another the 'intercornual' ridge projects upwards and forwards to form a mesial process (Plate XCVII., Fig. 2). As the intercornual ridge projects slightly upwards and forwards in certain Celtic short-horn skulls, 'Bos longifrons' may have in part descended from an Oriental race characterised by a long forward projecting intercornual process.

Now that much attention is being directed to the coat colour of cattle, it may not be out of place to ask, 'Of what colour was the Celtic short-horn—the native breed with which we must start in all our speculations as to the origin and development of British oxen?' The small ox of the Lake-dwellings has been described by some as of a grey or brown colour, by others as black, red, or brindled. In all probability the colour of the Celtic ox varied partly owing to artificial and partly to natural selection. In Scotland the coat was probably as a rule dark brown or black relieved by a broad reddish dorsal band.

Up to the end of the seventeenth century the cattle in the 'Celtic fringe' were usually black or dark brown, and they continued to be 'black' in the Western Islands and Highlands of Scotland up to the end of the eighteenth century. Prof. Walker, in his *History of the Hebrides*, frequently refers to the black cattle—he mentions, e.g., that in 1764 a farmer in Skye had 160 head of black cattle. During the seventeenth century very little provision was made for feeding cattle during winter, with the result that in severe winters many perished. It is stated that during the unusually hard winter of 1673 most of the cattle in England perished.

In Scotland during the eighteenth century the cattle in the Highlands were allowed to lie abroad all the year round, and had little or nothing to eat during winter and spring but what they could pick up in the fields. One result of this treatment was that half or even more sometimes perished; another was that many of the cows from poverty and weakness only bred once in two years; moreover, calves dropped before March apparently often succumbed for want of nourishment. It may be safely assumed that in the struggle for existence in the Highlands and Islands during the eighteenth century, the large breeds introduced from the Continent by the Romans, Saxons, Danes, and others would be first eliminated, and that as a rule only the small, hardy, native, indigenous Celtic short-horn would be left. Further support of the view that the Celtic short-horn was dark brown and black we have in the appearance now and again of a small brown or black calf; especially in Welsh and Highland herds—an obvious reversion to a once widely distributed native race.

By way of throwing light on the colour of the ancient British cattle, I have made

a number of crossing experiments with Shetland, Jersey, and other breeds, with a view to giving the ancient black race a chance of reappearing. I selected Shetland and Jersey cattle) because they appeared to differ but little from certain modern Swiss breeds believed to be descended from the small ox of the Lake-dwellers. By crossing a mouse-dun Shetland heifer having up-turned horns with a fawn-coloured Jersey bull, a red calf was obtained, which eventually grew into a dark-brown cow, decidedly larger than either of its parents. A second mouse-dun Shetland cow was put to a Jersey bull of a dark-fawn colour. The result was a red bull calf, which also eventually reached a good size, and assumed a dark-brown colour. In course of time the two crosses were interbred. I expected that the result of this union would be a calf that would eventually, in make and colour, agree with the small mouse-dun Shetland ancestors, or with the small fawn-coloured Jersey ancestors, or take after the large mulberry coloured cross-bred parents. As a matter of fact, the calf; red to start with, developed into a dark-brown cow, decidedly smaller than either of the parents or grand-parents.

This second cross has horns of the Celtic short-horn type (Plate XCVII., Fig. 4) and a broad, reddish dorsal band. In this small cow (she only measures 11.2 hands at the withers) we have probably a fairly accurate restoration of the Celtic ox of the first century. This 'restored' Celtic short-horn has produced two red calves to a red short-horn bull. One of the calves died when only a few days old; the other, now a yearling, is of a black brown colour like the dam.

The fact that all the cross-bred calves were red at birth suggests that our domestic cattle included amongst their ancestors a red variety, allied perhaps to one of the modern Oriental races.

Some of the skulls from Newstead belonged to animals very decidedly larger than the Celtic ox. Judging by the horn cores, some of the large skulls probably belonged to the Chillingham or Chartley type, while others probably belonged to crosses between native and imported cattle.

In addition to equine bones and bones of oxen, sheep, goats and dogs, the remains of the following animals were found during the excavations of the Roman Fort at Newstead, viz.

Pig<sup>1</sup> (*Sus scrofa*).

Elk<sup>2</sup> (*Alces machlis*).

Red Deer<sup>3</sup> (*Cervus elaphus*).

Roe Deer (*Capreolus caprea*).

Fox (*Canis vulpes*).

Badger<sup>4</sup> (*Meles taxus*).

- 1 Some of the pig bones belong to domestic, some to wild animals-three small pigs found together may have been captured during a hunting expedition.
- 2 As remains of elk have been found in four of the Border counties, and also at several Romano-British villages in England, it is not surprising that *Alces* is included in the Newstead list.
- 3 Some of the red deer antlers are decidedly larger than the antlers of the modern stags.
- 4 The remains of the badger consist of a nearly complete skull, the scapulae and innominate bones, ribs and limb-bones, of a nearly mature animal.

Hare<sup>1</sup> (*Lepus* sp. ?).

Water Vole (*Arvicola amphibius*).

Duck (*Anas boschas*).

Crane<sup>2</sup> (*Grus communis*).

Raven (*Corvus corax*).

Fowl.<sup>3</sup>

I am indebted to Mr. Pycraft, of the British Museum; Mr. Eagle Clarke, of the Royal Scottish Museum; and Dr. Ramsay H. Traquair, F.R.S., for assistance in identifying some of the bones. I am also indebted to the Council of the Royal Society of Edinburgh for permission to reproduce Figs. 58, 59 and 60; Plate XCV, Figs. 1 and 2; and Plate XCVI., Fig. 1.

- 1 The hare is represented by a shoulder blade-whether it belonged to the variable or the brown hare has not been determined.
- 2 The crane was still breeding in East Anglia at the end of the sixteenth century.
- 3 The domestic fowl is represented by a metatarsal armed with a large spur-perhaps the metatarsal belonged to a lighting cock.

# THE SKULLS OF THE CANIDAE

BY R. G. LINTON, ANATOMY DEPARTMENT,

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THE skulls of the Canidae from the Roman military camps at Melrose and Barhill are thirteen in number. One is of a fox; the rest are skulls of the dog. The latter may be said to represent five varieties or breeds of the domestic dog. No wolves' skulls were found. For purposes of description, the dogs' skulls have been arranged in the following groups:

*Group A* contains five skulls. They bear a considerable likeness to the skull of a cross between a bull-terrier and a greyhound; and with the skull of the average Airedale terrier they agree in many points, but differ from it in having the sagittal crest better developed. The crest though well formed is not high, so that the temporalis muscle could not have been excessive. The teeth are large and, as is the case in most of the skulls, are worn down to an extent such as is rarely, if ever) seen in the modern domestic dog. At the same time the cranial sutures are quite distinct, so that the skulls could not have belonged to dogs of any very great age. The same peculiarity is to be noticed in most of the skulls under consideration.

Two skulls have been isolated to form *Group B*, of which one only is fully developed. The other is that of a young dog, probably under twelve months old. That there is a marked distinction between these two skulls and those of the former group is quite evident. The total length of the skull is considerably less. The stephanic index in both young and old skulls is fairly great, indicating a deficiency in the growth of the temporalis muscle. In this respect the skulls are not unlike those of the spaniel, fox-terrier, Scotch and Irish terriers of to-day. The breadth of the cranium proportionate to its length is greater than in the skulls of group A.

*Group C* contains two skulls which are considerably larger than any of the others. Unfortunately, one of them is so broken as to be of little value, since it is impossible to obtain satisfactory or accurate measurements. The other, practically intact, is somewhat similar in form to the skulls of group A, but is built on a larger scale. The roof of the cranium, moreover, has a greater curvature. Contrasted with skulls of modern domestic dogs it differs probably least from the retriever 5; but the face is somewhat broader, actually and relatively to its length. It is also broader across the incisive or premaxillary bones.

In *Group D* are two skulls characterised by their breadth of face, a greater development of the sagittal crest and a more massive structure generally. It is a matter of no difficulty to distinguish these two skulls from the others. From the prominence of the sagittal crest the skulls must have belonged to animals which were possessed of considerable muscular power of the jaws. The skull of the modern bull-terrier is very similar in form and size.

*Group E* is represented by only a portion of one skull; the right zygoma and the anterior part of the face have unfortunately been broken away. This skull is placed by itself because, though it has reached its full state of development, it is peculiarly small when compared with the others of the collection. Compared with skulls of the present-day domestic dog, its place is found near the fox-terrier or the English black-and-tan terrier. The cranium is characterised by a high degree of antero-posterior curvature. The skull is evidently that of a member of a small breed of dog and one which was possessed of a short, sharp and narrow face, not unlike that of a 'badly-bred' fox-terrier.

# HUMAN BONES

BY PROFESSOR T. H. BRYCE, M.D.

THE material for this short report on human remains found at Newstead Roman Camp consists of a few skulls and a nearly complete skeleton recovered during the recent excavations, and a skull preserved in the National Museum of Antiquities, Edinburgh, along with other relics discovered during the formation of the North British Railway by Dr. J. A. Smith in 1846.

The bones are not the product of a regular cemetery, but represent casual interments, which in some cases are not necessarily of an age coeval with the camp at any period of its occupation. Some were found in refuse pits, and certainly date from Roman times; others, however, were found in one or other of the ditches and may belong to a later period.

SKULL No. I., found by Dr. Smith, is a very well-preserved specimen. It is the skull of a male about middle life. The processes and muscular ridges are not strongly marked, and the dimensions are moderate. In its proportions, it approaches the brachycephalic type, the cephalic index being 80, and the length-height index falls below the length-breadth index) that is the breadth is relatively to the length greater than the height. In the norma verticalis the shape of the outline is a short oval, and the zygomatic arches are not seen; the occiput is rounded but not prominent. The glabella and supraorbital ridges are faintly marked; the vault arches gradually and regularly to the bregma; the vertex is flat; the posterior slope is steep but not vertical, and ends in a gently rounded occipital protuberance.

The face is low and relatively broad; there is no alveolar prognathism, and the jaws are vertical; the mental protuberance is well pronounced, and the angle of the mandible is not everted. The dentition is complete; the crowns of the upper molars are slightly worn, but the lower molars are markedly ground.

SKULL No. II. was found in Pit No. XXIII. It is complete save for the lower jaw, and has special interest in having an injury which was possibly inflicted during the life of the individual, and, if so, must have been his death blow. It is the skull of an adult male about middle life. It is rugged and angular, the glabella and supraorbital ridges are protuberant, the glabella being specially so and overhanging considerably the

TABLE OF MEASUREMENTS

	No. OF SPECIMEN AND SEX.			
	No. I. M.	No. II. M.	No. VI. F.	No. IX. F.
Circumference,	515	—	—	480
Glabello-occipital length,	182	196	181	169
Ophryo-occipital length,	181	190	—	167
Minimum frontal width,	102.5	99	—	90
Maximum	120	120	—	108
Bi-parietal width,	146	144	143	135
Asterionic width,	111	117.5	—	100
<i>Cephalic index,</i>	80	74.5	79	79.8
Basi-bregmatic height,	133	141	—	126
<i>Height index,</i>	73	71.9	—	74.6
Basi-nasal length,	100	105	—	93
Basi-alveolar length,	95	103	—	94
<i>Gnathic index,</i>	95	98	—	101
Alveolo-nasal height,	60	68	—	62
Bizygomatic width,	135	122	—	120
<i>Upper facial index,</i>	44.5	55	—	51.6
Naso-mental height,	114	—	—	105
Bizygomatic width,	135	—	—	120
<i>Complete facial index,</i>	83.6	—	—	87.5
Nasal height,	50	48	—	44
Nasal width,	26	22	—	23
<i>Nasal index,</i>	52	45.9	—	52.2
Orbital height,	30	30	—	35
Orbital width,	38	39.5	—	36
<i>Orbital index,</i>	92	78.5	—	83
Palatal length,	—	55	—	49
Palatal width,	—	62	—	55
<i>Palatal index,</i>	—	—	—	112.2

deeply sunk fronto-nasal suture. The outline in the norma verticalis is a long oval, or rather ovoid, the parietal width distinctly exceeding the frontal. The proportions are dolichocephalic, the cephalic index being 74.5. The height index is 71.9, distinctly less than the length-breadth index. The arch of the vault rises from a distinct hollow above the prominent ridge formed by the supraorbital ridges and glabella, in a flat curve to the vertex, which is flat with a slight sagittal crest; the posterior slope is steeper and fuller than the anterior, and runs down to a prominent rounded occiput. The sides of the skull slope inwards below the parietal eminences, so that it is a so-called ill-filled skull. The lambdoidal suture is very complex, showing several Wormian bones on each side

just in front of the lambda the sagittal suture ends in a 30 mm. broad suture, in the posterior part of which there is a Wormian bone.

The glabella as mentioned above is very prominent and overhangs a deeply depressed fronto-nasal suture. The face is high and narrow; the orbits are very square, and the nasal aperture is narrow. There is a certain amount of alveolar projection.

As has been said, the skull shows signs of an injury possibly inflicted during life. On the frontal bone are two cuts, one on each side over the orbits and nearly parallel with one another. The cut on the left is shallow, and measures 3.5 cm. long; its inner or mesial lip is straight and even, but the outer is irregular owing to the breaking away of the outer table of the bone. The right incision is 8 cm. long and deeper than the left, the bone being fissured right through along the line of the cut. It begins 4 cm. above the centre of the right orbit and runs backwards in a slightly oblique direction to end on the parietal bone 14 mm. from the middle line. The mesial lip of the fissure is quite straight and sharp, but the outer is uneven due to the chipping away of the outer table. The border produced by the breaking away of the outer table is broader at the middle of the cut and tapers to a point at each end. This large cut very possibly represents a wound inflicted before death by a sharp weapon such as a battle-axe, the outer uneven border of the incision having been produced by the edge of the weapon turning outwards as the blow was struck, and chipping off the outer table of the bone, along the outer, which is also the lower, border of the cut.

SKULL No. III., from the outer ditch at the south-west corner of the early fort, is represented by a fragment consisting of the frontal bone and upper part of the face of an adult male.

The glabella and supraorbital ridges are fairly prominent. The palate is short and wide. The teeth of the upper jaw have been specially large and strong, judging by the size of the alveoli and of the 1st and 2nd molars which are present.

SKULL No. IV., from the outlet of the drain at the south-west corner of the enlarged fort, is that of a child about 12 years of age. As the face and mandible are absent, the exact age is not determinable. The specimen does not possess any features of special interest.

SKULL No. V., from the Bath buildings, is represented only by the parietal bones and tabular part of the occipital bone, i.e. the back part of the vault. The fragment has belonged to a skull of dolichocephalic proportions, and is specially remarkable in having a very prominent and bulging occiput. The interparietal part of the occipital bone forms a bulbous projection between the two parietals, but the globular enlargement involves also the hinder parts of the parietals, as if a tight cord had been drawn round the skull in front of the lambdoidal sutures. The lambdoidal suture is very complex, including a number of Wormian bones. Internally the left occipital (cerebral) fossa is deeper than the right, and there are slight recesses corresponding to the upper ends of the lambdoidal sutures.

SKULL No. VI., which came from the drain at the south-west corner of the later fort, is represented by a broken calvaria, the face and base being absent. The shape and curve of the frontal bone, and the thinness of the orbital margin, which is preserved on one side, suggest that it is the skull of a woman of adult age.

The outline in the norma verticalis is broadly ovoid, the parietal exceeding the frontal width. The breadth of the skull and the steepness of the curve of the vault behind suggest that it had proportions approaching the brachycephalic type of skull.

VII. In Pit No. XVI of the South Annexe, two broken jaw bones were found. One of them is certainly male, the other female. The dentition is complete in both jaws, and the teeth are good, being little worn and showing no signs of caries.

VIII. In the ditch of the early fort a fragment of the skull of a very young infant was discovered; also a lower jaw in which the wisdom teeth have not erupted) and belonging to a child between 14 and 18 years of age.

IX. SKELETON OF DWARFISH FEMALE. In Pit XVII were recovered the bones of a female of diminutive stature. The skeleton was complete save for certain of the cervical vertebrae, the sternum, and the bones of the hands and feet. The long bones are very ill developed and slender, but otherwise normal; there is no sign of rickets or other deformity; all the epiphyses are united, showing that growth was complete, but the lines where the chief or main epiphyses had joined are still visible. The first and second pieces of the sacrum are not fully joined, and the crests of the ilia remain still partly separated. The age of the individual must therefore have been, when death occurred, from 22 to 23 years. The wisdom teeth had erupted in both jaws, and there is a distinct amount of wearing of the crowns of the molars.

The characters of the pelvis when articulated leave no doubt as to the sex of the individual.

The skeleton has now been articulated, and stands between 4 feet 6 and 4 feet 7 high, a figure closely approximating to the stature calculated from the length of the leg bones, viz. 4 feet 6 or 4 feet 7 inches according to the formula used.

The measurements of the different long bones are as follows:

Clavicle	125 mm.		
		Maximum.	Oblique.
Humerus	{ Right	277 mm.	271 mm.
	{ Left	271 mm.	262 mm.
Radius	{ Right	203 mm.	
	{ Left	200 mm.	
Ulna	{ Right	224 mm.	
	{ Left	223 mm.	
Femur	{ Right	382 mm.	376 mm.
	{ Left	379mm.	373mm.
Tibia	{ Right	305 mm.	
	{ Left	301 mm.	
Fibula	{ Right	301 mm.	
	{ Left	298 mm.	

The measurements of the pelvis are as follows:

Conjugate diameter	99 mm.
Transverse "	109 "
Intercristal breadth	222 "
Distance between anterior iliac spaces	185 "

The skull is quite entire; it is of small size and shows certain evidences of immaturity, though the occipital has completely fused with the sphenoid bone. In the *norma verticalis* the outline is ovoid, the parietal exceeding the frontal width, and the zygomatic arches are seen. The proportions of the length to the breadth approach to brachycephaly, the cephalic index being 79.8. The occiput does not project, but there is distinct asymmetry of the occipital bone, the left side being more prominent than the right. The skull is ill filled, the outline in the *norma occipitalis* being markedly pentagonal; it is flattened in a vertical direction; the height index is 74.6, markedly less than the cephalic index.

The glabella is flat, the supraorbital ridges are very slight; the frontal eminences are not prominent, nor is the lower part of the frontal vertical, the bone arching evenly and gradually to the bregma. The under part of the occipital is particularly flat; it rises obliquely from the foramen magnum to the occipital protuberance, giving a remarkably ill-developed appearance to the hinder part of the skull.

The face is somewhat square; there is a distinct amount of forward projection of the alveolar edge of the upper jaw, giving a certain degree of alveolar prognathism the basi-alveolar length is 94, while the basi-nasal length is 93, bringing the gnathic index above 100. The nasal aperture is relatively broad, and the orbits are rounded.

Beyond the technical description of the various skulls, there is little to be said regarding the human remains found in or round the fort.

There is great variety in the cranial characters of the several specimens, and no ethnological data emerge from an examination of the collection. It is not possible to say whether the individuals were strangers or natives, nor to identify the races to which they belonged. It is curious that such a large proportion of the persons buried in this casual way were still in early life.

The case of the dwarfish girl excites more interest. The circumstances in which the skeleton was found are remarkable. The body had been thrown into a refuse pit, and there lay under the carcasses of as many as nine horses. What part did this tiny person play in the fort, and why did her remains receive such scant respect?

Although the stature is very low, it is perhaps hardly below, for a female, the lowest possible limit in a race of average stature, and there is no reason to conclude that this individual represented the pigmy race described by Kollmann. It is more reasonable to conclude that the low stature is pathological, and due to a premature union of the epiphyses.

# THE COINS

BY GEORGE MACDONALD, M.A., LL.D.

THE Coins recovered during the recent excavations at Newstead numbered 249 in all, 98 being of silver and 151 of brass or copper. While the few that came from the bottom of pits or of ditches were unusually well preserved, the great majority of the rest were in such poor condition that the task of identification was often difficult, albeit it was materially lightened by the never-failing help and patience of the Medal Room staff in the British Museum. Ultimately only 15 pieces—1 of silver and the others of brass or copper—had to be definitely set aside as hopeless. The remaining 234 constitute a series sufficiently extensive to deserve careful analysis. Besides these, the following lists include 27 specimens—5 of gold, 16 of silver, and 5 of brass or copper—authentically recorded as having been picked up or ploughed up upon the site, chiefly in the course of the nineteenth century; they are distinguished by an asterisk, and it must be understood that they are described at second-hand. Notices of other finds are too vague to be of value for statistical purposes.

Normally, the contents of a hoard are important mainly as indicating the character of the money current in a particular district at the time when they were withdrawn from circulation, and so as throwing light on the chronology of issues of doubtful date. The significance of a series like the present is entirely different. Properly interpreted, it may help in determining the limits of the period or periods during which the spot with which it is associated was in Roman occupation. As the canons to be applied to each of the various metals are not necessarily the same, it is desirable that gold, silver, and brass or copper should be catalogued separately. We shall begin with the gold.

## AUREI

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>NERO</b>			
<b>UNDATED</b>			
1*	NERO CAESAR AVGVSTVS Head l. laureate.	IVPPITER CVSTOS Jupiter seated l., holding thunderbolt and sceptre. Cohen <sup>2</sup> i. p. 287, 118.	Found in 1862: <i>Proc. Soc. Ant. Scot.</i> V. p. 108.

NO.	OBVERSE.	REVERSE.	REMARKS.
2*	Undescribed.	Undescribed.	<i>Proc. Soc. Ant. Scot.</i> i. p. 34.
<b>TITUS</b>			
<b>UNDATED</b>			
3*	T CAESAR VESPASIANVS Head l. laureate.	ANNONA AVG Abundantia seated l., with r. hand raised. Cohen <sup>2</sup> i. p. 430, 16.	Ploughed up in the Red- abbeystead (=O.S. No. 605) in 1792: <i>Proc. Soc. Ant. Scot.</i> i. p. 34. Head r. laureate.
<b>TRAJAN</b>			
<b>UNDATED</b>			
4*	Undescribed.	Undescribed.	<i>Proc. Soc. Ant. Scot.</i> i. p. 34.
<b>ANTONINUS PIUS</b>			
<b>TRIB. POT. xv: 152 A.D.</b>			
5*	ANTONINVS AVG PIVS PP TR P XV	COS IIII Emperor standing l., with globe Cohen <sup>2</sup> ii. p. 300, 305.	'Very fine preservation': <i>Proc. Soc. Ant. Scot.</i> i. p. 35.

The whole number of these gold pieces is too small to provide a basis for conclusions of moment. The one inference that can be drawn is far from being new: they show that Newstead was held by the Romans down to at least A.D. 152. The evidence of the silver is more interesting. But, before it is examined in detail, there are certain preliminary points that ought to be made clear. The oldest denarii were minted in the second century B.C. Obviously such a date is quite unsuitable as a *terminus a quo*. The presence of these pieces is explained by the fact that, owing apparently to its superior quality, Republican silver continued to circulate in the frontier provinces for more than a century after the establishment of the empire. It seems to have been in every-day use at all events as late as the Flavian era, although there is reason to believe that it vanished soon afterwards. Its appearance at Newstead, therefore, does no more than strengthen the testimony in favour of an Agricolan occupation. This prolonged defiance of Gresham's Law is difficult to account for, unless the good money was habitually accepted at a slight premium. The case of the legionary denarii of Mark Antony is different. They were so heavily alloyed that the deterioration which set in under Nero had to run its course for well over a hundred years before the ordinary imperial pieces touched the same depth of degradation. Their occurrence in hoards shows that they were still current towards the end of the second century A.D.; in the interval it had not been worth the while of any government to call them in. The indications as to the *terminus ad quem* are entitled to a larger measure of confidence. Denarii, indeed, are specially valuable in this respect. While money of all kinds undoubtedly took a little time to make

its way to the outskirts of the empire, the finds at Haltern and at Hofheim prove that silver travelled quicker than brass or copper.

## DENARII

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>REPUBLICAN PERIOD</b>			
<b>SECOND CENTURY B.C.</b>			
6	Head of Roma r.	Victory in biga r.	Found in the Praetentura.
<b>C. ABURIUS GEMINUS: 124-103 B.C.</b>			
7	GEM Head of Roma r.	ROMA C ABVRI Mars standing in quadriga galloping r.	Found in the Baths, 5' below surface, in drain running N.W.
<b>T. QUINCTIUS FLAMININUS: 124-103 B.C.</b>			
8	Head of Roma r.; behind, a flamen's Cap.	ROMA Castor and Pollux, mounted, galloping r.; beneath, round shield between T and Q.	Found 4' below surface, in cutting trench across area of Barracks, E. side.
<b>M. VOLTEIUS M.F.: 78 B.C.</b>			
9	Head of Apollo r. laureate.	S·C D·T M·VOLTEI·M·F Tripod-lebes, with serpent.	Found in filling in ditch of early fort, E. side.
<b>MANIUS CORDIUS RUFUS: 46 B.C.</b>			
10	RVFVS IIIIVIR Heads of Castor and Pollux r., with stars.	NV CORDIVS Venus Verticordia l., with scales and sceptre Cupid on shoulder.	Found in bottom of Pit LXV (River-bank Field O.S. No.610).
<b>P. CLODIUS TURRINUS: 43 B.C.</b>			
11	Head of Apollo r. laureate; behind, lyre.	P·CLODIVS M·F Diana Lucifera, standing to front, holding long torches.	Found in outer ditch of early fort, W. front, 8' down.
<b>C. VIBIUS VARUS: 38 B.C.</b>			
12	Head of Bacchus r., crowned with ivy and bunches of grapes.	C VIBIVS VARVS Panther l., with forefeet planted on Bacchic altar, on which rest a mask and a thyrsus.	Found in filling in the gateway in the reducing wall.
<b>DOUBTFUL DATE.</b>			
13*	Undescribed.	Undescribed.	<i>Proc. Soc. Ant. Scot.</i> i. p.34.
14*	"	"	" "

1 See Dragendorff in *Bonner Jahrbücher*, cxiii. p. 240.

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>M. ANTONIUS: 32–31 B.C.</b>			
15	ANT·AVG III·VIR·R·P·C Galley r.	LEG V... Military eagle, between signa.	Found beneath foundation of ambulatory of Principia, lowest level.
16	Similar.	Similar, with LEG VI...	Found in Barracks of Praetentura.
17	Similar.	Similar, with LEG XIII (?)	Found in the 'Exercir-Halle.'
18	Similar.	Similar, with LEG XX...	Found in the Praetentura, 2' or 3' below surface.
19	Similar.	Similar; only LEG visible.	Found in the Well Meadow (= O.S. No.608); Retentura.
20*	Similar.	Similar.	<i>Proc. Soc. Ant. Scot.</i> i. p.34
21	Similar.	Worn smooth.	Found in the Well Meadow (= O.S. No. 608), in trench cut to find N. end of Barracks, S. of road leading W.
22	Similar.	Similar.	Found in the Praetentura.
<b>AUGUSTUS CIRCA 2 B.C.</b>			
23	CAESAR AVGVSTVS DIVE F PATER PATRIAE Head r. laureate.	C L CAESARES AVGVSTI F COS DESIG PRINC IVVENT Gaius and Lucius, standing to front, each with spear and shield above, simpulum and augur's staff. Cohen <sup>2</sup> i. p. 69, 42.	Found in clay of rampart, above ditch of early fort.
<b>TIBERIUS CIRCA 15 A.D.</b>			
24	TI CAESAR DIVI AVG F AVGVSTVS Head r. laureate.	PONTIF MAXIM Livia seated r., with sceptre and flower. Cohen <sup>2</sup> i. p. 191, 16.	Found, adhering to 'first brass' of Titus, in N. half of Block XVIII.
<b>NERO UNDATED</b>			
25	IMP NERO CAESAR AVG P P Head r. laureate.	IVPPITER CVSTOS Jupiter seated l., with thunderbolt and sceptre. Cohen <sup>2</sup> i. p.288, 123.	Found in ditch of early fort, S. side.

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>GALBA: 68-9</b>			
26	IMP SER GALBA AVG Head r bare.	SPQR OB C S Wreath of oak. Cohen <sup>1</sup> 1. p. 226, 81; not in Cohen <sup>2</sup> .	Found in River-bank Field (= O.S. No. 610).
27	IMP SER GALBA Head r laureate.	VICTORIA Victory r., writing on shield. Cohen <sup>2</sup> i. p. 339, 316.	Found in Pit LXV (Riverbank Field = O.S. No. 610), 8' 6" down.
<b>OTHO: 69</b>			
28	IMP M OTHO CAESAR AVG TR P Securitas standing l., with	SECVRITAS P R Head r. bare. wreath and sceptre. Cohen <sup>2</sup> i. p. 353, 17.	Found in upcast from early building below Block XIV.
<b>VITELLIUS: 69</b>			
29	A VITELLIVS GERM IMP AVG TR P Head r. laureate.	PONT MAXIM Vesta seated r., with patera and sceptre. Cohen <sup>2</sup> i. p. 361, 72.	Found in Block XIII.
<b>VESPASIAN Cos. II. 70 A.D.</b>			
30	IMP CAESAR VESPASIANVS AVG Head r. laureate.	COS ITER TR POT Pax standing l., with branch and caduceus. Cohen <sup>1</sup> i. p. 274, 34; not in Cohen <sup>2</sup> .	Found 2' or 3' below surface in tracing foundations of early Barrack block, S. E. corner of fort.
31	Similar.	Similar; but Pax seated 1. Cohen <sup>1</sup> i. p. 275, 36; not in Cohen <sup>2</sup> .	Surface-find from S. Annexe.
<b>COS. III. OR IV.: 71-73 A.D.</b>			
32	IMP CAES VESP AVG P M COS..II Head r. laureate.	VESTA Vesta standing l., with simpulum and sceptre. Cf. Cohen <sup>2</sup> i. pp. 412 f., 573 f.	Found on line of inner ditch of early fort, 2' below surface.
<b>COS. IV.: 72-73 A.D.</b>			
33	IMP CAES VESP AVG P COS IIII Head r. laureate.	AVGVR TRI POT Simpulum, sprinkler, urceus, and augur's staff. Cohen <sup>2</sup> i. p. 371, 45.	Found at top of black deposit, above inner ditch of E. Annexe.

NO.	OBVERSE.	REVERSE.	REMARKS.
34	Similar.	Similar.	Find-spot doubtful. In good condition, when lost.
35	Similar.	Similar.	Found in the Principia.
36	Similar.	Similar.	Found near top of Pit LXVI. In good condition, when lost.
37	Similar.	TRI POT Vesta seated l., with simpulum. Cohen <sup>2</sup> i. p. 411, 563.	Found in the Principia. In good condition, when lost.
38*	Similar.	VICTORIA AVGVST Victory r. 'crowning trophy.' Cf. Cohen <sup>2</sup> i. p. 416, 618.	<i>Proc. Soc. Ant. Scot.</i> i. p.34.
<b>CENS. PONTIF. MAXIM.: 72-75 A.D.</b>			
39	IMP CAES VESP AVG CENS Head r. laureate.	PONTIF MAXIM Vespasian enthroned r., with sceptre and branch. Cohen <sup>2</sup> i. p. 397, 387.	Find-spot doubtful In good condition, when lost.
<b>COS. VI.: 75 A.D.</b>			
40	IMP CAESAR VESPASIANVS AVG Head r. laureate.	PON MAX TR P COS VI Female figure, naked to waist, seated l., with branch. Cohen <sup>2</sup> i. p. 395, 366.	Found within gateway of reducing wall, on S. side of road, on level with cobble foundation of outer wall of guard-chamber.
41	Similar.	Similar.	Find-spot doubtful. In good condition, when lost.
<b>COS. VI. OR VII.: 75 OR 76 A.D.</b>			
42	Similar.	Similar; but only PON MAX visible. Cf. Cohen <sup>2</sup> i. p. 396, 373.	Found in clay of W. rampart.
<b>COS. VII.: 76 A.D.</b>			
43	IMP CAESAR AVG Head r. laureate.	COS VII Eagle on cippus wings open. Cohen <sup>2</sup> i. p.377, 122.	Find-spot doubtful.
<b>UNDATED</b>			
44	IMP CAESAR VESPASIANVS AVG Head r. laureate.	IVDAEA Judaea, captive, seated r. behind, trophy. Cohen <sup>2</sup> i. p. 384, 226.	Found in the Retentura (Well Meadow = O.S. No. 608), in filling in large oven.
45	Similar.	Similar.	Found in the Baths.

NO.	OBVERSE.	REVERSE.	REMARKS.
46	Similar.	Similar.	Found in the Principia, lowest level. In good condition, when lost.
<b>DATE UNCERTAIN</b>			
47	...AVG... Head r. laureate.	AVGVR TRI POT Similar to Nos. 33 ff. Cf. Cohen <sup>2</sup> i. p. 371, 43 ff.	Found in the Barracks of the Praetentura.
48	...VESP AVG... Head r. laureate.	No inscr. visible. Victory r., with wreath and palm. Cf. Cohen <sup>2</sup> i. p. 413, 584 f.	Find-spot doubtful.
49*	Undescribed.	TRI POT 'Robed figure seated l.' Probably similar to No. 37.	Found in railway cutting in 1846. <i>Proc. Soc. Ant. Scot.</i> i. p. 34.
50	IMP CAES VESP...	Probably similar. Head r. laureate.	Found near the top of Pit LXVI. One half broken away.
<b>STRUCK AFTER DEATH OF VESPASIAN IN 79 A.D.</b>			
51	DIVVS AVGVSTVS VESPASIANVS Head r. laureate.	Two capricorns, back to back, supporting shield with SC; beneath, a globe. Cohen <sup>2</sup> i. p. 406, 497.	Found in the Barracks of the Praetentura.
<b>TITUS</b>			
<b>TRIB. POT. IX., Cos. VII.: 79 A.D.</b>			
52	IMP TITVS CAES VESPASIAN AVG P M Head r. laureate.	TR P VIII IMP XIII COS VII PP Ceres enthroned l., with ears of corn and torch. Cohen <sup>2</sup> i. p. 452, 270.	Found in S.E. corner of Principia, below level of last occupation. In very good condition, when lost.
<b>UNDATED</b>			
53	T CAES IMP VESP PON MAX TR POT Head r. laureate.	NEP RED Neptune standing l., with acrostolium and sceptre r. foot on globe. Cohen <sup>2</sup> i. p. 440, 121.	Found in E. Annexe.
<b>DOMITIAN</b>			
<b>COS. IV.: 76</b>			
54	CAESAR AVG F DOMITIANVS Head r. laureate.	COS IIII Pegasus, walking r. Cohen <sup>2</sup> i. p. 474, 47.	Found in the Baths.

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>COS. VI.: 79 A.D.</b>			
55	CAESAR AVG F DOMITIANVS COS VII Head r. laureate.	PRINCEPS IVVENTVTIS Two clasped hands, holding military eagle. Cohen <sup>2</sup> i. p. 504, 393.	Found in filling in ditch of early fort.
<b>COS. VII.: 79 A.D.</b>			
56*	CAESAR DIVI F DOMITIANVS COS VII Head r. laureate.	PRINCEPS IVVENTVTIS Lighted altar, garlanded. Cohen <sup>2</sup> i. p. 504, 397.	<i>Proc. Soc. Ant. Scot.</i> i. p. 34.
57	CAESAR DIVI F DOMITIANVS COS VII Head r. laureate.	PRINCEPS IVVENTVTIS Plumed helmet, on throne. Cohen <sup>2</sup> i. p. 504, 399.	Found in W. Annexe.
<b>TRIB. POT. VII.: 88</b>			
58	IMP CAES DOMIT AVG GERM PM TR P VII Head r. laureate.	IMP XII II COS XII II CENS P PP Athena r. on prow, brandishing spear; at her feet, owl Cohen <sup>2</sup> i. p. 491, 236.	Find-spot doubtful. In very good condition, when lost.
<b>TRIB. POT. IX., COS. XIV.: 89 A.D.</b>			
59	IMP CAES DOMIT AVG GERM PM TR P VIII Head r. laureate.	IMP XXI COS XIII CENS P PP Athena, standing l., leaning on spear. Cohen <sup>2</sup> i. p. 493, 255.	Found in the Baths, above cobble foundation of rampart, W. side. In good condition, when lost
<b>TRIB. POT. IX., COS. XV.: 90 A.D.</b>			
60	Similar.	IMP XXI COS XV CENS P PP Athena, standing l., with thunderbolt and spear. Cohen <sup>2</sup> i. p.493, 259.	Found in the Baths, 4' 6" below surface.
<b>TRIB. POT. XII.: 92 OR 93 A.D.</b>			
61	IMP CAES DOMIT AVG GERM PM TR P XII Head r. laureate.	IMP XXII COS XVI CENS P PP Similar to No.58. Cohen <sup>2</sup> i. p.495, 281.	Found outside earlier south gate (Well Meadow), 2' 6" below surface, under the bottoming of second occupation roadway. In very good condition, when lost.
<b>TRIB. POT. XIII., COS. XVI.: 93 A.D.</b>			
62*	IMP CAES DOM IT AVG GERM PM TR P XIII Head r. laureate.	IMP XXII COS XVI CENS P PP Athena, advancing r., with aegis and spear. Cohen <sup>2</sup> i. p.495, 283.	Found in 1853. <i>Proc. Soc. Ant. Scot.</i> i. p. 230.

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>TRIB. POT. XV.: 95 OR 96 A.D.</b>			
63	IMP CAES DOM IT AVG GERM PM TR P XV Head r. laureate.	IMP XXII COS XVII CENS P PP Similar to No. 58. Cohen <sup>2</sup> i. p.496, 293.	Found in the Barracks of the Praetentura. In good condition, when lost.
<b>UNDATED</b>			
64	DOMITIANVS CAESAR AVG F Head r. laureate.	No inscr. legible. Similar to No. 58.	Found in the River-bank Field (O.S. No. 610).
65	Head r. laureate.	Traces of inscr. Draped figure, seated l., holding small Victory (?). Similar to No. 58.	Find-spot doubtful.
<b>NERVA COS. II.: 96 A.D.</b>			
66	IMP NERVA CAES AVGAEQVITAS AVGVST PM TRP COS II PP Head r. laureate.	Aequitas standing l., with scales and cornucopiae. Cohen <sup>2</sup> ii. p.2, 3.	Found in the Barracks of the Praetentura.
<b>COS. III.: 97 A.D.</b>			
67	IMP NERVA CAES AVGFORTVNA AVGVST PM TR P COS III PP Head r. laureate.	Fortuna standing l., with rudder and cornucopiae. Cohen <sup>2</sup> ii. p. 7, 66.	Found on E. side of fort, 2' or 3' below surface. In good condition, when lost.
68	Similar.	FORTVNA P R Fortuna seated l., with ears of corn (?) and sceptre. Cohen <sup>2</sup> ii. p. 8, 79.	Found in the Barracks, E. side of Praetentura. In good condition, when lost.
<b>TRAJAN COS. II.: 98 A.D.</b>			
69*	IMP CAES NERVA TRAIAN AVG GERM Head r. laureate.	PM TR P COS II PP 'Robed figure, seated to l.' Cf. Cohen <sup>2</sup> ii. p.40, 203 ff.	<i>Proc. Soc. Ant. Scot.</i> i. p.34.
<b>COS. IV.: 101-103 A.D.</b>			
70	IMP CAES NERVA TRAIAN AVG GERM Head r. laureate.	PM TR P COS IIII PP Victory standing r. on prow, with wreath and palm; in front of prow, serpent. Cohen <sup>2</sup> ii. p. 43, 241.	Found in E. Annexe.
71	Similar; but no inscr. visible.	PM TR P COS IIII PP (?) Victory marching r., with wreath and palm. Cf. Cohen <sup>2</sup> ii. p. 43, 243.	Find-spot doubtful.

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>COS. V.: 104–115 AD.</b>			
72	IMP TRAIANO AVG GER DAC PM TR P Bust r. laureate.	COS V PP SPQR OPTIMO PRINC Roma standing l., holding Victory and leaning on spear. Cohen <sup>2</sup> ii. p. 25, 68.	Found in South Annexe (Field O.S. No.554).
73	Similar.	COS V PP SPQR OPTIMO PRINC Victory, marching l., with wreath and palm. Cohen <sup>2</sup> ii. p. 26, 77.	Found in Block XIV, 3' down, about foundation level.
74	Similar.	COS V PP SPQR OPTIMO PRINC Pax standing l., holding olive- branch and leaning on column. Cohen <sup>2</sup> ii. p.27, 83.	Found in tracing foundation of early Barrack block at S.F. corner of fort. In good condition, when lost.
75	Similar.	Similar.	Found in the South Annexe (Fore-ends = O.S. No.607).
76	Similar.	COS V PP SPQR OPTIMO PRINC Trophy. Cohen <sup>2</sup> ii. p.28, 100.	Find-spot doubtful.
77	IMP TRAIANO AVG GER DAC PM TR P COS V PP Bust r. laureate.	SPQR OPTIMO PRINCIPI Aequitas l., with scales and cornucopiae. Cohen <sup>2</sup> ii. p. 65, 462.	Found in the Baths. In very good condition, when lost.
<b>COS. VI.: 111–116</b>			
78	IMP TRAIANO OPTIMO AVG GER DAC PM TR P Bust r. laureate.	COS VI PP SPQR Pax (or Felicitas) standing l., with caduceus and cornucopiae. Cohen <sup>2</sup> ii. p. 29, 106.	Found in the Barracks of the Praetentura, 2' below foundations of last occupation. In good condition, when lost.
79	IMP CAES NER TRAIANO OPTIMO AVG GER DAC Bust r. laureate.	PM TR P COS VI PP SPQR Similar. Cohen <sup>2</sup> ii. p. 47, 278.	Found in the Barracks of Praetentura. In good condition, when lost.
80	Similar (?).	Similar (?).	Found in the Praetentura, 2' or 3' below surface.
81	Similar (?).	PM TR P COS VI PP SPQR Virtus standing r., with parazonium and spear; r. foot on helmet. Cf. Cohen <sup>2</sup> ii. p. 46, 272 and 274.	Found, 1' below surface, in clay above ditch of early fort, S. side.

NO.	OBVERSE.	REVERSE.	REMARKS.
82	IMP CAES NER PM TR P COS VI PP SPQR TRAIANO OPTIM AVG PROVID GER DAC PARTH ICO Bust r. laureate.	Providentia standing l., bearing a sceptre and extending r. hand at her feet, globe. Cohen <sup>2</sup> ii. p. 50, 315.	Found in the Retentura (Well Meadow = O.S. No. 608), 1' 6" down. In good condition, when lost.
<b>DATE DOUBTFUL</b>			
83	Inscr. illegible. Head r. laureate.	Inscr. illegible. Traces of figure standing l., holding cornucopiae.	Find-spot doubtful.
<b>HADRIAN COS. II.: 119 A.D.</b>			
84	IMP CAESAR TRAIAN PM TR P COS II FORT RED HADRIANVS AVG Bust r. laureate.	Fortuna seated l., with rudder and cornucopiae. Cf. Cohen <sup>2</sup> ii. p. 169, 745.	Found in the Principia, 2' 6" below gutter of outer courtyard. In good condition, when lost.
<b>COS. III.: 119-128 A.D.[1]</b>			
85*	IMP CAESAR TRAIAN PM TR P COS III CLEM HADRIANVS AVG Bust r. laureate. [121 A.D.]	Clementia standing l., with patera and sceptre; in front, altar. Cohen <sup>2</sup> ii. p. 122, 212.	Found in 1847. <i>Proc. Soc. Ant. Scot. i. p. 35</i>
86*	IMP CAESAR TRAIAN PM TR P COS III CONCORD HADRIANVS AVG Head r. laureate. [119 AD.]	Concordia seated l. Cohen <sup>2</sup> ii. p. 125, 255.	Found in railway cutting in 1847. <i>Proc. Soc. Ant. Scot. I. p. 35.</i>
87	HADRIANVS AVGVSTVS Head r. laureate. [125 A.D.]	COS III Genius l., holding cornucopiae, and patera over altar. Cohen <sup>2</sup> ii. p. 135, 335.	Found in F. Annexe. In good condition, when lost.
88*	Similar. [125 A.D.]	COS III Roma seated l., holding Victory and spear. Cohen <sup>2</sup> ii. p. 135, 339.	<i>Proc. Soc. Ant. Scot. i. p. 35.</i>
89*	Similar. [127 A.D.]	COS III Virtus standing r., l. foot on helmet. Cohen <sup>2</sup> ii. p. 136, 353.	<i>Proc. Soc. Ant. Scot. i. p. 35.</i>

1 Owing to the number of years over which Hadrian's third consulship extended, the precise date of many of his coins is more or less conjectural. The dates inserted in square brackets here, and in the case of the corresponding brass or copper pieces, are those given by Laiffranchi, 'Cronologia delle monete di Adriano' in *Rivista Italiana di Numismatica*, 1906, pp. 329-374.

NO.	OBVERSE.	REVERSE.	REMARKS.
90	Similar, with bust. [127 A.D.]	<b>COS III</b> Victory standing r., crowning herself. Cohen <sup>2</sup> ii. p. 136 f., 358.	Found beneath cobbling of road leading from E. gate.
91	Similar, with head. [127 A.D.]	<b>COS III</b> Abundantia(?) seated l., r. foot on modius. Cf. Cohen <sup>2</sup> ii. p. 138, 379.	Found in River-bank Field (O.S. No. 610).
92	Similar.	<b>COS III</b> Abundantia standing l., with acrostolium and cornucopiae; foot upon a modius. Cohen <sup>2</sup> ii. p. 138, 381.	Found in the Principia.
93	<b>HADRIANVS</b> <b>AVGVSTVS PP</b> Head r. laureate.	<b>COS III</b> Female figure seated l., raising r. hand. Cf. Cohen <sup>2</sup> ii. p. 139, 398.	Found in the Principia.
94	<b>HADRIANVS AVG</b> <b>COS III PP</b> Head r. bare. [134 A.D.?)	<b>FELICITAS AVG</b> Felicitas standing l., with caduceus and olive-branch. Cohen <sup>2</sup> ii. p. 159, 614.	Find-spot doubtful.
95	Similar, but head laureate.	<b>FORTVNA AVG</b> Fortuna standing l., with rudder and cornucopiae. Cohen <sup>2</sup> ii. p. 171, 762.	Found in the Baths.
96	Similar. [138 A.D.]	Similar; Fortuna holds patera and cornucopiae. Cohen <sup>2</sup> ii. p. 171, 775.	Found in the Retentura (Well Meadow = O.S. No. 608), July, 1852. <i>Proc. Soc. Ant. Scot.</i> i. p. 35.
97*	<b>IMP CAESAR TRAIAN</b> <b>HADRIANVS AVG</b> Bust r. laureate. [123 A.D.]	<b>PM TR P COS III</b> Genius sacrificing at altar. Cohen <sup>2</sup> ii. p. 197, 1091.	Found in the South Annexe (Fore-ends=O.S. No. 607).
98*	Similar. [122 A.D.]	<b>PM TR P COS III</b> Victory flying r., with trophy. Cohen <sup>2</sup> ii. p. 200, 1131.	<i>Proc. Soc. Ant. Scot.</i> i. p. 35.
99	Similar. [122 A.D.]	<b>P M TR P COS III</b> Fortuna l., leaning on column, and holding rudder and cornucopiae. Cohen <sup>2</sup> ii. p. 202, 1155.	Found 2' 6" below Via Principalis, opposite S.E. corner of Block XVI.
100	Similar. [121 A.D.]	Similar; no column visible. Cohen <sup>2</sup> ii. p. 202, 1157.	Found in the Barracks of the Praetentura.

NO.	OBVERSE.	REVERSE.	REMARKS.
101	Similar. [120 A.D.]	P M TR P COS III SAL AVG Salus seated l., feeding serpent twined round altar. Cohen <sup>2</sup> ii. p. 216, 1327.	Find-spot doubtful.
102*	HADRIANVS AVG COS III PP Head r. laureate. [133 A.D.]	TELLVS STAB Tellus l., with plough-tail and rake; behind, two stalks of corn. Cohen <sup>2</sup> ii. p. 225, 1427.	<i>Proc. Soc. Ant. Scot.</i> i. p. 34.
103	... RAIAN... ANVS AVG Bust r. laureate.	CONCORDIA P R Concordia seated l., with patera and cornucopiae. Not in Cohen.	Found in filling in gateway in the reducing wall.
104	No inscription visible. Head r. laureate.	No inscription visible. Libertas standing l., holding sceptre and cap. Cf. Cohen <sup>2</sup> ii. p. 202, 1159.	Found in the Baths.
105	Inscription illegible. Head r. laureate. <sup>1</sup>	Traces of inscription. Victory marching r., with trophy.	Find-spot doubtful.
<b>ANTONINUS PIUS COS III.: 140-143</b>			
106	ANTONINVS AVG PIVS PP TR P COS III Head r. laureate.	GENIO SENATVS Genius of the Senate standing l., with branch and sceptre. Cohen <sup>2</sup> ii. p. 309, 399. <b>TRIB. POT. XII.: 149 A.D.</b>	Found in the Principia. In very good condition, when lost.
107	ANTONINVS AVG PIVS PP TR P XII Similar.	COS IIII Abundantia standing l., with ears of corn and anchor; in front, modius. Cohen <sup>2</sup> ii. p. 299, 284. <b>TRIB. POT. XV.: 152 A.D.</b>	Find-spot doubtful.
108	IMP CAES T AEL HADR ANTONINVS AVG PIVS PP Similar.	TR POT XV COS IIII TRANQ Tranquillitas standing r., with rudder and ears of corn. Cohen <sup>2</sup> ii. p. 351, 826.	Find-spot doubtful.

1 This identification is not quite certain. The coin is much damaged, and the head may possibly be that of Pius.

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>TRIB. POT. XVII.: 154 A.D.</b>			
109	ANTONINVS AVG PIVS PP TR P XVII Similar.	LIBERALITAS VII COS IIII Liberalitas standing l., shaking fruit from a cornucopiae. Cf. Cohen <sup>2</sup> ii. p. 321, 519.	Found 2' below surface, on N.W. side of fort.
<b>TRIB. POT. XXI.: 158 A.D.</b>			
110	ANTONINVS AVG PIVS PP IMP II Similar.	TR POT XXI COS IIII Roma seated l., holding small Victory in r. Cohen <sup>2</sup> ii. p. 369, 1028.	Found 2' or 3' below surface, on E. side of fort.
<b>VOTA DEC. III.: 159-160 A.D.</b>			
111	ANTONINVS AVG PIVS PP Similar.	COS III VOTA SVSCEP DEC III Emperor in sacrificial garb, standing l., holding patera over tripod. Cohen <sup>2</sup> ii. p. 378, 1115.	Found 2' or 3' below surface, in tracing foundation of early building beneath Blocks II and III.
<b>FAUSTINA SENIOR STRUCK AFTER THE DEATH OF FAUSTINA IN 141 A.D.</b>			
112	DIVA FAVSTINA Bust r. draped.	AETERNITAS Aeternitas standing l., raising r. hand and holding sceptre. Cohen <sup>2</sup> ii. p. 415, 26.	Found 1' 6" below surface, on line of inner ditch of early fort, N.W. side.
113	Similar.	AVGVSTA Ceres standing l., with torch and sceptre. Cohen <sup>2</sup> ii. p. 421, 96.	Find-spot doubtful.
114	Similar.	Similar, but Ceres raises drapery with l. Cohen <sup>2</sup> ii. p. 421, 104.	Found in the South Annexe (Fore-ends O.S. No.607).
115*	Similar.	CONSECRATIO Peacock, walking r. Cohen <sup>2</sup> ii. p. 426, 175.	<i>Proc. Soc. Ant. Scot.</i> i. p. 36.
<b>MARCUS AURELIUS Cos II.: 145-146 A.D.</b>			
116	AVRELIVS CAESAR AVG PII F Head r. bare.	COS II Marcus, wearing toga, standing l., with olive-branch and cornucopiae. Cohen <sup>2</sup> iii. p. 13, 110.	Found on N. side of Bath Building, above rampart foundation. In good condition, when lost.

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>FAUSTINA JUNIOR</b>			
117	FAVSTINA AVGVSTA Bust r. draped.	CERES Ceres seated l., with ears of corn and torch. Cohen <sup>2</sup> iii. p. 139, 35.	Find-spot doubtful. In good condition, when lost.
<b>CRISPINA</b>			
118	CRISPINA AVG Bust r. draped.	DIS GENITALIBVS Lighted altar. Cohen <sup>2</sup> iii. p. 383, 15.	Found in the Retentura (Well Meadow O.S. No. 608).

The following summary shows in convenient form how these 113 denarii are distributed:

Republican Period	9
Mark Antony	8
Augustus	1
Tiberius	1
Nero	1
Galba	2
Otho	1
Vitellius	1
Vespasian	22
Titus	2
Domitian	12
Nerva	3
Trajan	15
Hadrian	22
Antoninus Pius	6
Faustina Senior	4
Marcus Aurelius	1
Faustina Junior	1
Crispina	1
	<u>113</u>

It is instructive to compare this list of coins, casually dropped at intervals during the Newstead occupation, with the contents of a hoard discovered in 1909 at Castle Bromwich, near Birmingham.<sup>1</sup> The latest of the Newstead pieces points plainly to the early part of the reign of Commodus as the time when the Roman garrison was finally withdrawn. The denarii of Pius and his consort had evidently been in circulation on the spot for some considerable period. Those of Marcus and his wife had not yet reached Caledonia in any quantity. Commodus himself is represented

1 Fully described by Mr. G. C. Brooke in *Num. Chron.* 1910, pp. 13 ff.

only by Crispina, whom he married in 178 A.D., two years before his accession, and discarded soon after he became emperor. The interest of the comparison with the Castle Bromwich hoard lies in the fact that the latter must have been hidden away almost simultaneously with the close of the Newstead series. Whether its concealment was connected with the disturbances that culminated in the abandonment of Southern Scotland, it is impossible to say.<sup>1</sup> Including, however, 18 pieces struck in copper and washed in silver, it consisted of 194 denarii, the latest being one of Commodus, dated 177 A.D. Its composition was as follows:

Mark Antony	1
Vespasian	23
Titus	3
Domitian	7
Nerva	3
Trajan	34
Hadrian	48
Sabina	2
Antoninus Pius	30
Faustina Senior	10
Marcus Aurelius	21
Faustina Junior	10
Lucius Verus	1
Commodus	1
Total,	194

This may fairly be taken as typical of the normal silver currency of the province of Britain about 150 A.D. The contrast with the Newstead list is striking. Vespasian is the first emperor who appears, while the percentage of pre-Trajanic to later issues is just over 19 as compared with almost 56. Again, the Castle Bromwich pieces were) for the most part, in poor condition; the earlier ones) in particular, were worn through usage. At Newstead, on the other hand, some of the denarii of the Flavian Emperors had seen but little service; quite a large proportion are noted as having been in 'very good' or in 'good' condition, when lost—descriptions which may be roughly regarded as indicating that the Coins to which they are applied had not been in active circulation for more than, say, ten and twenty-five years respectively. The numismatic evidence would thus seem to be convincing as to a first-century occupation of the site. It may even throw some light on the question of how long this occupation lasted. That it did not end with the recall of Agricola in 86 A.D. is tolerably plain. The whole of the 'good' or 'very good' coins of Domitian are subsequent to that year. Furthermore, one of the 3 coins of Nerva ranks as 'good,' while of the 15 struck by Trajan there are as many as three which

<sup>1</sup> A much smaller hoard, which must have been buried about the same time, or possibly a few years earlier, was recently discovered at Nottingham (*Num. Chron.* 1910, pp. 205 f.).

are 'good' and one which is 'very good.' The last one, at least, must have been dropped before the Antonine period. This particular piece (No. 78) was minted in Trajan's fifth consulship—that is, between 104 and 111 A. D.—and was therefore probably lost towards the end of his reign or about the beginning of the reign of his successor. It looks as if the abandonment of Newstead might have coincided with the building of Hadrian's Wall. The thread of argument is, of course, a slender one. But it is certainly not weakened by the circumstance that of the 15 denarii of Hadrian which it was possible to examine personally, there were only two which called for remark as having been obviously in 'good' condition when lost. [1] This rather suggests that the Hadrian coins were dropped during the reign of Pius, and that during Hadrian's own reign the fort had been deserted.

Such are the conclusions to which a scrutiny of the denarii seems to point. It remains to see how far they are confirmed or contradicted by the testimony of the brass or copper. The condition of the latter is often so poor that it is not possible either to date them or to express any opinion as to the amount of usage to which they had been subjected before they were dropped. It is therefore hardly worth while attempting a detailed chronological arrangement; it will be sufficient to note such dates as are definitely ascertainable. As far as may be, the following list reproduces Cohen's order

### BRASS OR COPPER

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>AUGUSTUS</b>			
119*	Undescribed.	Undescribed.	'Second brass.' <i>Proc. Soc. Ant. Scot.</i> i. p. 34. This is perhaps a doubtful entry. <sup>2</sup>
<b>NERO</b>			
120	Bust l. laureate.	SC Victory flying l., holding shield inscribed S P Q R. Cf. Cohen <sup>2</sup> i. p. 298 f., 288ff	'Second brass.' Find-spot doubtful.
121	Similar.	SC Triumphal arch. Cohen <sup>2</sup> i. p. 299, 306.	'First brass.' Found in the Baths.

1 Others, of course, may have been so, although the evidence of it was not apparent.

2 No detailed description is given. It may have been a coin of Hadrian, on which only AVGVSTVS was legible.

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>VESPASIAN</b>			
122	IMP CAES VESPASIAN AVG Head r. laureate.	AEQVITAS AVGVSTI SC Aequitas standing l., with scales and spear. Cf. Cohen <sup>2</sup> i. p. 369, 12ff	'Second brass.' Find-spot doubtful.
123	Similar; beneath head, globe.	FIDES PVBLICA SC Fides standing l., with patera and cornucopiae. Cf. Cohen <sup>2</sup> i. p. 380, 165ff	'Second brass.' Found in the River-bank Field (O.S. No. 610).
124	Similar.	Similar.	'Second brass.' Find-spot doubtful.
125	IMP CAESAR VESPASIAN AVG COS IIII Head r. radiate.	FORTVNAE REDVCI SO Fortuna standing l., with olive branch, rudder, and cornucopiae. Cohen <sup>2</sup> i. p. 382, 195.	'Second brass,' 72 or 73 A.D. Found in black deposit of ditch of early fort.
126	IMP CAESAR VESPASIAN AVG COS VIII PP Head r. radiate. <sup>1</sup>	FORTVNAE REDVCI SC Fortuna standing l., with rudder and cornucopiae. Cohen <sup>2</sup> i. p. 382, 198.	'Second brass,' 77 or 78 A.D. Found in the Retentura (Well Meadow=O.S. No.608).
127	Similar; but head laureate.	Similar. Cohen <sup>2</sup> i. p. 382, 199.	'Second brass,' 77 or 78 A.D. Find-spot doubtful.
128	Similar; but nothing after COS legible.	Similar.	'Second brass.' Find-spot doubtful.
129	Similar; but even fewer letters visible.	Similar.	'Second brass.' Found in the River-bank Field (=O.S. No. 610).
130	IMP CAESAR VESPASIAN AVG COS IIII Bust r. radiate.	PAX AVG SC Pax standing l., holding caduceus and extending patera over altar. Cohen <sup>2</sup> i. p. 390, 301.	'Second brass,' 72 or 73 A.D. Find-spot doubtful.
131	Similar; number of consulship uncertain.	Similar.	'Second brass.' Find-spot doubtful.
132	IMP CAESAR VESPASIAN AVG CO.... Head r. laureate.	PROVIDENT SC Altar. Cf. Cohen <sup>2</sup> i. p. 397, 396.	'Second brass.' Found in black deposit of ditch of early fort, S. side.
133	IMP CAES VESPASIAN AVG COS VIII PP Similar.	Similar. Cohen <sup>2</sup> i. p. 398, 400.	'Second brass,' 77 or 78 A.D. Find-spot doubtful.

1 The condition of the coin renders it impossible to say whether there has been a globe beneath. The same is true of others.

NO.	OBVERSE.	REVERSE.	REMARKS.
134	IMP CAES VESPASIAN AVG PM TR P PP COS III Head r. laureate.	ROMA SC Roma standing l., holding Victory on globe and leaning on spear. Cohen <sup>2</sup> i. p. 399, 419.	'First brass,' 71 A.D. Find-spot doubtful.
135	IMP CAES VESPASIAN AVG COS VIII PP Bust r. radiate; beneath, globe.	SC Victory advancing l., holding shield inscribed S P Q R Cohen <sup>2</sup> i. p. 403, 466.	'Second brass,' 77 or 78 A.D. Find-spot doubtful.
136	IMP CAESAR VESPASIAN AVG COS III Head r. laureate.	SC Eagle standing to front on globe; wings open; bead r. Cohen <sup>2</sup> i. p. 404, 480.	'Second brass,' 71 A.D. Find- spot doubtful.
137	Similar, with COS IIII.	Similar. Cohen <sup>2</sup> i. p. 405, 481.	'Second brass,' 72 or 73 A.D. Find-spot doubtful.
138	Similar; inscription less certain.	Similar.	'Second brass.' Found in bottom of ditch of early fort, S. side.
139	Similar.	Similar.	'Second brass.' Found in the Principia.
140	Similar.	Similar.	'Second brass.' Found in tracing foundation of early building beneath Blocks II and III in the Praetentura, S.E. corner, near surface.
141	IMP CAES VESPASIAN AVG COS VIII PP Head r. laureate; beneath, globe.	Similar; but head l. Cohen <sup>2</sup> i. p. 405, 483.	'Second brass,' 72 or 73 A.D. Find-spot doubtful.
142	Traces of inscription. Head r. laureate.	VICTORIAAVGVSTI SC Victory marching l., with wreath and palm. Cf. Cohen <sup>2</sup> i. p. 415, 607 ff	'Second brass.' Find-spot doubtful.
143	Similar.	Similar.	'Second brass.' Found in the Well Meadow (O.S. No. 608).
144	Similar.	Similar.	'Second brass.' Found in the River-bank Field (O.S. No. 610).
145	Inscription only partly visible. Head r. laureate.	Indecipherable.	'Second brass.' Find-spot doubtful.
146	Similar.	Indecipherable.	'Second brass.' Found in the Baths.

NO.	OBVERSE.	REVERSE.	REMARKS.
147	Similar.	Indecipherable.	'Second brass.' Found in the Baths.
148	No letters legible. Similar.	Indecipherable.	'Second brass.' Found in E. end of Principia, on level of old walls, 4' down.
149	Similar.	Indecipherable.	'Second brass.' Found in the Pit in the Principia (No.1).
<b>TITUS</b>			
150	IMP T CAES VESP AVG PM TR P PP COS VIII Head r. laureate.	ANNONA AVG SC Abundantia standing l., with statuette of Aequitas and cornucopiae; in front, basket with ears of corn; behind, forepart of vessel, decked with wreaths. Cohen <sup>2</sup> i. p. 430, 14.	'First brass,' 80 A.D. Find-spot doubtful.
151	T CAES IMP AVG F TR P COS VI CENSOR Head r. laureate.	FIDES PVBLICA SC Fides standing l., with patera and cornucopiae. Cohen <sup>2</sup> i. p. 436, 88.	'Second brass,' 77 or 78 A.D. Find-spot doubtful.
152	Similar to No.150; but number of consulship doubtful.	PAX AVGVST SC Pax standing l., with olive-branch and cornucopiae. Cf. Cohen <sup>2</sup> i. p. 441, 139f.	'First brass.' Found in the Riverbank Field (O.S. No. 610).
153	T CAES IMP AVG F PON TR P COS VI CENSOR Head r. laureate.	ROMA SC Roma standing l., holding small Victory. Cohen <sup>2</sup> i. p. 445, 184.	'First brass,' 77 or 78 AD. Find-spot doubtful.
154	Similar.	Similar.	'First brass,' 77 or 78 A.1). Found in clay of rampart, above ditch of early fort.
155	Similar to No. 151; but beneath, globe.	SECVRITAS AVGVSTI SC Securitas, seated r., supporting head on r. hand, and holding sceptre in l.; in front, altar. Cohen <sup>2</sup> i. p. 451, 260.	'Second brass,' 77 or 78 A.D. Find-spot doubtful.
156	Similar.	Similar; almost obliterated.	'Second brass,' 77 or 78 A.D. Found in the Principia.
157	Inscription illegible. Head r. laureate.	Similar; but somewhat better preserved.	'Second brass.' Find-spot doubtful.

NO.	OBVERSE.	REVERSE.	REMARKS.
158	Similar.	Indecipherable.	'First brass.' Found, adhering to denarius of Tiberius, in N. half of building on W. side of Via Quintana.
159	Similar.	Indecipherable.	'Second brass.' Find-spot doubtful.
<b>DOMITIAN</b>			
160	IMP CAES DOMIT AVG GERM COS XIII CENS PER PP Head r. laureate.	FIDEI PVBLICAE SC Fides standing r., with poppy-head, ears of corn, and basket of fruit. Cohen <sup>2</sup> i. p. 481, 113.	'Second brass,' 87 A.D. Found in inner ditch, E. side of S. Annexe, covered with yellow clay from ditch bottom.
161	Similar; but only . . . RM COS . . . visible.	Similar. Cf. Cohen <sup>2</sup> i. p. 481, 106ff.	'Second brass.' Found in the Retentura (Well Meadow = O.S. No. 608).
162	IMP CAES DOMITAVG GERM COS XI CENS POT PP Bust r. radiate.	FORTVNAE AVGVSTI SC Fortuna standing l., with rudder and cornucopiae. Cohen <sup>2</sup> i. p. 481, 121.	'Second brass,' 85 A.D. Found in Pit LXXIX.
163	IMP CAES DOMIT AVG GERM COS XII CENS PER PP Head r. laureate.	Similar. Cohen <sup>2</sup> i. p. 481, 122.	'Second brass,' 86 A.D. Found in black deposit of ditch of early fort. Almost in mint condition, when lost.
164	IMP CAES DOMIT AVG GERM COS XIII CENS PER PP Bust r. radiate, with aegis.	Similar. Cohen <sup>2</sup> i. p. 481, 127.	'Second brass,' 87 A.D. Find-spot doubtful.
165	IMP CAES DOMIT AVG.... Head r. laureate.	Similar. Cf. Cohen <sup>2</sup> i. p. 481, 118ff.	'Second brass.' Found in the Retentura (Well Meadow = O.S. No. 608).
166	IMP CAES DOMIT AVG GERM COS. . CENS. PP Head r. laureate.	IOVI VICTORI SC Jupiter enthroned l., holding small Victory in r. Cf. Cohen <sup>2</sup> i. p. 497, 307 ff.	First brass,' 85–95 A.D. Found in the Baths, E. end.
167	Similar; no letters visible.	Similar.	First brass,' 85–95 A.D. Find-spot doubtful.
168	Similar.	Similar.	'First brass, 85–95 A.D. Found in the South Annexe (Fore-ends = O.S. No. 607).
169	IMP CAES DOMIT AVG GERM COS XI CENS POT PP Bust r. laureate, with aegis.	MONETA AVGVSTI SC Moneta standing l., with scales and cornucopiae. Cohen <sup>2</sup> i. p. 499, 326.	'Second brass,' 85 A.D. Find-spot doubtful.

NO.	OBVERSE.	REVERSE.	REMARKS.
170	IMP CAES DOMIT AVG GERM COS XII CENS PER PP Similar.	Similar. Cohen <sup>2</sup> i. p. 499, 327.	'Second brass,' 86 A.D. Found in inner ditch of early fort, W. side. Almost in mint condition, when lost.
171	Similar.	Similar.	'Second brass,' 86 A.D. Found in the River-bank Field (O.S. No. 610).
172	Similar; but only . . . CENS PER . . . legible.	Similar. Cf. Cohen <sup>2</sup> i. p. 499, 327 ff.	'Second brass,' 86–95 A.D. Find-spot doubtful.
173	IMP CAES DOMITAVG GERM COS XI... Similar.	Similar. Cf. Cohen <sup>2</sup> i. p. 499, 325 ff	'Second brass,' 85–89 A.D. Found in the River-bank Field (O.S. No. 610).
174	No inscription visible. Similar.	Similar.	'Second brass.' Find-spot doubtful.
175	Inscription illegible. Head r. laureate.	SC Mars running r., holding small Victory, parazonium and trophy. Cf. Cohen <sup>2</sup> i. 507, 430ff.	'Second brass,' 84–87 A.D. Find-spot doubtful.
176	CAES DIVI AVG VESP F DOMITIANVS COS VII Head r. laureate.	SC Athena armed r. Cohen <sup>2</sup> i. p. 507, 439.	'First brass,' 79 A.D. Find-spot doubtful.
177	Inscription illegible. Head r. laureate.	SC Hope standing l., holding flower and raising skirt. Cf. Cohen <sup>2</sup> i. p. 508, 448 ff.	'Second brass,' 74–81 A.D. Find-spot doubtful.
178	Similar.	Similar.	'Second brass,' 74–81 A.D. Found in the Retentura (Well Meadow=O.S. No. 608).
179	Similar.	Similar.	'Second brass,' 74–81 A.D. Found in the River-bank Field (O.S. No 610).
180	IMP CAES DOMITIAN AVG GERM COS X Head r. radiate.	VIRTVTI AVGVSTI SC Virtus standing l., with spear and parazonium. Cohen <sup>2</sup> i. p. 523, 646.	'Second brass,' 84 A.D. Found in the River-bank Field (O.S. No. 610).
181	Similar; only . . . MITA legible.	Similar.	'Second brass,' 84 A.D. Find-spot doubtful.
182	Head r. laureate.	Indecipherable.	'Second brass.' Find-spot doubtful.
183	Similar.	Indecipherable.	'Second brass.' Find-spot doubtful.
184	Similar.	Indecipherable.	'Second brass.' Found in block of buildings to W. of the Baths.

NO.	OBVERSE.	REVERSE.	REMARKS.
<b>UNCERTAIN FLAVIAN EMPERORS</b>			
185	Head of Vespasian or Titus radiate.	Indecipherable.	'Second brass.' Found in Pit LVIII (River-bank Field=O.S. No. 610).
186	Head of Titus or Domitian r. laureate.	Indecipherable.	'Second brass.' Found in black deposit of ditch of early fort.
<b>NERVA</b>			
187	Head r. laureate.	Indecipherable.	'First brass.' Found in the River-bank Field (O.S. No. 610).
<b>TRAJAN</b>			
188	IMP CAES NER TRAIANO OPTIMO AVG GER DAC PARTHICO PM TR P COS VI PP Bust r. laureate.	ARMENIA ET MESOPOTAMIA IN POTESTATEM P R RIEDACTAE SC Trajan, armed, standing r. between river-gods Tigris and Euphrates, planting his foot on neck of captive Armenia. Cohen <sup>2</sup> ii. p. 27, 39.	'First brass,' 116 AD. Find-spot doubtful.
189	IMP CAES NERVAE TRAIANO AVG GER DAC PM TR P COS VI PP Bust r. laureate.	FELICITAS AVGVST SC Female figure standing l., details indecipherable. Cohen <sup>2</sup> ii. P. 33, 143.	'First brass,' 112–117 A.D. Found in the Baths.
190	IMP CAES NER TRAIANO OPTIMO AVG GER DAC PARTHICO PM TR P COS VI PP Bust r. radiate.	SENATVS POPVLVSQVE ROMANVS SC Trajan, in military dress, advancing r. between two trophies. Cohen <sup>2</sup> ii. p. 55, 356.	'Second brass,' 116 A.D. Find-spot doubtful.
191	Similar to No. 188, but with COS V	SPQR OPTIMO PRINCIPI SC Roma standing l., holding small figure of Victory. Cohen <sup>2</sup> ii. p. 58, 383.	'First brass,' 104–110 A.D. Found in the Baths, adhering to another 'first brass' of Trajan, one of Hadrian, and an uncertain 'second brass.'
192	Similar.	Similar. Cohen <sup>2</sup> ii. p. 58, 383.	'First brass,' 104–110 A.D. Find-spot doubtful.
193	Similar.	SPQR OPTIMO PRINCIPI SC Similar, but Roma seated on pile of arms. Cohen <sup>2</sup> ii. p. 59, 391.	'First brass,' 104–110 A.D. Found in the Baths, on floor of Frigidarium.

NO.	OBVERSE.	REVERSE.	REMARKS.
194	Similar.	SPQR OPTIMO PRINCIPI SC Pax standing l., with olive-branch and cornucopiae; r. foot on neck of captive. Cohen <sup>2</sup> ii. p. 60, 406.	'First brass,' 104–110 A.D. Find-spot doubtful.
195	Similar.	SPQR OPTIMO PRINCIPI SC Victory l., crowning trophy. Cohen <sup>2</sup> ii. p. 64, 446.	'Second brass,' 104–110 A.D. Found in the South Annexe (Fore-ends = O.S. No. 607).
196	Similar.	SPQR OPTIMO PRINCIPI SC Victory r., fastening shield to tree. Cohen <sup>2</sup> ii. p. 64, 452.	'First brass,' 104–110 A.D. Find-spot doubtful.
197	Similar.	SPQR OPTIMO PRINCIPI SC Hope standing l., holding flower and raising skirt. Cohen <sup>2</sup> ii. p. 64, 459.	'First brass,' 104–110 A.D. Find-spot doubtful.
198	Similar.	SPQR OPTIMO PRINCIPI SC Female figure standing l., holding scales (?) and cornucopiae. Cf. Cohen <sup>2</sup> ii. p. 65, 463.	'First brass,' 104–110 A.D. Found in the Retentura (Well Meadow = O.S. No. 608).
199	Similar.	SPQR OPTIMO PRINCIPI SC Trajan on horseback r., spearing prostrate foe. Cohen <sup>2</sup> ii. p. 69, 503.	'First brass,' 104–110 A.D. Find-spot doubtful.
200	Similar.	SPQR OPTIMO PRINCIPI SC Octastyle temple, with statue of divinity. Cohen <sup>2</sup> ii. p. 75, 553.	'Second brass,' 104–110 A.D. Find-spot doubtful.
201	.... TRAIANO AVG GER DA... Similar type.	Inscription illegible. Female figure seated l., r. arm outstretched.	'First brass.' Found in tracing older building, S. of Principia.
202	.... AIANO AVG GIER DAC PM TR P C.... Similar type.	Inscription illegible. Female figure seated l., with patera (?) and cornucopiae; no back to seat.	'First brass.' Found in the Baths.
203	....NO AVG GER DAC... Similar type.	Worn smooth.	'First brass.' Found in Pit XCV.

NO.	OBVERSE.	REVERSE.	REMARKS.
204	IM... ES TRAIAN AVG... Head r. laureate.	Indecipherable.	'First brass.' Find-spot doubtful.
205	.....IAN..... Bust r. laureate.	Indecipherable.	'First brass.' Find-spot doubtful.
206	.....ANO AVG GER DAC.... Similar.	Not visible.	'First brass.' Found in the Baths. One of a group of four, adhering; see No. 191.
207	IMP CAES NERVAE TR Similar.	Indecipherable.	'Second brass.' Found in filling of inner ditch, W. Annexe.
208	Inscription illegible. Similar type.	Indecipherable.	'First brass.' Found in the Baths.
209	Similar.	Indecipherable.	'First brass.' Found in the Baths.
210	Similar.	Indecipherable.	'First brass.' Find-spot doubtful.
211	Similar.	Indecipherable.	'First brass.' Find-spot doubtful.
212	Similar.	Indecipherable.	'Second brass.' Find-spot doubtful.
213*	Undescribed.	Undescribed.	'Second brass.' <i>Proc. Soc. Ant. Scot.</i> i. p. 34.
<b>HADRIAN</b>			
214	IMP CAESAR TRAIANVS HADRIANVS AVG Bust r. laureate.	PONT MAX TR POT COS III BRITANNIA SC Britannia seated facing, head r. Cohen <sup>2</sup> ii. p. 121, 197.	'Second brass' [119 A.D.]. [1] Found in inner court of Principia, 2' down.
215	Similar.	Similar. Cohen <sup>2</sup> ii. p. 121, 197.	'Second brass' [119 A.D.]. Find-spot doubtful.
216	HADRIANVS AVGVSTVS Bust r. laureate.	COS III SC Diana standing to front, with arrow and bow. Cohen <sup>2</sup> ii. p.133, 316.	'First brass' [126 A.D.]. Found in the 'Exercier-Halle.'
217*	HADRIANVS AVGVSTVS Head r. laureate.	COS III SC Galley. Cohen <sup>2</sup> ii. p. 144, 446 or 449.	'Second brass' [125 A.D.]. <i>Proc. Soc. Ant. Scot.</i> i. p. 35.

1 On these dates see *supra*, p. 395, footnote.

NO.	OBVERSE.	REVERSE.	REMARKS.
218	HADRIANVS AVGVSTVS Bust r. laureate.	COS III PP SC Roma standing r., with spear and cornucopiae. Cf. Cohen <sup>2</sup> ii. p. 147, 485.	'Second brass.' Find-spot doubtful.
219	IMP CAESAR TRAIAN HADRIANVS AVG PM TR P COS III Bust r. radiate.	FELICITAS AVGVSTI SC Felicitas standing l., with caduceus and cornucopiae. Cohen <sup>2</sup> ii. p. 161, 642.	'Second brass' [122 A.D.]. Find-spot doubtful.
220	IMP CAESAR TRAIANVS HADRIANVS AVG Bust r. laureate.	PONT MAX TR POT COS... FORT RED SC Fortuna seated l., with rudder and cornucopiae. Cf. Cohen <sup>2</sup> ii. p. 170, 756 ff	'First brass' [117–119 A.D.]. Find-spot doubtful.
221	Similar. Head r. radiate.	Similar. Cf. Cohen <sup>2</sup> ii. p. 570, 757 ff	'Second brass' [117–119 A.D.]. Find-spot doubtful.
222	HADRIANVS AVGVSTVS Head r. bare.	COS III PP IVSTITIA AVG SC Justitia enthroned l., with patera and sceptre. Cohen <sup>2</sup> ii. p. 180, 886.	'Second brass' [128 A.D.]. Find-spot doubtful.
223	Similar; but bust r. laureate.	Similar. Cohen <sup>2</sup> ii. p. 180, 889.	'First brass' [128 or 129 A.D.]. Found on floor of Block XIV.
224	IMP CAESAR TRAIANVS HADRIANVS AVG PM TR P COS III Bust r. laureate.	LIBERTAS PVBLICA SC Libertas seated l., with laurel- branch and sceptre. Cohen <sup>2</sup> ii. p. 584, 948.	'First brass' [121 A.D.]. Find- spot doubtful.
225	IMP CAESAR TRAIANVS HADRIANVS AVG PM TR P COS III Head r. laureate.	LOCVPLETATORI ORBIS TERRARVM SC Hadrian seated l. on raised platform; in front of him, Liberalitas pouring wealth out of cornucopiae; in front of platform, two men standing r., the foremost holding up robe to receive benefits. Cohen <sup>2</sup> ii. p. 185, 950.	'First brass' [121 A.D.]. Found 2' below surface in trenching area of Praetentura, E. side of fort.
226	Similar; but bust.	MONETA AVGVSTI SC Moneta standing l., with scales and cornucopiae. Cohen <sup>2</sup> ii. p. 186, 97	'First brass' [121 A.D.]. Find- spot doubtful.
227	Similar.	RESTITVTORI ORBIS TERRARVM SC Hadrian standing l., raising with r. hand kneeling female figure, who grasps globe; roll in his l. hand. Cohen <sup>2</sup> ii. p. 213f, 1285.	'First brass' [121 A.D.] Found in the South Annexe (Fore- ends=O.S. No.607).

NO.	OBVERSE.	REVERSE.	REMARKS.
228	HADRIANVS AVG COS III PP Bust r. laureate.	RESTITVTORI PHRYGIAE SC Hadrian standing l., raising with r. hand kneeling figure of Phrygia. Cohen <sup>2</sup> ii. p. 214, 1286.	'First brass' [136 A.D.]. Find- spot doubtful.
229	Inscription illegible. Head r. laureate.	SALVS AVG SC Salus standing l.; in front, altar. Cf. Cohen <sup>2</sup> ii. p. 217, 1338.	'Second brass.' Find-spot doubtful.
230	Similar.	..... SC Virtus (?) standing r. Cf. Cohen <sup>2</sup> ii. p. 228.	'Second brass.' Found in the Retentura (Well Meadow=O.S. No. 608).
231	Similar, but bust.	Inscription illegible. Roma (?) standing l.	'Second brass.' Find-spot doubtful.
232	.... TRAIANVS HADRIAN... Bust r. laureate.	Female figure (Concordia?), enthroned, holding patera.	'First brass.' Found, near surface, in tracing foundation of early building beneath Blocks II and III.
233	RIANVS A.... Head r. laureate.	Indecipherable.	'First brass.' Found in Pit I (Principia) 12' down.
234	.... VS ..... Bust r. laureate.	Indecipherable.	'First brass.' Found in the Baths, one of group adhering; see No. 191.
235*	Similar.	Female figure standing l. SC	'First brass.' Found about 1862. <i>Proc. Soc. Ant. Scot.</i> v. p. 341 and p. 362.
236*	Undescribed.	Undescribed.	'Second brass.' Found about 1862. <i>Proc. Soc. Ant. Scot.</i> V. p. 342 and p. 362.
237	Inscription illegible. Head r. laureate.	Indecipherable.	'Second brass.' Find-spot doubtful.
238	Similar.	Indecipherable.	Second brass.' Find-spot doubtful.
239	Similar.	Indecipherable.	'Second brass.' A fragment. Find-spot doubtful.
240	Similar.	Indecipherable.	'Second brass.' Edges gone. Find-spot doubtful.
<b>SABINA</b>			
241	SABINA AVGVSTA HADRIANI AVG PP Bust r., with stephane.	VESTA SC Vesta, enthroned l., with sceptre and palladium. Cohen <sup>2</sup> ii. p. 254, 82.	'First brass' [132 A.D.]. Found in the Baths, in the Tepidarium.

NO.	OBVERSE.	REVERSE.	REMARKS.
242	Similar.	Indecipherable.	'Second brass.' Found in the River-bank Field (O.S. No.610).
<b>ANTONINUS PIUS</b>			
243	ANTONINVS AVG PIVS PP TR P X... Bust r. laureate.	COS IIII FIDES EXERC SC Fides standing l., with vexillum in either hand. Cf. Cohen <sup>2</sup> ii. p. 307, 376 f.	'First brass,' 155 or 156 A.D. Find-spot doubtful.
244	ANTONINVS AVG PIVS PP TR P XVII Head r. radiate.	COS IIII LIBERTAS SC Libertas standing l., with cap of Liberty and sceptre. Cohen <sup>2</sup> ii. p. 323, 539.	'Second brass,' 154 A.D. Found in E. Annexe.
245	Similar, with XVIII	Similar. Cohen <sup>2</sup> ii. p. 323, 541.	'Second brass,' 155 A.D. Found, 4' down, on top of early foundation, in tracing line of early building beneath Blocks II and III, near S.E. corner of fort.
246	ANTONINVS AVG PIVS TR P COS III Head r. laureate.	PP SALVS PVBLICA SC Salus, seated l., feeding serpent twined round altar. Cohen <sup>2</sup> ii. p. 343, 739.	'First brass,' 140–143 A.D. Found, 2' or 3' down, on E. side of fort.
247	ANTONINVS AVG PIVS IMP II Similar type.	PP TR POT XXI COS IIII SC Fortuna standing l., with patera, cornucopiae, and rudder. Cohen <sup>2</sup> ii. p. 369 f., 1033.	'First brass,' 158 A.D. Find-spot doubtful.
248	Inscription illegible. Head r. radiate..... SC	Female figure standing l., attributes doubtful.	'Second brass.' Find-spot doubtful.
249	Inscription illegible. Head r. laureate.	Indecipherable.	'Second brass.' Found in the River-bank Field (O.S. No. 610).
<b>FAUSTINA SENIOR</b>			
250	DIVA FAVSTINA Bust r. draped.	AETERNITAS SC Aeternitas veiled, standing l., raising r. hand. Cohen <sup>2</sup> ii. p. 415, 29.	'Second brass.' Find-spot doubtful.

NO.	OBVERSE.	REVERSE.	REMARKS.
251	Similar.	Similar. Cohen <sup>2</sup> ii. p. 415, 29.	'Second brass.' Found in Block XIII.
252	Similar.	CONSECRATIO SC Vesta standing l., with torch, holding patera over altar. Cohen <sup>2</sup> ii. p. 425, 162.	'First brass.' Found in S. Annexe, in field to S. of Railway (O.S. No. 554), near the surface.
253	Similar.	PIETAS AVG SC Pietas standing l. at altar. Cohen <sup>2</sup> ii. p. 432, 250.	'Second brass.' Find-spot doubtful.
254	Similar.	Inscription illegible. Female figure standing l., attributes doubtful.	'Second brass.' Find-spot doubtful.
255	Similar.	Indecipherable.	'Second brass.' Found in filling of inner ditch of W. Annexe, where it cuts across the Baths. The depth suggested that it had been dropped in the filling.
<b>MARCUS AURELIUS</b>			
256	AVRELIVS CAESAR AVG PII FIL Youthful bust r., bare-headed.	TR POT VIII COS II SC Athena, armed, standing l., holding owl in r. hand. Cohen <sup>2</sup> iii. p. 66, 667.	'Second brass,' 154 A.D. Find-spot doubtful.
257	Similar.	TR POT VIII COS II SC Similar type, but Athena holds small Victory. Cohen <sup>2</sup> iii. p. 67, 678.	'First brass,' 155 A.D. Found in inner court of Principia, on level of gutter of last occupation.
<b>FAUSTINA JUNIOR</b>			
258	FAVSTINA AVG PII AVG FIL Bust r. draped.	FELICITAS SC Felicitas standing l., with caduceus. Cohen <sup>2</sup> iii. p. 145, 108.	'Second brass.' Find-spot doubtful.
259	DIVA FAVSTINA PIA Bust r. draped; hair waved.	SC Crescent, with horns upwards, surrounded by seven stars. Cohen <sup>2</sup> iii. p. 153, 213.	'Second brass.' Found in the Retentura (Well Meadow = O.S. No. 608), in trench cut to find N. end of Barracks.
260	Inscription illegible. Bust r. draped.	Indecipherable.	'Second brass.' Edges gone. Find-spot doubtful.

The distribution of the brass or copper pieces among the various emperors and empresses is as follows:

		'First Brass.'		'Second Brass.'	
Augustus (?)	–		+ 1	=	1
Nero	1		+ 1	=	2
Vespasian	1		+ 27	=	28
Titus	5		+ 5	=	10
Domitian	4		+ 21	=	25
Uncertain Flavian	–		+ 2	=	2
Nerva	1		+ –	=	1
Trajan	20		+ 6	=	26
Hadrian	12		+ 15	=	27
Sabina	1		+ 1	=	2
Antoninus Pius	3		+ 4	=	7
Faustina Senior	1		+ 5	=	6
Marcus Aurelius	1		+ 1	=	2
Faustina Junior	–		+ 3	=	3
Totals,	50		+ 92	=	142

Hoards of early Imperial brass or copper are rare, but there is fortunately one available which was discovered at Croydon in 1905, and which must have been buried about 180 A.D.<sup>1</sup> Here is a summary of its contents so far as they could be identified:<sup>2</sup>

Claudius	1
Nero	1
Vespasian	14
Titus	1
Domitian	17
Nerva	10
Trajan	83
Hadrian	46
Antoninus Pius	47
Faustina Senior	12
Marcus Aurelius	13
Faustina Junior	20
Total,	267

It will be seen at a glance that the comparison fully bears out the evidence of the silver; The percentage of pre-Trajanic to later issues is about 49 at Newstead and only 16.5 at Croydon. It will be remembered that, in the case of the silver, the corresponding figures were 56 and 19. The difference between 49 and 56 is due to

1 Described by Mr. F. A. Walters in *Num. Chron.* 1907, pp. 353 ff.

2 Thirteen specimens were too corroded to be recognisable.

the prolonged period during which denari remained in circulation—a phenomenon which has no analogy in the inferior metals. When allowance is made for this, the closeness with which the two sets of percentages approximate is remarkable. There can be no doubt as to many of the Newstead brass or copper pieces having been lost during the occupation that began in the Flavian period. Those struck under Domitian call for more particular notice. They number 25 in all, and as many as 19 of the 25 can be approximately dated. If we keep the lesson of Haltern and Hofheim in mind,<sup>1</sup> it will appear extremely significant that 15 out of the 19 were minted in 84 A.D. or subsequent years. Either Newstead continued to be held after Agricola was recalled in 86, or the great majority of the 'first' and 'second brass' coins of Domitian were not dropped until the Antonine period. The proportion which the Domitians bear to the whole—17 per cent., as against only 6 at Croydon—makes the latter explanation extremely improbable. And the improbability will seem greater, if it be noted that two 'second brass' pieces issued in 86 A.D. (Nos. 163 and 170) were 'almost in mint condition,' when lost. The testimony of the brass or copper is therefore all in favour of the first-century occupation having been prolonged into the reign of Trajan.

1 See above, p. 387.