BULLETIN No. 2

FOSSILS RECORDED FROM THE GIPPING VALLEY CHALK

This list is not meant to be exhaustive; it has been compiled from

A. J. Jukes Brown, "On the Zones of the Upper Chalk in Suffolk", Proc. Geol. Assoc., vol.XVIII, part 2, 1903, pp.85-94.

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C. T. A. Gaster, "The Chalk Zones of Offaster pilula and Actinocamax quadratus", Proc. Geol. Assoc., vol.LII part 3, 1941, pp.210-215.

and the writer's notes (see "Fossils from the Gipping Valley Chalk", in this Bulletin).

Certain of the records below need verification (some would seem suspect or incorrect identifications); synonomy in some cases needs checking. Brydone (1932) implies that several species come from other localities (than those he gives).

SPONGES.

Porospaera globularis (Phillips) - Little Blakenham.

Porosphaera sessilis Brydone - Little Blakenham.

also P. taeniiformis Brydone and P. irregular forms from Little Blakenham, P. galeata Solley from Coddenham, P. sp. from Claydon, Coscinopora quincuncialis (T. Smith) from Claydon, a Ventriculitid from Great Blakenham, and 'sponges' from Great Blakenham and ?Bramford.

CORALS.

Axogaster cretacea Lonsdale? - Little Blakenham.

also Coelosmilia laxa Edwards and Haime from ?Little Blakenham, and ½ mile S.W. of Claydon Church, C. granulata Dune, from Coddenham and Bramford, Onchotrochus serpentinus Duno? and Stephanophyllia bowerbanki E.&H.? from Coddenham, and Parasmilia from Needham Market (Ipswich Museum).

ANNELID WORMS.

Ditrupula triminghamiensis Nielsen - Little Blakenham, Offton, Bramford, Claydon, Coddenham.

Neomicrorbis crenatostriatus (Muhster) - Shrubland (as Serpula granulata (J. de C. Sowerby)).

also Serpula ampullacea Sow. and S. fluctuata S. Woodw. from Little Blakenham, S. ilium Sow. from Coddenham and Offton, S. plexus Sow. from Coddenham, and S. sp. from Bramford and Bramford brickyard.

BRYOZOA.

Onychocella danae d'Orb. from Shrubland, Retispinopora arbuscuium Bryd. from Little Blakenham, R. patula, Bryd.? from Coddenham, Retepora? from Barking, and cheilostomes from Bramford and Claydon.

BARNACLES.

Pollicipes (or Scalpellum) sp. from Little Blakenham and Offton, Scalpellum maximum from Coddenham, and barnacle from ?Bramford.

BRACHIOPODS.

Crania egnabergensis Retzius - Coddenham.

Gibbithyris semiglobosa (J. Sowerby) - Coddenham (as Terebratula semiglobosa).

Cretirhynchia lentiformis (S. Woodward) - ½ mile S.W. of Claydon Church (as Rhynchonella limbata var. lentiformis).

also Megerlia lima Desl. from Little Blakenham, Rhynchonella subplicata Mant. from Offton, Terebratulina striata Wahl. from Little Blakenham and Offton, T. sp. from Claydon, and terebratulid from ?Bramford.

BIVALVE MOLLUSCS.

Ostrea incurva Nilsson - Little Blakenham and Offton; Bramford (as 0. cuivirostris Nilss); Barking, Claydon? and Coddenham? (as O. acutirostris, Nilss).

Pycnodonte vesicularis (Lamarck) - Little Blakenham and Bramford (as Ostrea vesicularis); Coddenham and Bramford (as 0. normaniana, d' Orb.); Needham Market and Claydon.
Gryphaeostrea caniculata (J.Sowerby) - Little Blakenham and Offton (as Ostrea canaliculata).
Ostrea semiplana J. de C. Sowerby - Little Blakenham, Offton, Coddenham.
0. boucheroni Coquard - 'Masons'.
Chlamys cretosa (Defrance) - Little Blakenham and Offton (as Pecten cretosus); Bramford, Claydon and ?Coddenham.
Neithea sexcostata (S. Woodward) - Little Blakenham and Offton (as Pecten sexcostatus).
Pteria tenuicostata (Roemer) - Little Blakenham, Offton, Coddenham, Bramford, Barking, Claydon. Spondylus spinosus (J. Sowerby) - Offton.#
Atreta nilssoni (Hagenow) - Shrubland (as Pimyodon nilssoni).
Inoceramus cuvieri J. Sowerby – 'Masons'.
also Pteria coerulescens Nilss from Bramford, Plicatula hantonensis Bryd. from Little Blakenham, Spondylus iatus Sow. from Coddenham and Bramford, Inoceramus mytiloides? from Barking, I. sp. from Bramford, Little Blakenham and Claydon, and Spondylus sp. from Little Blakenham, 'Masons' and Claydon.

BELEMNITES.

Actinocamax verus Miller - Little Blakenham, 'Masons', Barking, Bramford, - ½ mile S.W. of Claydon Church, Coddenham
Gonioteuthis granulata (Blainville) - 'Masons', Barking (Needham Market), Bramford, pit by Norwich Road between pit 600 yards SW of Claydon Chuch and Whitton, - ½ mile S.W of Claydon Church, Coddenham? (as Actinocamax granulatus).
Gonioteuthis quadrata - Little Blakenham, Bramford, - ½ mile S.W Claydon Church, Coddenham; (as Actinocamax quadratus).
Belemnitella mucronata (Schlotheim) - Bramford, and - ½ mile S.W Claydon Church, also Actinocamax (granulated) from Offton, and Belemnitella lanceolata from Bramford.

AMMONITE.

Aptychus leptophyllus Sharpe, from Shrubland.

CRINOIDS.

Bourguetiorinus sp. - Little Blakenham, Bramford, and Coddenham (as 'a calyx approaching Form 2'). "Isocrinus" sp. - Little Blakenham.
Marsupites testudinarius (Schlotheim) -' Masons'.

OPHTUROID.

Ophiura serrata Roem.? from Little Blakenham.

ASTEROIDS.

Metopaster parkinsoni (Forbes) - Little Blakenham.
Pycinaster magnificus (Spencer) - Little Blakenham, Coddenham.
Crateraster quinqueloba (Goldfuss) - Little Blakenham.
also Calliderma smithiae Forbes from Little Blakenham and Offton, Hadranderaster simplex Forbes from Shrubland, and asteroid plates from 'Masons', Bramford and Claydon.

ECHINOIDS.

Offaster pilula (Lamarck) - Bramford (as Cardiaster pilula), ½ mile S.W Claydon Church.
Hagenowia rostrata Forbes - pit by the Norwich Road between the pit 600 yards SW of Claydon church and Whitton
Echinocorys - as E. scutatus, Leske, from Bramford, Bramford brickyard, Claydon; as E. scutatus cf. var. depressa Brydone, from Bramford; as E. scutatus, large rounded form, from Bramford, ½ mile S.W Claydon Church, Coddenham; as E. scutatus, large forms, from pit by Norwich Road between the pit 600 yards SW of Claydon church and Whitton; as E. sp. from 'Masons', Little Blakenham, Offton, Shrubland; and as E., small race, from 'Masons'.

also Cidaris hirudo Sorignet? from Claydon, C. serrata Desor? from Little Blakenham, Offton, Shrubland; Cidarid from Bramford, Cyphosoma radiatum Sor. from Coddenham, ?Micraster and ?Discoidea from Bramford.

FISH.

Lamna appendiculata, Agassiz - Bramford.
also Cimolichthys lewesiensis Leidy from Shrubland, and fish remains from Little Blakenham, 'Masons' and Claydon.

(extracted by R. Markham)

FOSSILS FROM THE GIPPING VALLEY CHALK; AND A NOTE ON THE ZONES.

A list of the fossils found in the local chalk by the writer (mainly when at school) is given. Some pits have been visited more than others (reflected by number of species recorded); records for Claydon Church Lane pit (of which more details will appear in the next bulletin) include many recent finds made by members of the Geological Group.

With some genera, two or more species are probably present; one or two echinoid fragments seen in a private collection several years ago would seem to need checking.

	1	2	3	4	5	6	7	8	9	10
Sponge(s)	x			x		?		x	x	
Ventriculitid sponge				x						
Porosphaera									o	
Coral						x		? o	o	
Worm-tube						x			x	
Terebratulid						?				
Terebratulina									o	
Rhynchonellid								x	x	
Bryozoa (cheilostome)						x			x	
Barnacle						? s				
Inoceramus	x	x	x	x	x	x			x	
Ostrea vesiculosa					x	s		x	o	
Ostrea	x			x	x	x			x	
Pteris tenuicostata						x			x	
Chlamys cretosa						s			o	? s
Spondylus	o			o					o	
Actinocamax verus	x			x	x	x			x	
Gonioteuthis	x	x	x	x	x	x			x	
Belemnitella						o			x	
Echinocorys	x			x		x	x	x	x	
?Micraster						s				
?Discoidea						s				
Cidarid						s			o	
Offaster pilula						s				
Marsupites				x						
Bourgueticrinus						s				
Asteroid				x		s			? o	
Fish (scales and bones)	x			x		x		x	x	

1 Little Blakenham (Blood Hill) TM 112 485
2 Little Blakenham TM 109 489
3 Little Blakenham TM 109 491
4 Great Blakenham ('Masons') TM 112 499
5 Needham Market TM 094 542
6 Bramford (ex. 'Coes Pit') TM 129 482
7 Bramford TM 129 488
8 Claydon ('William's') TM 135 491
9 Claydon (Church Lane), TM 136 498
10 Coddenham ? TM 120 548

x = collected by writer
o = collected by others when writer present
s = collected by others, later seen by writer

Further collecting will of course add more records, but it should be done sratigraphically. Chalk pits are dangerous, particularly after the frosts of winter and early spring when many pit-owners restrict access.

Our local chalk has generally been divided into

Zone of Belemnitella mucronata (c.30ft. visible), on

Zone of Gonioteuthis (c.120ft. visible).

The writer has been able to collect from horizons above and below those of earlier writers experience, and suggests that the local zones may in fact be Zone of Gonioteuthis, on Zone of Marsupites.

Marsupites was first found about eleven years ago at the very base of 'Masons' pit, Great Blakenham, and its finding is due to the great depth to which the chalk has been worked.

The Claydon Church Lane pit shows slightly higher chalk than that available in the Bramford and old Claydon pits, and Gonioteuthis quadrata has been found above the Belemnitella chalk; as Gonioteuthis quadrata does not appear to have been recorded in B. mucronata chalk, it is probable that our local Belemnitella is not B. mucronata, but perhaps B. praecursor (which is recorded from Gonioteuthis chalk), and that true mucronata zone may not occur in the Gipping Valley.

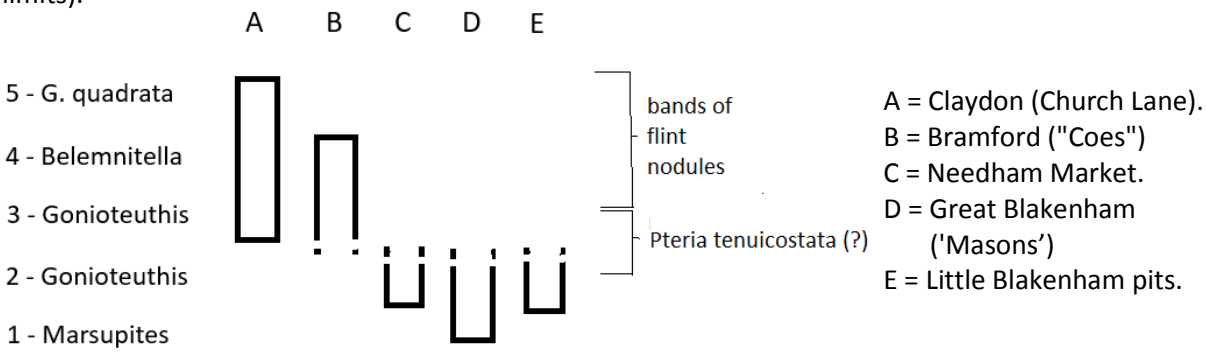
The local chalk is easily split into a number of horizons? I hope that the following observations will be of use as a guide for the more detailed studies of future workers,

5 - horizon of Gonioteuthis quadrata.
4 - horizon of Belemnitella
3 - horizon of Gonioteuthis, and Echinocorys (as a common fossil).
2 - horizon of Gonioteuthis (with Inoceramus and Ostrea also common).
1 - horizon of Gonicteuthis and Marsupites.

In horizion 5, the Gonioteuthis usually have the pseudoalveolar cavity preserved, it is generally deep and quadrate; in horizons 1, 2 and 3, the anterior ends of the guards of Gonioteuthis are usually imperfectly calcified - when it is present (in only a very few specimens) it is not quadrate nor quite so deep.

Bands of flint nodules are common in horizons 4 and 5. Echinocorys is common in horizons 3, 4 and 5, hut seemingly not so below.

The diagram below shows the horizons present in certain pits (dashes - uncertain upper or lower limits).



Little work has been done on thicknesses; horizons 1, 4 and 5 are probably all at least ten feet, 3 is probably three times this, and 2 is by far the thickest (and least studied); these are only meant as a rough guide. Pteria tenuicostata (which may be used as a zonal fossil) has been found in the lower parts of Claydon (Church Lane) and Bramford ('Coes') pits, and has been recorded from several other localities.

R. Markham.

CHALK IN THE ORWELL VALLEY.

An elongated (12 yards) mass of chalk was seen forming the E. rim of the dredged channel of the Orwell, at a location approximately 400 yards downstream from a point opposite Piper's Vale swimming pool. The feature was seen in May 1963 when at a low spring tide it was possible to walk out to the channel edge on a stony 'hard'. No opportunity has arisen since to revisit the feature during a suitably low tide.

C. Allen.

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Extracted by R. Markham

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R. M.

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Extracted by R. Markham.

THE GEOGRAPHY OF THE 'CRAG SEA'

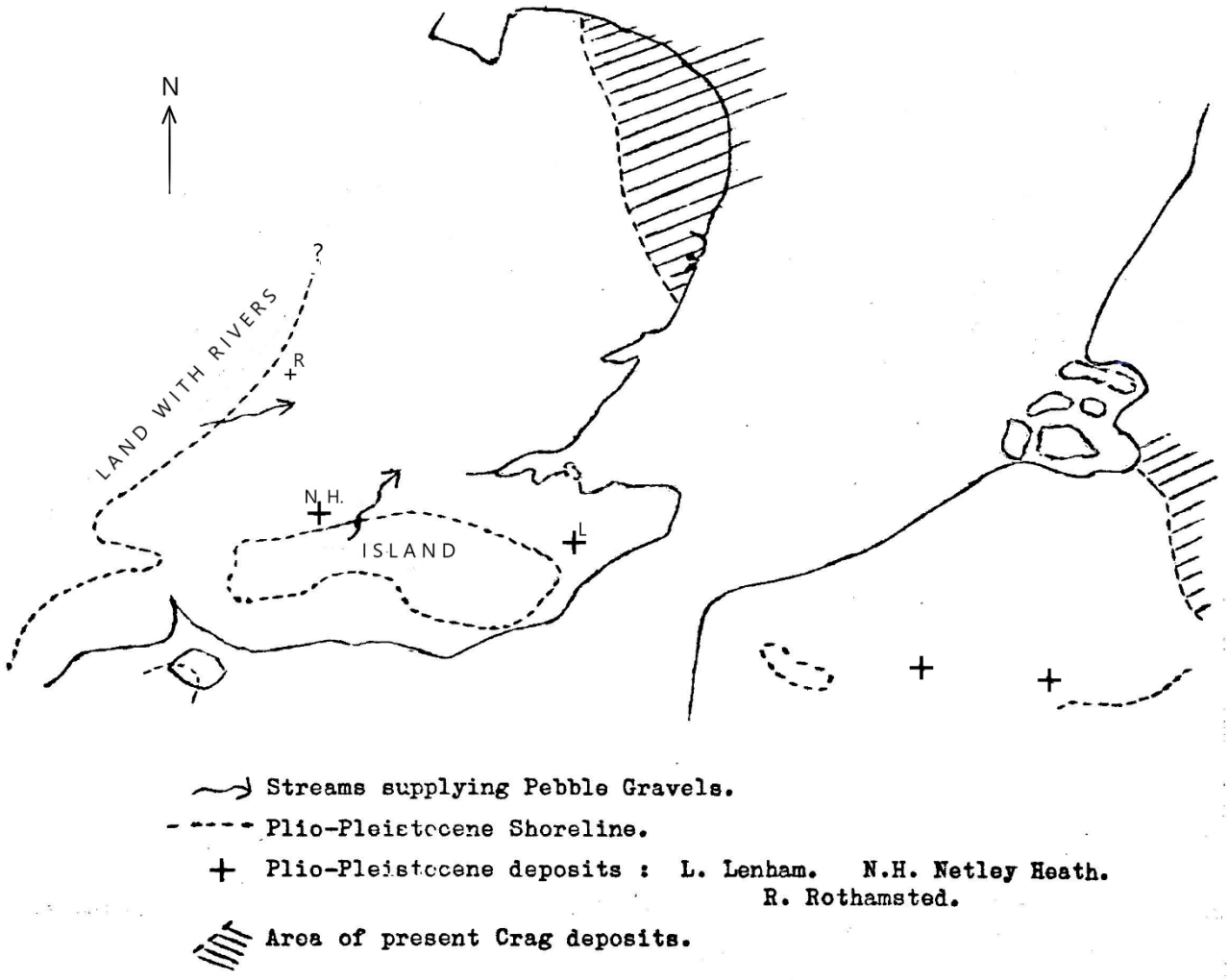
The evidence for the extent and character of the sea which deposited the East Anglian Crags is scanty. Harmer in 1902 described the Crags as being the deposits of a shallow sea which was part of a slowly subsiding basin, represented today by the North Sea.

The base on which the Crags rest emphasises the nature of this basin, and the amount of subsidence that has taken place. This base is at 600ft.O.D. in the Chiltern Hills, 400ft. in South London, -200ft. at Lowestoft and -1,200ft. at Utrecht.

The extent of the Plio-Pleistocene sea is traced mainly by the recognition of erosion surfaces. Marine erosion surfaces are landforms which have a small relief amplitude and cut across underlying structures. They are recognised by field observation, by the inspection of contoured maps, by the pattern of drainage they support and by any deposits resting on them. The surfaces typically slope at 10-80ft. per mile and may be terminated by a rise or a series cf bluffs representing an old cliff line.

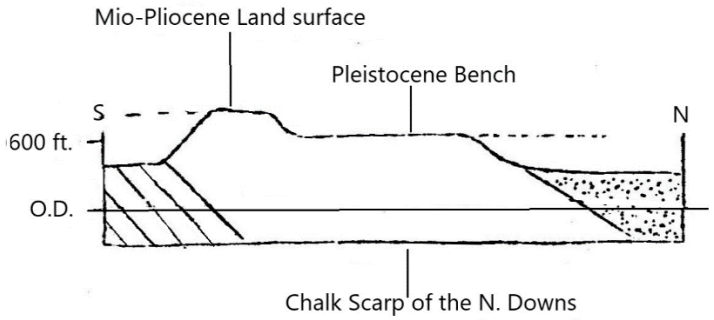
Much controversy has .entered on the surfaces cut in S.E. England, to which references are given below. Today, a platform cut on an old land surface by rivers and now elevated to 700ft. O.D. on the North Downs is dated as Mio-Pliocane in age. Below this, a surface cut by a sea is traced around the Weald and along the edge of the Chilterns. The Central Weald at this time remained an island.

Shorelines of the Crag Sea - map

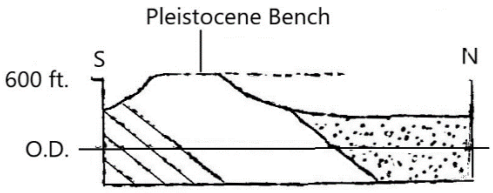


Schematic diagrams of the surface remnanats in the N. Downs

Colley Hall



Netley



On the marine surface, a number of deposits have been recorded. At Lenham in 1857, fossiliferous sands were found. These deposits contain a fauna of Diestian Age (which is Pliocene and older than the Gedgravian deposits of E. Anglia). At Netley Heath, Headly Heath, Sanderstead and other scattered localities, patches of gravel rest on surfaces cut in the chalk or Eocene deposits. At Netley Heath, a Pleistocene fauna has been recorded. The platform on which these deposits rest can be projected across the Thames valley onto the Chiltern plateau, where Red Crag fauna has been recorded at Rothamsted (Herts).

The 1948 Plio-Ploistooene boundary was drawn up mainly on Continental evidence and correlations. In this country, the Plio-Pleistocene spread of the 'Crag Sea' is diachronous, the limits of the Pliocene sea being a very tentative line somewhere to the west of the deposits of East Anglia and Lenham. Following the deposition of Coralline Crag deposits, the sea advanced to establish a shore line along the Chilterns and the Weald during its maximum extent in Red Crag times; there was however a period of regression of the sea in the Plio-Pleistocene interval, exemplified in East Anglia by the sharp faunal break between Coralline and Red Crag deposits, and also by the erosion of the Coralline Crag mass, only remnants of the former extent being preserved within the region.

Towards the close of Crag Sea: times, the so called Pebble Gravels were deposited by rivers flowing off the unsubmerged land. These have been correlated with various late Lower Pleistocene deposits, such as the Westleton Beds.

Outside S.E. England, the reconstruction of Crag times geography is very tentative. In S.W. England, gravels near Barnstaple may be Lower Pleistocene in age, representing a sea level of 150-200ft. The fossiliferous beds at St. Erth in Cornwall suggest a sea-level estimated between 200-400ft.

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C. Allen.

RED CRAG BARNACLES AT BRAMFORD

Three specimens of Balanus sp, adhering to a black rounded flint pebble were collected from the pebbly 'Red Crag Sands' on the E. face of the Bramford (Coe's) Chalk Pit in 1959.

C. Allen.

SIZEWELL NORWICH CRAG; RIFLE RANGE SITE (1953)

The small excavation "by the 100 yard firing point, now filled in, was extremely rich in molluscan remains of which the fauna is unpublished. A related fauna occurs near Shell Pit Cottages near Thorpeness Halt. Traces of an apparently similar assemblage was noted from trenches at Wangford which also yielded part of an antler of Euctenoceres tetraceros.

The fauna includes;-

		R/R pit	SPC
Neptunea antiqua	rare	x	?
Scala (Boreoscala)	uncommon	x	x
Turritella communis		x	x
Leucoma fusiformis	rare	x	
Melampus pyramidalis		x	x
?Paludestrina minuta	abundant	x	x
Purpura (Nucella) lapillus	small	x	x
Trochus (Gibbula) cinerarius	rare	x	?
Eumargarita crassistriata	rare	x	
Ringicula buccinea	rare	x	
Littorina littorea	abundant	x	x
Bela scalaris	rare	x	
Natica (Lunatia) catena		x	x
Natica (Lunatia) nana		x	
Potamides (Phytopotamides) tricinetus	v. common	x	x
Calyptraea chinensis	rare	x	
Margarita elegantisima	rare	x	
Paludina lenta	rare	x	
Pleurotoma inermis v. nuda	rare		x
Amouropsis islandica	rare	x	
Succinea oblonga		x	
Cardium edule	abundant, small	x	x

Although it is believed there is no section now open it is desirable that there should be farther investigation. It should be noted therefore that a small excavation below the turf will most probably expose the shelly crag sand. Sieving is essential to collect the small species.

The large excavations for the nuclear power station exposed a great area of sand in which no entire shells were seen, only minute intermediate fragments were found.

At Wangford main street trenches were dug to about ten feet and there is about two to three feet of decalcification. It may be possible to dig in the field west of the street after the harvest and should excavation be contemplated, as two mammalian fossils, cetacean and terrestrial, were found in a short section of trench it is possible this area may be richer in vertebrate fossils than some other sites. In any event the Blyth Valley has produced many bones and teeth of Villafranchian fauna in the past twenty years.

H. E. P. Spencer.

CRAG FOSSILS FROM BROOME (1963)

A temporary excavation at Broome (NGR:TM 348915) near Bungay enabled a variety of fossils to be collected from the (at this site) very stony Norwich Crag; unfortunately the in situ position of the remains was not seen, as the Crag was below water-table and specimens had to be collected off spoil-heaps.

It is interesting to note that this locality affords an example of direct superposition of Upper Pleistocene fauna (Valley Gravel with mammoth, Mammuthus primigenius) on Lower Pleistocene (Norwich Crag).

Faunal list

Macoma obliqua	C	Neptunia antiqua	
M. praetenuis	C	Nucella lapillus	C
M. calcarea?		N. tetragona	1
Cardium edule	C	Turritella communis	2
C. angustatum?	1	T. incrassata	1
Serripes groenlandica	1	Potamides tricinctus	C
Ensis siliqua	C	'Natica' catena?	1
Mytilus edulis	C	Littorina littorea	C
Pecten pseudoprinceps	1	Viviparus	2
Chlamys opercularis		Paludestrina	
Nucula sp.		Calyptraea chinensis	
Yoldia oblongoides			
Phacoides borealis	2	Cliona (borings)	
Divaricata sp.	3		
Arctica islandica	C	Polydora (borings)	
Astarte semisulcata	1		
A. montagui	1	Barnacles	
Spisula ovalis	C		
Abra sp.	2	Proboscidean - ivory fragments	
Scrobicularia plana	1		
Mya arenaria	C	Cervid - fragment of antler	
M. truncata			
Corbula gibba	1	Equid - portion of tooth	
Platax woodwardi		Gazelle - left horn-core and	
Raia clavata		piece of occipital	

This list is not meant to be a critical study, and has not been checked since collection; for some mollusca, number of specimens found is given (C = common), Macoma obliqua is commonest bivalve, followed by Cardium edule and Macoma praetenuis; Nucella lapillus the commonest gastropod. Mytilus edulis and Mya truncata (4 specimens) were found with valves joined. Cardium angustatum? needs a more complete specimen for verification. Astarte semisulcata and Scrobicularia are not usually associated, although they are here represented by only single specimens; it may be that more than one horizon is represented. Two shells (both incomplete) are of particular interest, - Pecten pseudoprinceps S. V. Wood (found by John Riches of Broome) - only a few specimens are known, and Nucella tetragona (a not uncommon Red Crag shell, but rare in Icenian; the Broome specimen is much darker-coloured than the associated shells and is possibly derived; it is unfortunate that it could not be seen in situ).

Fish remains are very common, and pieces of mammalian bone occur - the most interesting of those is a left horn-core and part of the occipital of a gazelle, also found by John Riches and kindly presented to Norwich Castle Museum (Accession Number 318.963).

About nine horn-cores of gazelle have been found in the Crag-

1 - Norwich Crag, Thorpe near Norwich; in Geol. Surv. Museum. (1)
2 - Norwich Crag, Thorpe near Norwich; in Geol. Surv. Museum. (1)
3 - Norwich Crag, in Brit. Mus. (Nat. Hist.) (1)
4 - Norwich Crag, Bramerton. (2)
5 - Norwich Crag, Thorpe. (3)
6 - Norwich Crag, Horsead; in Norwich Museum.
7 - Norwich Crag, Broome; in Norwich Museum.
8 - Red Crag, Felixstowe; in Ipswich Museum.
9 - Red Crag, in Ipswich Museum.

(1) record from E. T. Newton, (1884), Quart. Journ. Geol. Soc. vol. xl. pp.280-282
(2) M. Hinton, (1908), Geol. Mag. vol.5
(3) J. Sainty, (1929), Proc. Prehist. Soc. East Anglia, vi, pt.2, pp.58 & 66.

Certain other bones from the Crags have been referred to Gazelle/Antelope.
The specimens have been referred to Gazella anglia E. T. Newton, except the Bramerton one, referred to G. daviesii Hinton. On the continent, G. scheuderae Hooijer is recorded from the Reuver Clay and G. borbonica Deperet, from St. Vallier, Val d!Arno, etc.. Gazelle has been recorded from Coralline Crag (A. S. Woodward) and from Forest Bed, Norfolk (Nicholson & Lydekker)} these are probably errors.

R. Markham

NOTE ON NUCELLA IN THE WEYBOURNE CRAG, (April 1963).

An interesting discovery in the basal layer of the Crag west of West Runton Gap is the occurrence of flints with up to half-a-dozen specimens of Nucella lapillus (Linne) lying around the edges. Modern molluscs of the same species may be seen crawling on flints at the same locality, and it is suggested that the fossil molluscs were crawling over the 1 fossil stones1 before becoming covered with sediment. Double valves cf bivalve molluscs are common in this layer, but it is seldom that gastropods can be shown to approximate to their 'position of life'.

R. Markham.

(Previously duplicated in Norfolk Research Committee Bulletin No.16 (1966) pp.3-4, see "Note on Nucella and Neptunea in the Weybourne Crag"; I am grateful to be able to reproduce it here).

A FOREST-BED PIG

The finding of an incomplete skull of a pig in the Upper Freshwater Bed of the Cromer Forest Bod Series at West Runton in January 1958 is recorded by Miss E. B. Green in "Notes on Recently Discovered Remains of Extinct Norfolk Mammals", Trans. Norf. Norw. Nat. Soc., 1960, Vol.19, part 2, pp.69-72. Part of the skull was found embedded in a sandy layer beneath the black bed (which is so conspicuous at this site), at its junction with the upper bed. The skull is recorded as "incomplete, the front portion being missing, but most of the hinder part remains. Much of the skull is shattered and, unfortunately because of distortion due to crushing, it may be impossible to repair completely the surviving portion. All the molars and premolars remain on the left side as well as the socket for the incisor, but on the right side there are only two molars. These teeth are fairly worn and it is obviously the skull of a mature beast. This is the most important fossil of pig to be recovered from the Forest Bed". It is referred to Sus scrofa L.

In 1963, a portion of right mandible of a large pig was found by R. M. Jacobi, in the sandy deposit below the black bed east of Goss's Gap, West Runton, and was recorded by the present writer in "Notes on Three Mammalian Jaws from the Forest Bed", Norfolk Research Committee Bulletin No 16, 1966, pp.2-3. The well-preserved dentition consists of the broken canine, premolars (all three) and molars 1,2,3; on study in conjunction with the above skull, it was found that although the height of the crowns of the teeth in the skull is not as great as in the lower jaw, the occlusal surfaces join perfectly, suggesting the remains possibly belong to the same animal. The finding of the skull and mandible from the sane stratum and locality is indeed a fortunate coincidence; both specimens are preserved in Norwich Castle Museum.

Contortions (?cryoturbations) at the junction of the sandy and black beds may be responsible for the much shattered condition of the skull.

R. Markham.

NOTES ON THE FOREST-BED DEER JAWS IN NORWICH CASTLE MUSEUM.

Most of the Forest Bed deer remains in Norwich Museum were studied by A. Azzaroli in 1951, and many were mentioned or figured by him in 1953 in "The Deer of the Weybourn Crag and Forest Bed of Norfolk", Bull. Brit. Mus. (Nat. Hist.), Geology, vol.2, no.1. The writer, when inspecting the jaws in the early 1960s., referred more material to species or genera, and made some measurements; the results of these studied are given here -the material has not been checked since, and I work from my notes.

Deer are usually classified by antlers, the teeth (in contrast to other mammalian groups) playing a secondary part. In these notes, only the teeth and jaws are mentioned; they have not been here studied in relation to antlers. Four distinct types appear to be present, - Megaceros, Libraless, cf. Dama, and ?Euctenoceros; mandibles have been chiefly used. The locality and deposit of many specimens is unknown; presumably most are from the Forest-Bed.

(FC) - Norwich Castle Museum Fossil Catalogue Number.
(AN) - Norwich Castle Museum Accession Number.
(Azz) - determined by A. Azzaroli; any errors in other determinations will be those of the writer.
(NCM) - Norwich Castle Museum

MEGACEROS

The genus is characterised by marked hyperostosis (thickening) of the mandibular ramus, used here as the chief feature for identification. Three species are important (Azzaroli gives figures and desciptions).

M. verticornis (Dawkins)

M. savini (Dawkins) - teeth intermediate in size between M. verticornis and

M. dawkinsi (Newton) - teeth smaller than above species. Anterior folds on lower molars; hinder portion of P4 bordered by small burr near base of outer wall. Hyperostosis of lower jaw well marked.

MEGACEROS MANDIBLES.

FC 199	- Megaceros dawkinsi (det. by ?). Posterior portion of left mandible with M2 (roots), M3? and ascending ramus.
FC 200	- M. dawkinsi? (Azz). Posterior end of left mand. with M1(fragment), 2 (broken), 3(roots), and portion of ascending ramus. 'Cromer' (A. Gurney coll.).
AN 61.18(103)	- M. dawkinsi? Left mand. with M1 (root), M2 (roots), M3, and portion of ascending ramus. The jaw shows well marked hyperostosis, is certainly Megaceros, and may be M. dawkinsi. From Kessingland (Crowfoot coll., ex. Mr. Thompson).
AN 465.959	- M. dawkinsi? A fine near-complete right mandible found at Paston, near Bacton, by Mr. R. West in October 1959, may probably be assigned to this species. The mandibular ramus is thick (hyperostotic), characteristic of the genus. Most of the ascending ramus is present, also portion of the bone in front of the premolar teeth; premolars 3 & 4, and molars 1, 2, 3, are present. The length of the tooth row, and the small burr near the base of the outer wall of the last premolar are features of the specimen characteristic of M. dawkinsi? the anterior fold is well seen in M1 but is very fain" in M2 and 3? the basal column is strongly developed in M1, is small in M2, and is obscured in M3. Length, of molars 77mm. Breadth of M2 13mm. The hyperostosis is moderate and is not so well marked as some identified with this species (e.g. the three above specimens). The colour of the specimen varies from blue-black to grey-buff, and patches of ferruginous sand and gravel matrix adhere. (This jaw previously noted in Norf. Research Comm. Bull. No.16, p.2).
PC 202	- M. savini? Portion of left mand. with PM4, M1, M2, M3; length of molars 83mm; M2 breadth 16mm. (Rev. J. Crompton coll., 50.7l). (det. Azz).
PC 211	- M. verticornis? (Azz). Left mand. with P3, 4, M1, M2, M3. Length of molars 93mm. M2 breadth 17mm. From Kessingland (R. J. Colman coll.).
PC 213	- M. verticornis? (Azz). Right mandible with M2, 3; M2 breadth 19mm. From Corton, 6 March 1883 (R. J. Colman coll.). The writer prefers to refer it to M. sp.; however, it appears that some confusion of numbers may have taken place since Azzaroli's visit, and I am not certain that we are talking about the same specimen.
PC 203	- M. sp. (Azz). Portion of right mandible with M2 (fragment of root) and another fragment of molar.
PC 205	- M. sp. Left mand. with M1 (fragment), 2 (broken), 3 (slightly damaged), with portion of ascending ramus. (Pitch coll.)
PC 206	- M. sp. Portion of right mand. with roots of 2 teeth. From Cromer (Gurney coll.}.
PC 208	- M. sp. (det. Azz?). Portion left mand. with M2 & M3 (both damaged).
PC 210	- M. sp. (Azz). Portion of left mand. with M1, M2, M3 (3rd. lobe broken); breadth of M2, 16mm. From Kessingland (R. J. Colman coll.)
PC 214	- M. sp. Left mand. with H1 (broken), 2, 3; M2 breadth 18.5mm. From Corton, 6 March 1833 (R. J. Colman coll.).
AN 61.18(3066)	- M. sp. Right mand. with M3. From Kessingland (Crowfoot coll., ex Mr. Thompson).
AN 61.18(3068)	- M. sp. Right mand. with roots of P4 & M1, and M2 & M3. M2 breadth 16mm. (rather difficult to measure). From Kessingland (Crowfoot coll., ex Mr. Thompson).

AN 41.18 (3069)	- M. sp. Eight mand. with P4 (root) and (all broken) M1, M2, M3, with portion of ascending ramus. M2 breadth 17mm. From Kessingland (Crowfoot coll., ex Mr. Thompson).
FC 3810, AN 61.18(4008)	- M. sp. Right mand. with P2 (root), P3, P4, and (all slightly broken) M1, M2, M3, with portion of ascending ramus. Length of molars c.55mm. (difficult to measure, as M3 broken); M2 breadth c.13mm. (M2 slightly broken). (Crowfoot coll.,ex Angell coll.).
FC 3515, AN 38.09	- M. sp? (Azz). Portion of left mandible with M1, M2, M3; length of molars 98mm; M2 breadth 16.5mm. (Rev. E. E. Mentford. coll)
PC 3550	- M. sp. Portion of Left mand. with M1. From Corton (Colman coll. ex. H. Smith).
FC 3809	- M. sp. Right mand. with roots of 3 teeth. From Pakefield, 1887 (Fitch coil.}.
FC 3814, AN 42.948(8)	- M. sp. Left mand. with P4, M1, M2, M3; length of molars 85mm. M2 breadth 16.5mm. From Upper Freshwater Bed, West Runton (Savin coll.).
FC 3816, AN 42.948(37)	- M. sp. Portion of right mand. with M3 (broken). From Overstrand (Savin coll.).

	Nor. Castle Mus. Ref.	Length of the three molars (mm)	Breadth of M2 (mm)
Megaceros verticornis?	211	93	17
Megaceros savini?	202	53	16
Megaceros dawkinsi?	465.959	77	13
Megaceros ?	3515	98	16.5
Megaceros ?	3814	85	16.5
Megaceros	3810	c.55	c.13

3810 seems to be Megaceros, but appears rather on the small side.

LIBRALCES (Elk).

Elk tooth are distinctive, and single teeth are easily identified. The lower molars have strong basal columns. Azzaroli figures and describes several species, three of which are important here -

Libralces gallicus Azzaroli
Libralces latafrons (Johnson) – jaw intermediate in size between L. gallicus and…
Libralces reynoldsi Azzaroli - jaw size exceeds L. gallicus by roughly half.

Three mandibles in Norwich Museum were referred to Libralces by Azzaroli –

PC 3549, AN 116.22(2) – Libralces reynoldsi (Azz). A fine right mandible with P4, M1, M2, M3; length of 3 molars 112mm., breadth of M2, 24mm. (Azzaroli gives 25mm.). Recorded as 'Cromer' (Buxton coll.). Figured by Azzaroli, Fig.7.A.

PC 296A - Libralces latifrons? (Azz). Portion of a right mandible with M3 (damaged). Found at Walcot, 1877 (Fitch coll.).

AN 73.959(4) - Libralcas gallicus (Azz). Fine right mandible with P3, P4, M1, M2, M3. From West Runton (shelly crag over stone bed, between W. & E. Runton) (J. E. Sainty coll.).

Single teeth that may be referred to elk are (FC nos.) 3827 (RM/.), 3828 (RP/4), 3829 (RM/.), and perhaps 3831 (LM/.).

	Ref.	Length of the three molars (mm)	Breadth of M2 (mm)
Libralces reynoldsi	N. C. M. 116.22(2)	112	24
Libralces latifrons	Savin 168	88	20
Libralces gallicus	Brit. Mus. M.6206	80	19

DAMA (Fallow Deer)

Three fine mandibles, all from the Upper Freshwater Bed, West Runton, (Savin coll.) may perhaps be referred to fallow deer.

PC 3548 – Dama ? (Azz). Left mandible with P3, P4, M1, M2, M3, with portion of ascending ramus. Some matrix (grey silt with freshwater shells, incl. Pisidium) remains inside. Length of molars 62mm., M2 breadth 12mm. (measurements rather difficult to take because of some obscuring matrix).

FC 3813 - Dama? Right mandible with P4, M1, M2, M3.

FC 3815, AN 42.948(9) -Dama? Left mandible with P3 (broken), P4, M1, M2, M3. Length of molars 59.5mm., M2 breadth 12mm.

For comparison, some measurements of a modern fallow deer (Dama dama) are given (NCM Acc. No., 114.26) -

Left mandible with P3, P4, M1, M2, M3: Length of molars 57mm.. M2 breadth 11mm.

Right mandible with P3, P4, M1, M2, M3: Length of molars 57mm.. M2 breadth 10mm.

EUCTENOCEROS

Azzaroli gives measrements, and figures the dentition of certain species, but there is little descriptive matter.

PC 3547, AN 7.945(45) - Euoctenoceros sedgwicki? (Azz). A fine right mandible, from Trimingham (A. C. Savin coll.). Azzaroli figures it (Figs.46, 47), and describes it, "young but fully grown;.....teeth massive;,....P4 has a complete internal wall and molars bear a strong anterior ridge. Ramus depressed and thick.....a large coronoidal process. Breadth of M2 is 17mm.. Either "Cervus obscurus or Euctenoceros sedgwicki".

FC 204 - Euctenoceros sp. A median portion of left mandible, with M1 (broken) and M2 (damaged); the two molar teeth bear anterior ridges, and the specimen is provisionally referred to E. sp.; M2 breadth 13mm. From Bacton (Gurney coll.).

Maxillae - a few maxillae may perhaps be mentioned –

FC 206A - right maxilla with M1 & M2 (damaged), M3. From Cromer (Gurney coll.).

FC 209 - left maxilla with P3, P4, M1, M2, M3 (all molars slightly broken). Length of molars 63mm.; M2 breadth 19mm. (Pitch coll.). The teeth bear traces of a cingulum... (the upper molars of Euctenoceros are described as having a discontinuous cingulum).

PC 212 - fragment of maxilla with molar fragment. From Corton, 6 March 1883. (R. J. Colman coll.).

PC 3551, AN 116.22(3) - Megaceros dawkinsi? (Azz). Portion of left maxilla with P4, M1, M2, M3. Length of molars 64mm, M2 breadth 19mm.; two loose premolars possibly belong to this specimen. From Cromer (Buxton coll.).

C 3552, AN 7.945(64) –l eft maxilla with P2, P3, P4, M1, M2, M3. Total length of teeth 118mm., length of molars 68mm., M2 breadth 21mm.. From Trimingham (Savin coll.).

FC 3747 - both maxillae; left with P2, P3, P4, M1, M2, M3, right with P2,P4, M1, M2, M3. Length of molars left) c.74mm.; M2 breadth (left) 22.5mm.; M2 breadth (right) 24mm. From Kessingland.

AN 61.18(129) - maxilla fragment with broken premolar. From Kessingland (Crowfoot coll., ex. Thompson).

In his monograph, Azzaroli records Megaceros verticornis maxilla from Kessingland in Norwich Museum; (this may be 3747).

	Ref.	Length of the three molars (mm)	Breadth of M2 (mm)
?Euctenoceros?	NCM 209	63	19
Megaceros dawkinsi?	NCM 3551	64	19
?	NCM 3552	68	21
?Megaoeros verticornis?	NCM 3747 (left)	c.74	22.5
	Ref.	Total length of tooth row (mm	Breadth of M2 (mm)
?	NCM 3552	118	21
Megaoeros verticornis	Brit. Mus.	124	22

Single teeth - of the many single teeth, several are localised; they have not been studied by writer, but may be recorded here.

AN 73.959(6) - upper molar, from West Runton (?Megaceros verticornis)(?).
AN 73.959(7) - upper molar, from West Runton (Capreolus capreolus)(?).
AN 73.959(8) - upper molar, from West Runton (Megaceros)(?).
AN 73.959(5) - portion of right mandible with Ml1, M2 (damaged). from West Runton (?Megaceros verticornis)(?).
PC 3638, AN 98.951 – upper molar, Bacton.
PC 3811 - portion of mandible, from Kessingland (Cervus elaphus)(?)
PC 38I7, AN 7.945(140) - right upper molar, from Upper Freshwater Bed, West Runton.
PC 3818, AN 42.948(39) - lower molar, from Upper Freshwater Bed, West Runton.
PC 3819, AN 42.948(15) - upper molar, from Upper Freshwater Bed, West Runton.

The identifications of these (mainly) single teeth (apparently made before acquisition by Norwich castle Museum) have not been checked by writer.

Miscellaneous specimens

PC 3812 - Megaceros sp. mandible (Fitch coll.); has been suggested as from Forest Bed, however the state of preservation does not point to this source. B. McWilliams informs me that the catalogue says "Megaceros hibernicus **not** Forest Bed, H. D. Kalke 1955".
"8" (?number of old collection) - upper molar with trace of cingulum; compare Euctenoceros.

I wish to thank Mr. F. W. Cheetham (Director, Norwich Castle Museum) for permission to publish these specimens, and Mr. B. McWilliams (Geologist, Norwich Castle Museum) for reading through these notes, commenting on some of the specimens, and giving me additional information on 3551, 61.18(129). 73.959(5-8), and 3812.

R. Markham.

UPPER PLEISTOCENE MAMMALS OF NORFOLK.

These notes are based chiefly on specimens in Norwich Castle Museum, plus some in Private Collections; no attempt at completeness has been made, neither has a search of the literature been made, but the following references are of interest-

E. B. Green, in Norfolk Research Committee Bulletins 8 (1955), 9 (1956), and 11 (1958).
R. G. West, "The Glacial and Interglacial Deposits of Norfolk", Trans. Norf. Norw. Nat. Soc., Vol. 19, pt. 6. 1961.

Most of the localities mentioned are gravel pits in river valleys.
Based on the writer's notes, made early 1960s. at Norwich Museum.

Key: NCM = Norwich Castle Museum
PVT = Private Collection.

WAVENEY VALLEY

BROOME – NGR: TM 348915 - has yielded Elephas primigenius (tusks), Bison sp. (horn-core) and a cervid pedicle ('?Megaceros?'); a large flake has been found (not in situ) by writer (NCM). A silt containing leaves of dwarf arctic trees has been recorded by Dr. West; blocks of this silt found loose in pit have yielded similar leaves, also beetle remains and specimens of the landshell Pupa, to writer. Bos has been recorded, but may be a mistake for Bison. This site is interesting in that fossiliferous Upper Pleistocene sand and gravel here rests directly on Lower Pleistocene Norwich Crag (also fossiliferous, see separate atricle).

EARSHAM – NGR: TM 313901 - yielded Elephas sp. (bone fragments) and Megaceros giganteous (antler); also from Earsham (exact site unknown) a fine right horn-core and occipital of Bison sp. (NCM).

HOMERSFIELD – NGR: TM 288856 - Elephas primigenius, Rangifer tarandus, Megaceros giganteus (a fine skull), Equus caballus (tooth). Bison sp. (horn-core) and Tichorhinus antiquitatis (upper

molar); (NCM). Records of Bos and Cervus possibly mean Bison and either Megaceros or Rangifer. A skull of Tichorhinus from Homersfield is in Ipswich Museum. Fragments of marine molluscs (Pleistocene) have been found in pit by writer, but exact provenance is unknown. Several lithologies are present in the pit.

WORTWELL - NGR: c.TM 277850 - Elephas primigenius (teeth) one scratched, recorded as ice-scratches; tusk), Bison sp. (horn-core and occipital), Rangifer tarandus (antler), Equus sp. (metacarpal, metatarsal) and 'Rhinoceros' sp. (metacarpal, ?humerus); (NCM). The Elephas, Bison and Equus are recorded as coming from a depth of c.15-30ft.

Elephas primigenius remains from WEYBREAD and HOXNE are in NCM, and from DISS in PVT; (exact sites of finds unknown). Bison, Equus and Rangifer are recorded from WEYBREAD, and a fine skull of Tichorhinus antiquitatls from WEYBREAD (NGR: TM 248818) is in Ipswich Museum.

NEEDHAM, NGR: c.TM235820 – a few bones of Rhinoceros, Equus and bovid, plus one rhino. bone in PVT (information from B. McWilliams)

Bos primigenius remains from ROYDON (NGR: TM 085802) (from silty peat') are in NCM, and a fine skull and antlers of Megaceros giganteus (apparently from Waveney Valley; exact site unknown) is in PVT.

Two faunas are certainly present in the Waveney Valley - the gravel fauna (Elephas, Bison, Megaceros, Rangifer, etc.), and the Postglacial (Holocene, Flandrian) fauna with Bos primigenius (and possibly Megaceros).

The gravel has been recorded as Gipping; the fauna is'cold'in its affinities, and could be Gipping or Weichselian. The gravel rests on Norwich Crag at Broome, but appears to rest on Lowestoft Till higher up the valley (blue chalky till on spoil-heaps at Weybread; recorded as resting on till at Homersfield).

THET VALLEY

SHROPHAM – NGR: c.TM 003938 - has yielded Elephas primigenius (molars), Elephas antiquus (molar), bovid (?Bison) (femur, metacarpal, tibia, radius and ulna, humerus, mandible), Rangifer tarandus (antlers), Equus caballus (metatarsal, tibia), 'Rhinoceros' sp, (metapodial, humerus) (NCM); a few freshwater mollusca have been seen. Bos primigenius, Ursus arctos, also other remains of Elephas antiquus have been recorded (PVT), but have not been seen by writer; another cervid may be present.

SNETTERTON – NGR: TL 994920 – at this site, peaty alluvium rests on sand and gravel, on chalky till. Elephas primigenius no doubt comes from the gravel, as may cervid (apparently Cervus elaphus) remains in a similar state of preservation to those of Elephas, (NCM). Bos and Equus come from the peat; a scapula from the peat was found to be decalcified and quite pliable (PVT).

ROCKLANDS – NGR: TL 990956 - Rangifer tarandus (antler) (PVT), 'from silty peat, on thin gravel, on chalk'; Cervus elaphus.

WRETHAM - Emys.

Faunas of several ages seem to be present in the Thet Valley. At Shropham, the Elephas antiquus (and possibly other animals) may represent Ipswichian fauna, and the Rangifer, etc., probably occurring higher in the section, Weichselian fauna. The Rocklands peat (with Rangifer) may be Late Pleistocene (Late Weichselian); the Wretham Emys is probably postglacial and is likely to be of slightly different age to the postglacial Snetterton peat.

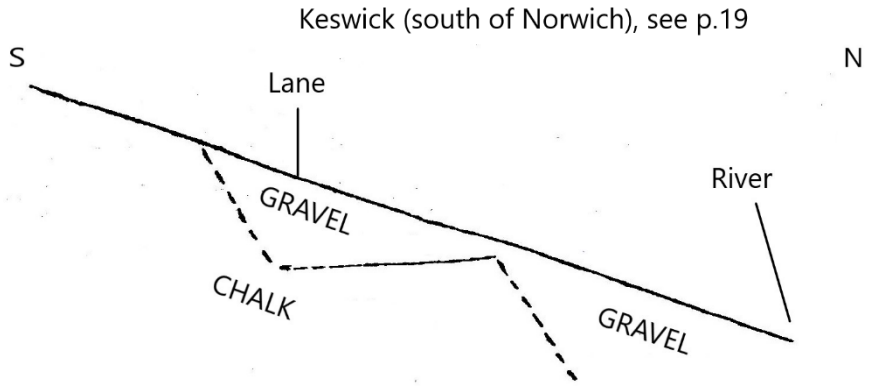
YARE AND WENSUM VALLEYS

KESWICK – NGR: TG 213051 - Acheulian-type implements (many fine hand-axes; a flake found loose by writer) (NCM). Elephas primigenius (teeth) (PVT). Two base-levels of the gravel are present (see diagram next page), the higher having been seen (resting on chalk) in a trench on the eastern edge of the pit. Gravel is 'imported' from other pits for washing, and may lead to confusion when collecting loose material.

WHITLINGHAM (Sewage Farm) yielded another fine series of Acheulian-type implements (NCM).

Elephas primigenius (tusk), Equus, and artefacts (flakes, Acheulian handaxe) have been recorded from CARROW, and Elephas primigenius from LAKENHAM, but the specimens have not been seen by writer.

A tooth of Elephas primigenius from MARKSHALL (found in making a cutting 1842) is in NCM.



PELTHORPE – NGR: TG 159186 - Elephas primigenius (NCM).

WESTON LONGVILLE (Lenwade) – NGR: TG 10901835 - well-bedded sand and gravel, contorted at top. Lamellae of Elephas tooth (NCM) found loose in pit by writer {1962); Bison (PVT) from Lenwade, ?this pit. Workmen mentioned elephant teeth and hand-axes (not seen by writer).

GREAT WITCHINGHAM – NGR: TG 095178 -Elephas primigenius (NCM); Acheulian handaxe recorded, not seen by writer.

LYNG EASTHAUGH – NGR: TG 09251775 - has yielded Elephas primigenius (teeth), Rangifer tarandus (antler), 'Rhinoceros' sp. (vertebra) (NCM).

SPARHAM – NGR: c.TG 074I77/075169 - Elephas primigenius (teeth); NCM, Acheulian hand-axe recorded from TG 076179, but not seen by writer.

LYNG –NGR: TG 06701825 - Elephas primigenius (teeth) (NCM); also in PVT from Lyng (?this pit).

also, LYNG, NGR: c.TG 065183 - mammoth tusk, fine Rangifer antler and a second fragment, also Acheulian handaxe (information supplied by B. McWilliams).

BEETLEY - has yielded an interesting fauna, Elephas antiquus, Hippopotamus amphibius, 'Rhinoceros', Cervus elaphus, Megaceros giganteus, and Bovid (most in NCM); freshwater molluscs, plant remains, etc.. A report of the Beetley site will appear in the next Bulletin

REYMERSTON – NGR: c.TG 031058/034059 - peat on gravel. Rangifer tarandus (NCM) from peat, also Bos primigenius.

EAST BILNEY - Rangifer tarandus (NCM).

Several faunas are present in this system of valleys.

Gravel yielding abundant Acheulian-type implements occurs at Whitlingham and Keswick, and apparently occupies the sides ("Upper Terrace") of the valley, as opposed to the more general valley bottom ("Flood Plain Terrace") position.

The mammoth-reindeer fauna is not well represented (or, at least, recorded), except at the Lyngs; several sites have yielded sparse mammoth teeth and Acheulian implements. The upper parts of the gravels may be disturbed (as at Lenwade).

Beetley shows a cold-warm-cold succession, with Hippopotamus and Elephas antiquus during the warm (?Ipswichian) period.

Reymerston and East Bilney have yielded Rangifer; perhaps of similar age to Rocklands.

Cervus elaphus and Bos primigenius have been recorded from the Broads (Postglacial), and deposits of similar age also range up the river valleys.

COAST

MUNDESLEY (River Bed) - Elephas antiquus and Emys (NCM).

Elephas primigenius has been recorded from the Bacton Valley Gravel. In

NCM are remains of Elephas primigenius (tusks), Ovibos moschatus, Megacerus giganteus, Rangifer tarandus and ?Tichorhinus antiquitatis (skull) dredged from NORTH SEA.

The presence of Elephas antiquus and Emys in the Mundesley River Bed suggests an Ipswichian Interglacial age.

WEST NORFOLK

PENTNEY (Nar Valley) – NGR: c.TF 702130 - has yielded Elephas primigenius (rib and teeth), Rangifer tarandus (antler), Ovibos (referred to 0. palantis by Dr. Kretzci) (a fine skull but incomplete); vertebra and ulna (rhinoceros or bovid?; to be identified) and cervid (antler); (NCM).

EAST WINCH - Equus caballus, 'Rhinoceros' sp.; a cervid antler may come from here; exact locality unknown. (NCM).

STOKE FERRY (Wissey Valley) – NGR: TL 69099 - Elephas primigenius (tooth and bones), bovid (?Bos primigenius) (tibia), 'Rhinoceros' sp. (metapodial); NCM). Bison, reindeer, mammoth and wolf recorded from this site (as 'Wretton', NGR: TL 685992).

WEREHAM - Elephas primigenius (NCM).

Only a few notes on West Norfolk are given.

Pollen analysis records show the Wretton Beds to be Ipswichian (Last) Interglacial and Weichselian (Last) Glaciation age (including Chelford Interstadial); the Pentney beds have been suggested as of Gipping Glaciation date (the fauna could also be Weichselian).

NOTES ON THE ANIMALS

	Common names
Elephas primigenius	Mammoth (Woolly Elephant)
Elephas antiquus	Straight-tusked Elephant
Tichorhinus antiquitatis	Woolly Rhinoceros
Equus caballus	Horse
Hippopotamus amphibius	Hippopotamus
Bison	Bison
Bos primigenius	Giant Ox
Megaceros giganteus	Giant Beer
Cervus elaphus	Red Deer
Rangifer tarandus	Reindeer
Ovibos	Musk-Ox
Ursus	Bear
Emys	European Freshwater Tortoise

The presence of Rangifer suggests a cooler climate than present; Hippopotamus a temperate climate. Elephas antiquus seems to be associated with warn: climatic conditions.

Associations invtiving Elephas primigenius, Ovibos moschatus, Rangifer and Tichorhinus are evidence of 'cold' (periglacial) environment. Records of breeding remains of Emys are evidence of higher summer temperatures than present day (apparently with July mean temperature at least 19° C); the present day extent of breeding animals seems to be Spain, Southern France, Italy, Greece, Balkans, E. Czechoslovakia, S, Russia, most of Poland, and N.E. Germany (it is nearly extinct at the present day in the northern parts of Prussia and Poland); non-breeding animals extend into N. France and N. Germany.

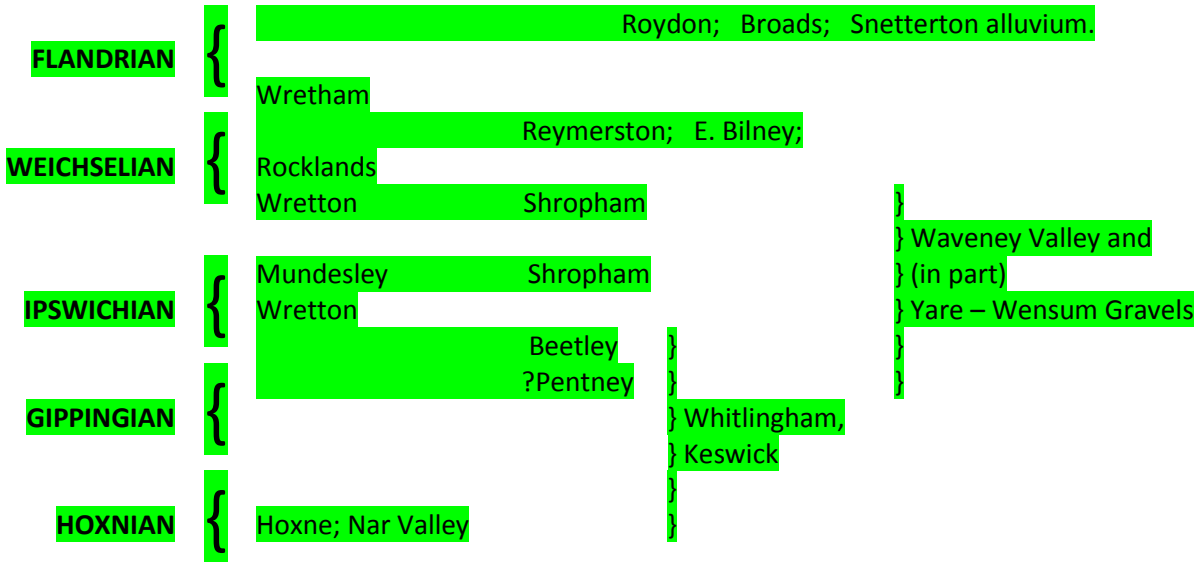
The non-existence of the southern part of the North Sea would have allowed the further extension of Emys range; identification of the animals as non-breeding or as breeding populations will allow of even more precise ecological iresults. Emjrs remains are recorded in Britain from Mundesley and Wretham in Norfolk, from Harkstead, Stoke and Bobbitshole in Suffolk, and from Yorkshire, Cambridgeshire, and Thames Valley; it appears to be characteristic of the Last Interglacial and the Holocene (?Atlantic-Sub Boreal),

Most of the remains recorded are of large animals; the smaller ones may not "be present in the gravel, also workmen and amateur collectors seem generally not to see or look for smaller hones. Many "bones of one species at a particular site may "be due to various causes, e.g. at Shropham, bovid hones were far the commonest and here represent several (at least) animals, probably a herbivore herd; at Beetley, hippopotamus bones were commonest, but do not represent a number of animals, but rather, parts of the skeleton of one beast.

It is possible that some localities (with large faunal lists) have been better worked than others (with perhaps a single record); when material is not in the museum or has not been recorded by the museum, it cannot of course appear here, leading to further bias in obtained data.

The above records are the result of collecting by many people over a number of years; all finds are important and should be reported to the local museum (that records may be kept).

The following stratigraphical table is tentative in" many places, reflecting the need for much further work



I wish to thank the owners of the specimens for permission to examine them, Mr. F. W. Cheetham (Director, Norwich Castle Museum) for permission to publish the museum specimens, and Mr. B. McWilliams (Geologist, Norwich Museum) for reading through these notes and supplying information on fauna- from Needham and Lyng.

R. Markham.

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The editor wishes to thank the people who have made this bulletin possible -contributors, subscribers, those who have helped with production, and Ipswich Museum for facilities granted; the stencils have been typed by the editor. Permission to visit pits and sections should always be obtained from the owner or occupier of the land. It has been necessary to hold two articles (on the Beetley interglacial site, and on the Battisford 'dig') over to Bulletin No. 3.