RADM

IPSWICH GEOLOGICAL GROUP

BULLETIN No. 18

SEPTEMBER 1976

CONTENTS

S. Finlay.	"Landguard Common, Felixstowe, Suffolk".	pages 2 - 4.
(William of Newburgh (reprint), translated by R. Wingfield).		
	"The Green Children of Woolpit".	4 - 5.
R.M..	"Bibliography: Journal of the Royal Anthropological Institute, vol. 33 (1903) - vol. 89 (1959)".	5 - 6.
R. Markham.	"Notes on Geological Group 'Digs' at Gedgrave, Battisford, and Wangford".	6 - 9.
T. Pain.	"The genus Neptunea in Britain".	9 - 11.
R. Markham.	"Notes on Itinerary I, Geologists' Association Guide No. 12".	11.
A.R.C. Boatman.	"Sedimentary Characteristics of the Red Crag".	12 - 13.
R.A.D.M.	"Financial Statement: Geological Group, 1975".	13.
R. Markham.	"Notes on Edward Charlesworth, 1813-1893".	14 - 16.
R.A.D. Markham.	"Geology of the Solar System".	17 - 24.
R. Markham.	"Suffolk Brickearths".	25 - 28.
J.B. Eaton.	"Coastal Studies at Orford Haven".	29 - 30.

LANDGUARD COMMON, FELIXSTOWE, SUFFOLK.

map reference TM 2831, 2832, 2932. 140 acres.

This area consists of a triangular promontory or ness of marine shingle (2-3 cm. diameter) and sand at the eastern mouth of the Orwell and Stour rivers. For hundreds of years it had belonged to the Ministry of Defence (M.O.D.) but when the Anglian regiment moved out some six or seven years ago there was considerable local controversy as to its future.

It is adjacent to the expanding dock at the west side and to the town of Felixstowe at the north: it is not suitable land for agricultural development in any way.

When vacated by M.O.D. the area had some R.A.F. married quarters. These are still occupied by R.A.F. families.

The area also contains an ancient monument, Landguard Fort; a rifle range, several old search light filments, concrete tank traps and other man made artefacts all of which have been allowed to become delapidated and in a dangerous condition - indeed Landguard Fort interior has been used recently by soldiers to practice street fighting before going to Northern Ireland.

During the last decade Felixstowe has developed into a large flourishing port dealing with E.E.C. trade as well as the U.S. and Middle East and more recently has made great strides as a passenger port. Most of the trade uses containers so large storage areas are necessary. The land acquired by the Felixstowe Dock and Railway Company including that on Landguard Common may be seen on the map in the Felixstowe Centenary Supplement of the Felixstowe Times dated 29 Sept. 1975.

When the Anglian regiment moved out of the buildings at TM 283326 these were taken over by Customs and Excise and became part of the dock complex. The Dock area is clearly defined by a high chain-link fence surrounding its area on Landguard Common. The dock area of Landguard Common now occupies some 85 acres, while the R.A.F. married quarters and the Customs and Excise take up about another 5 acres.

In the south west, an area of about 10 acres is owned by Harwich Harbour Conservancy Board (HHCB) and this is technically in Essex. There is an H.H.C.B. employee living on this land who acts as unofficial warden for the adjacent Suffolk Trust for Nature Conservancy (STNC) which will be discussed later. On the H.H.C.B. land there is also a large gravel processing plant operated by Hall Aggregates who produce fine and coarse aggregates from the material being continually dredged to keep open the deep water channel that serves both Harwich and Felixstowe harbours. This firm uses the jetty on the H.H.C.B. land.

Adjacent to these workings is Landguard Fort which was first used in a minor way in 1534, the Fort proper was erected in 1620 and a second Fort in 1667 and was in continual use till 1904. However, unfortunately Landguard Fort, albeit scheduled as an ancient monument is something of an white elephant.

It has much beauty including a magnificent granite facing - all hand made on the south east wall, a cupola built to defend the moat and the mechanism still left from the drawbridge as well as two ancient cannon at present doing duty as gate posts! It also has a plaque which bears the inscription "This battery is named Darell's battery after Captain Nathaniel Darell of Colehill, Kent, Govenor of Landguard Common 1667-70."

The Fort itself has great potential as sometimes suggested in the local press; the Felixstowe Dock and Railway Company considered buying it to make an hotel and restaurant but the expense of doing anything worthwhile with the building would be formidable and quite out of the question in the present economic situation so it is left to the rabbits and brambles - and the D.O.E.! The Dock Company, before the Fort was scheduled as an ancient monument, even considered buying it to demolish it and use the land but even that proved impossible as the Fort could not be blown up as it is too near other buildings and it is too massive and well built to be knocked down! At present the Fort is in a very dilapidated state: it is not open to the public and is in quite a dangerous condition in parts inside but it is a magnificent building which has the potential of the Portr Nigra at Trier and has spectacular views of both Harwich and Felixstowe Docks and shipping lanes.

The south east shore of Landguard Common particularly at the south end is a prograding coast line somewhat slowed down - according to the local D.O.E. expert - by the removal of so much shingle by dredging. The beach is terraced in four grades or steps each about 20 cm high and 5 m apart and at the sea edge there is alluvial sand and this is being built up inside the 200 m

breakwater at TM 283302. There are groynes along the east side of the common &they seem to collect shingle on each side and have sand in the middle. The direction at which the sea approaches this coast varies very much with tide and wind from south-east to north-west.

The sea channel to the west of the spit was blasted in 1969 and the sandstone pieces from this exercise can be seen on the shore and have been used to strengthen the breakwater at the south end,where there is a classic display of seaweeds. There are alsc plenty of sand hoppers in the bladder wrack and yellow lichen growing on the alkaline cement jetty wall in the splash zone.

The area has been overrun by rabbits but is still one of the few areas where sea spurge and hen bane can be found and the sea poppies are beautiful. Apart from rabbits galore and some rats there are few other mammals but these include the odd stoat,vole and weasel. There are large numbers of cabbage white butterflies and a few red admirals,holly blues and brown small heath. There seemed to be no evidence of land or sea worms.

Little terns nest in the area and thrushes have their cracking stones to crack the shells of the colourful snails in the area but these snails seem to be declining in number.

The marshy ground TM 285 325 area has dried up and cracked this summer (1975) due to the drought and only supports small patches of moss. The whole area is at present unsightly but work is in progress to improve the appearance.

There were many plans to develop the area when M.O.D. announced its intention of withdrawing in 1968-70 time.One was to build a power station on the site-hotly contested by the locals!-but bore holes established that the shingle etc. was 30m deep before solid chalk,on which foundations could be built,was reached.

Another suggestion was that the whole area should be bought by the Felixstowe Dock and Railway Company and developed and yet another idea that Suffolk Coastal District(which includes the late Felixstowe Urban District Council) should buy the land for recreational purposes,while naturalists pointed out that this was one of the few areas where the little terns still breed.

The agreed distribution of the land is shown in the Felixstowe Town Map(Development Plan). The dock land is heavily used and has been well fenced off-the RAF married quarters are still MOD property and the area marked CRA now belongs to the Suffolk Coastal District who are clearing away the gun emplacements,tank traps,railway lines etc,levellingthe beach, and in filling the marshy area behind the man made embankments. The coast line has groynes and concrete revetment and these,with the man made embankments, are being retained as protection against erosion from the sea bearing in mind that in the area immediatly north east of the Common,37 lives were lost in the East Coast floods of 1953. Normally there is a 3m tide range. When this work has been finished the area will be used for some recreational purposes still unspecified: there is a road access to it from Manor Terrace TM 290320 without going through the dock area.

To the naturalists and the coservationists the most important decision was to sell an area to the Suffolk Trust for Nature Conservation thus maintaining the little terns breeding area-though it should be mentioned that this year they chose to breed on HHCB land adjacent! The area also provides a quiet sheltered place for moulting gulls,resting places for migratory birds and it is hoped that the hen bane and sea spurge continue to flourish. The STNC land is screened from the Hall Aggregates Works by an abrupt rise in land that, though obviously man made originally, is quite old as it supports ilex as well as tamarisk and alder.
There are several proposals as to what STNC should do with their land. There is an access road and small tarmac area that could act as a car park for a few cars and an idea is that a railway sleeper path should be laid through the area so that interested people could walk through and observe while still keeping to the path. Another suggestion is that only one third of the area should be open for "viewing" at any one time depending on the season.

The main consensus of opinion is that the area should be well fenced off and screened from the CRA and then left as it is with the tank traps etc. in position and no access to the public without permission so that the birds can be unmolested but there is certainly a need to exterminate

or severely restrict the rabbit population which is destroying so much of the vegetation.

There are two 'groups' against this scheme- the fishermen who regularly use the coast line but this could be possibly be overcome by a permit system, and the group that advocates the CRA as a water sports centre but this seems very unlikely so near to the major shipping lanes to Felixstowe and Harwich.

Taken as a whole it would seem that this "carve up" of Languard Common is fair enough: the people of Felixstowe have got their CRA, the HHCB still keeps its "watch dog" corner and the STNC has its conservation area: true the docks have the largest slice but they are the life blood of the area. The area is quite exposed to winds from the cold areas of Europe so is not suitable for much outside amusement.

S.Finlay.

(Mrs Finlay's article was originally used for another purpose, and has, with permission, been slightly altered where it referred to maps lists and letters not reproduced here.)

THE GREEN CHILDREN OF WOOLPIT

About the green children.....Nor does it seem right to miss out a miracle unheard of for centuries which is known to have happened in Anglia in the reign of Stephen. Indeed, I hesitated about this matter for a long time although it was already mentioned by many people. It seemed ridiculuos to me to bring to belief a matter of no rational explanation or a very obtuse one, until I was overwhelmed by the weight of so much evidence of such a kind that I was compelled to believe and be amazed by something which I cannot understand or fathom with any concentration of my mind.

There is a village in East Anglia, four or five miles it is said from the noble monastery of the blessed King and martyr Edmund. Next to this village can be seen certain very ancient ditches, which in the English tongue are called Wlfpitts i.e. Wolf pits; and these give the name to the village nearby. From these pits, at harvestime with the harvesters busy in the fields collecting the crops; two children came out, one male and one female, with their whole bodies green and dressed in clothing of unusual colour and material. While they were wandering, amazed through the fields, they were arrested by the harvesters and taken to the village, where many gathered at the sight of such a novelty. For some days they were kept without them eating food even when they were almost fainting from hunger they would not touch any of the food offered to them. By chance it happened that beans were being brought in from the fields, which seizing immediately they looked for the pith inside the stalks and when finding nothing in the stalks they wept bitterly. Then one of the bystanders ripped out the pith from a pod and offered it to them; this they took at once and ate it, they lived on this food for some months until they got used to bread. Then gradually their colour changed as the nature of our food affected them and they became like us, they also learned the use of our language. It seemed a good idea to the wise that the children should receive the sacrament of Holy Baptism, this was done but the boy who seemed the youngest died soon after, leaving his sister who now was not much different from our own women, and it is said that she later married a man from Kings Lynn. When they had learnt our language and when they were asked who they were; where had they come from?, their answer was that they were from the land of St Martin, who was highly venerated there. They could not explain where this land was or how they had got from that land to where they had been found by the villagers. What they did remember was that when they were looking after their Fathers herds in the fields, they heard a great noise, just like we now usually hear the bells of the Monastery of Saint Edmund; and while they were wondering about this noise they suddenly found themselves amongst the harvesters in strange surroundings. When they were asked if there was any belief in Christ their reply was that there was Christianity and that there were churches. To a question about the sun and its movements, the answer was that the sun did not rise in their country, that the amount of light was small like we have just before sunrise and

just after sunset. They did mention that they could clearly see another country from their own, across a very big river. These things and many others, which would take far too long to relate, were answered by the children to those people who had asked. Anyone can say what they like as they puzzle over these things; I am not ashamed to have told this amazing event , indeed this story is too complicated for our intelligence to understand.

The above passage is a translation from the latin version written by Williamof Newburgh, and can be found in "Suffolk in the XVII Century": a "Breviary of Suffolk" by Robert Reyce, 1618.
The manuscript from which the breviary is taken is numbered 3875 in the Harleian Collection at the British Museum, where there are two modern versions of the breviary by Jermyn and Davy: additional MSS.8200.1915.5829.
Also from breviary- Woolpitt. This place, has by some been thought to be the Roman Sitomagus. The extensive deposits of brick earth tend to support this view. The Romans were great brick makers and their excavations may account for the second syllable of the name. In all liklehood the first syllable has nothing to do with wool; it may refer to wolves, perhaps it is only a record of a former proprietor named Ulf.

(This article taken with permission from a written copy by V.R.Jones of Woolpit .
Latin translation by R. Wingfield of Pakenham).

BIBLIOGRAPHY: JOURNAL of the ROYAL ANTHROPOLOGICAL INSTITUTE
vol.33(1903) - vol.89(1959)

(all seen except: Jan.-June 1910;1916;1917;July-Dec.1918;
Jan.-Junel919; July-Dec. 1932; July-Dec. 1935;1952,partl)

Layard,N.F. 1903. "A Recent Discovery of Palaeolithic Implements in Ipswich"
v.33, pp.41-43.

Layard,N.F. 1904. "Further Excavations on a Palaeolithic Site in Ipswich"
v.34, pp.306-310

Warren,S.H. 1905. "On th Origin of 'Eolithic' Flints by Natural Causes, Especially by the Foundering of Drifts"
v.35, pp.337-364.

Layard,N.F. 1906. "A Winters Work on the Ipswich Palaeolithic Site"
v.36, pp.233-236.

Hayes,C.W. 1909. "Deneholes and other Chalk Excavations : their Origin and Uses"
v.39, pp.44-76

Dawkins,W.Boyd. 1910. "The Arrival of Man in Britain in the Pleistocene Age"
v.40, pp.233-263

Abbot,W.J.Lewis. 1911. "On the Classification of the British Stone Age Industries, and Some New, and Little Known, Well-marked Horizons and Cultures."
v.41, pp.458-481

Warren,S.H. 1912. "The Classification of the Prehistoric Remains of Eastern Essex"
v.42, pp.91-127

Keith,A. 1912. "Report on the Skeleton found near Walton-on-Naze."
v.42, pp.128-135.

Moir,J.Reid&A.Keith. 1912. "An Account of the Discovery and Characters of a Human Skeleton found beneath a Stratum of Chalky Boulder Clay near Ipswich."
v.42, pp.345-379

Smith,R. 1914. "Flint Finds in Connection with Sand."
v.44, pp.376-84

Irving,D. 1914. "Some recent work on Later Quaternary Geology and Anthropology, with its bearing on the Question of'Pre-Boulder-Clay Man'."
v.44, pp.385-393.

Warren,S,Hazeldine. 1914. "The Experimental Investigation of Flint Fracture and its Application to Problems of Human Implements"
v.44, pp.412-450
Moir,J.R. 1920. "On the Occurence of Flint Implements of Man in the Glacial Chalky Boulder Clay of Suffolk."
v.51, pp.135-152
Gladstone,R.J. 1921.
"Description of a Human Cranium, Dredged from the Bed of the River Trent, and a Comparison of this with Ancient and Modern British Skulls."
v.51, pp.343-369.
Moir,J.R. 1921. "On an Early Chellian-Palaeolithic Workshop-Site in the Pliocene 'Forest-Bed' of Cromer,Norfolk."
v.51, pp. 385-418
Boswell,P.G.H. & J.R.Moir. 1923. "The Pleistocene Deposits and their contained Palaeolithic Flint Implements at Foxhall Road, Ipswich."
v.53, pp.229-262
Jones,F.W. & T.D.Campbell. 1925. "A Contribution to the Study of Eoliths."
v.55, pp.115-122
Moir,J.R. 1925. "Further Discoveries of Early Chellean Flint Implements in the Cromer Forest-Bed of Norfolk."
v.55, pp.311-339
Soloman,J.D. 1933. "The Implementiferous Gravels of Warren Hill."
v.63, pp.101-110
Warren,S.H.,J.G.D.Clark,H.Godwin,M.E.Godwin & W.A.MacFadyen. 1934. "An Early Mesolithic Site at Broxbourne sealed under Boreal Peat."
v.64, pp.101-128
Marston,A.T. 1937. The Swanscombe Skull."
v.67, pp.339-406
The Swanscombe Committee of the Royal Anthropological Institute. 1938. "Report on the Swanscombe Skull."
v.68, pp.17-98

R.M..

NOTES ON GEOLOGICAL GROUP 'DIGS' AT GEDGRAVE,BATTISFORD,AND WANGFORD.

1. GOMER FIELD,GEDGRAVE.

The 'dig' of the weekend 13 and 14 September 1975 was held in the famous 'Gomer Field' at Gedgrave,near Orford,with a view to exposing the fossiliferous Coralline Crag.

Saturday was a wonderfully sunny day,and digging progressed satisfactorily, stopping for a while in order to watch a weasel chasing a rabbit through the site. Sunday was quite a different matter, with pouring rain hindering collecting; filling in one of the excavations proved a teaser as water kept coming in at a greater rate than the spoil, -driftwood and some bricks, followed by dry weather, solved this problem.

Two holes were dug, no."1" at a lower level than no."2".

No.2 was excavated to about 3 feet 6 inches, and no.1 to 4 feet 6 inches, both exposing shelly Coralline Crag.

No.2 showed rather yellowish crag, with some larger shells in the lower part; no.1 was in whiter crag, most of which was below water-table (water-table was only reached in the bottom of no.2 hole.) Use of a hand-pump on Saturday and motor-pump on Sunday enabled us to dig some way below the water-table.

Samples were taken for later sorting. The following fossils were noted during the course of the 'dig':-

Bivalve Molluscs -
(D) - double valves.
Arctica islandica
Pecten
Chlamys opercularis
" dubius
" tigerina
Cardita senilis (D)
Cyclocardia
Ensis
Glycymeris
Venus casina
Phacoides borealis (D)
Diplodonta (D)
Thracia (D)
Ostrea
Astarte omalii
" spp.
Corbula gibba
Anomia
Cardium ?decorticatum

Gastropods -
Natica multipunctata
" sp.
Turritella incrassata
Trivia
Scala
Calyptraea chinensis

Brachiopod -
Terebratula

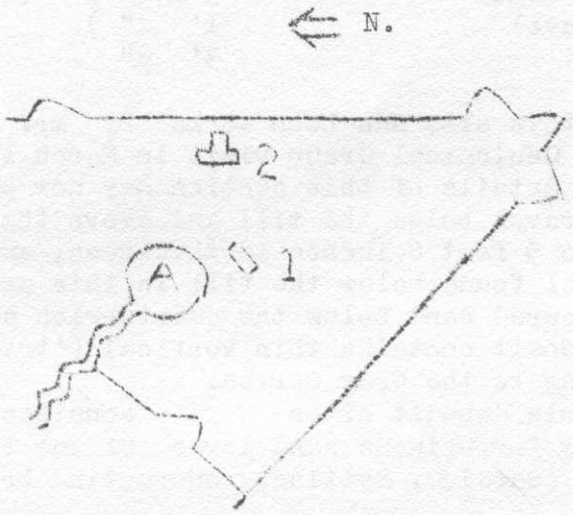
Corals -
Flabellum woodi
Cryptangia woodi

Bryozoa -
Cellepora
Hydractinia

Barnacles

Echinoid -
Spatangid

Sketch plan of part of Gomer Field, showing pond (A) and positions of trenches 1 and 2.



I wish to thank Mr. Starmer for permission to dig, Mr. Pinney and Mr. Sands for local help, S. MacFarlane for supplying the pumps, R. Chees man for caravan facilities, and C. Down for sending me a list of fossils found (similar to the above list).

2. BATTISFORD.

The Geological Group 'dig' of January 1967 is fully recorded in our Bulletin no. 3 (August 1967), pp. 1 and 2.

In 1971 the pit (grid ref. TM 061538) became a geological reserve of the Suffolk Trust for Nature Conservation, and in 1972 the Geological Group undertook the following work -

- wire fence and 'gate' put up.
- notice erected.
- most of the rubbish moved to one corner of the pit.
- scrub-clearing started.
- a few small trees taken down.
- section clearing started.

Since then, work has concentrated on our attempt to dig through the pebble bed to reach the Chalk. In January 1967 we had dug through 3 ft. 4 in. of shelly pebble-gravel; a 'dig' in March 1973 increased this to 5 ft., while the November 1974 'dig' took us to 5 ft. 10 in.. Finally, in March 1976, chalk was reached under 6 ft. 10 in. of shelly pebble-gravel, and about 7 ft. 10 in. below the base of the pit. This was no mean feat considering the difficulties of excavating such coarse gravel and dealing with copious

inflow of water (the water table has on occasions been about 7 feet above the top of the chalk!).

The total thickness of the Crag pebble deposit at this site isxthus about 14 ft. 10 in..

A few additional fossils may be added to the 1967 list:-

Searlesia costifera
Nucella tetragona
Natica multipunctata
Scaphella lamberti
?Hinia retico sa

Mineralised wood, Edaphodon tooth fragment } found by, and kept by, Somersham Youth Club members.

I wish to thank Mr. J. Knock for help in connection with our work at this site.

In September 1972, the Geological Group undertook an excavation in an old pit on the south side of the road, opposite the above pit, and obtained the following section-

Soil	10"	
Till	6' 8"	
Sand and Gravel	3' 4"	
Pale-coloured sand	5' 10"	
Sand and gravel (fossiliferous)	2' 6")	
Sand with thin gravel layers	3' 1")	12' 1"
Ferruginous sand	5' 2")	(Crag pebble deposit).
Sand and gravel	1' 4")	
Chalk	3' 6"	

Since then, this site has been worked by Mr. Keen, who kindly gave permission for the Geological Group visit in March 1976.

Some further details of this section may now be added-

The sand and gravel below the till and above the pale-coloured sand has been measured up to 5 feet 6 inches in thickness, and belongs to the quartz-rich sand and gravel found below the till in this area.

The pale-coloured sand below the quartz-rich sand and gravel and above the crag pebble deposit contains thin vertical ('trace fossils') tubes, and may therefore belong to the Crag Series.

The Crag pebble deposit often consists entirely of sand and gravel (without the ferruginous sand layer of the 1972 section); it contains moulds of molluscs (Cardium, Mytilus), encrusting bryozoa, and bone fragments.

3). WANGFORD WOOD.

The site of Dr. P. E. P. Norton's excavation, and of the joint Ipswich Geological Group / Geological Society of Norfolk 'dig' of 16th. May 1976.

The section below is based on measurements and notes by P. Cambridge and R. Markham made on 16 May, and on further notes by R.M. made 20 May, when the section was further deepened to below water-table by C. Garrod.

Soil	1' 3"
Banded sandy loam, a few flint pebbles	3' 6"
Bed of large flint pebbles	10"
Cross-bedded units of shelly sand, with stones; lowest 4"(+) with prominent black (?manganese dioxide) material	5' 3"
Cross-bedded units of shelly sand, with stones: lowest 4"(+) pale coloured	5' 3"
Brown stony crag	1' 7"
Brown shelly crag, thin brown silt at base	1' 4"
Brown stony crag, some black staining	8"
Brown crag	11"
White crag	1' 0"
Brown crag	1' 0"
Sand, pale, with small shell fragments	1' 4"

WT------

(section continued on next page).

Shelly crag 7"
Dug into, but not directly seen (as under water)
-apparently sand, with shell material, and
a thin bed bed of stones c. 5" down c.11"

(WT = approximate position of water table, just above on 16 May, just below on 20 May).

R. Markham.

THE GENUS NEPTUNEA IN BRITAIN.

Those of us who live in S.E. England and whose acquaintance with our only living representative of the genus Neptunea, N. (Sulcosipho) antiqua (L.) is confined to specimens collected at such places as Sandwich, Kent, where it is common, may be excused from knowing that it is the largest British Gastropod. Shells from the south east never exceed 100 mm. in length, but in the northern North Sea and off Ireland shells up to 200 mm. in length are sometimes obtained by trawlers.

Jeffreys (1867) noted that N. antiqua was good bait for codfish and a favourite delicacy of the lower working-classes in London. At Billingsgate it was sold under the name of "almond" or "red whelk"; the tail (liver) was said to be more fat and tender than lobster. As an article of food however, it is now apparently entirely replaced by the "common whelk" Buccinum undatum (L.). Large shells of N. antiqua var. alba (Jeffreys) were used by the Shetland Islanders as lamps, the body-chamber was filled with oil and the wick protruded through the siphonal-canal. The shell was then suspended from the ceiling.

N. antiqua is a northern cold-water species and although common in the North and Irish Seas is very rare west of the Straights of Dover. Like all other "whelks" N. antiqua is an epifaunal scavenger. The eggs are contained in cases or capsules, which overlap one another in an imbricated fashion. They are deposited in clusters of from a dozen to a hundred, the capsules in each cluster being equal in size. They spawn at the end of winter and later perfect little snails emerge from the capsules. There is no free-swimming larval stage and distribution must therefore be by crawling only and consequently very slow indeed!

N. antiqua inhabits the Coralline zone and extends downwards to deep water. When crawling it holds its shell with the apex up so that it never drags the apex or other parts of the shell over the ground. Neptunea like Buccinum and Murex,,moves almost exclusively for the purpose of scavenging. It crawls usually with the broad foot 10 mm,.deep in the sediment. It tips its shell forward and downward and pushes the elongate siphonal process into the substrate forward of the front edge of its foot. In this way the sediment is plowed up and pushed sideways. The shell with the siphonal process is moved slowly to and fro while the animal crawls. During this activity the siphon lies protected in the siphonal canal and is never extended as far as in a moving Buccinum. The animal ploughs through the sediment in order to find dead organic material. When the animal crawls about in its search it disturbs the upper sediment layers considerably, down to a depth of 15 mm..

When prosobranch shells have a siphonal (i.e. anterior canal) the canal encloses a muscular and generally mobile siphon from the dorsal side; this extension of the mantle protrudes beyond the shell. A siphon is usually accompanied by a sensory organ (osphradium) which lies at the opening of the siphonal tube in the mantle cavity. Experiments have shown that the osphradium of prosobranchs tests the water for smells. Whereas the existence of an anterior canal on a shell indicated that the carrier must have been a predator or scavenger (e.g. Neptunea) its length does not give any information about the use of the siphon and the environment in which it is used. If the anterior canal is short and flared at the end as in Buccinum, the siphon is used to test for smells in open water, if however the anterior canal protrudes far (usually in the direction of the shell axis) the canal surrounds the siphon entirely, even when it is extended. Together with its protective calcareous cover it can be moved through the sediment, and can search for dead organic material in the water of the

interstices between sand grains.

The genus Neptunea indigenous to the North Pacific, probably originated in Japanese waters during the Eocene period. Early Oligocene demes evolved in a boreal habitat, their descendants migrating northward. During the Beringrin transgression demes of N. tabulata and N. lyrata stocks penetrated the Bering straits and spanned the Arctic, where the N. despecta and N. heros stock originated and dispersed; reached the North Atlantic via Iceland and eventually the Noth Sea; where in the early Pleistocene the sinistral N. contraria angulata (S.V. Wood) became abundant. Fossil shells of this sub-species are very common in the Red Crag (Lower Pleistocene) of Walton-on-Naze, Essex. By Upper Pleistocene times N. c. angulata had vanished and was replaced by N. antiqua, still living in the area.

The occurrence of N. despecta (L.) in the Red Crag, in spite of the claim of Harmer (1919-1925) remains unproven, most of his so-called despecta being referable to the striated form of N. antiqua. At the present time N. despecta is Arctic in distribution, the writer has, however, specimens of it dredged in the Shetland-Faroe channel, which would appear to be itś most southerly occurrence on this side of the North Sea. The distribution shown for this species by Golikov (1963, 156) which included the southern North Sea as well as the west coast of Ireland and the Irish Sea is certainly based upon erroneous information, as is the same author's suggested distribution for N. (S.) antiqua (L.), which certainly does not extend its range so far south as he would have us believe.

In connection with the occurrence of Neptunea in the Lower Pleistocene of East Anglia, already mentioned, reference should also be made to the work of F. Strauch (1972). This author considered the strongly carinate shells from the Pleistocene, incorrectly referred to the recent species N. despecta (L.) and N. decemcostata (Say) by Harmer, to represent an ancestral stock from which evolved the Atlantic species N. antiqua (L.), N. despecta (L.) and N. decemcostata (Say). Strauch described a new taxa, N. lyratodespecta, from Iceland, to contain this ancestral Pleistocene race and separated the North Sea population as var. anglica. He also recognised as a subspecies of N. lyratodespecta, Murex striata J. Sowerby, 1812, and designated one of Sowerby's figured specimens (Min. Conch. 1, pl.22) now in the B.M.(N.H.) as the lectotype.

The differences between Strauch's type of var. anglica (1972, pl.1, fig. 16) and the lectotype of N.striata are very slight, the carinations in the former being slightly stronger, a feature in which these shells are noticeably variable. It would seem probable therefore, that but one species of carinate Neptunea exists in the British Pleistocene and if this is so, then the oldest name available for it is that of Sowerby, 1812. Strauch's var. anglica would then become a synonym of N. lyratodespecta striata (Sowerby, 1812) together with N. despecta Harmer, 1914, (non Linne, 1758) and N. decemcostata Harmer, (non Say, 1825).

The question of the status of N. lyratodespecta s.s. is unfortunately by no means agreed amongst Conchologists and further comparative study of both Pleistocene and recent carinate Neptunea, such as N. antiqua var. striata Jeffreys, which occurs in fairly deep water, off the coast of S.W. Ireland, will be needed before the problem can be resolved.

It is perhaps worth noting here, that Linne's original specimen of N. contraria is a recent shell, probably from Vigo, Spain, not a Pleistocene fossil as is commonly believed. N. sinistrorsa (Deshayes, 1830) therefore becomes a synonym of it. The sinistral Red Crag Neptunea is certainly worthy of sub-specific rank and the oldest available name for it is N. contraria angulata S.V. Wood, 1848.

In addition to the typical form of N. antiqua as found in S.E. England, a comparatively small shell, usually brown in colour and up to 100 mm. in length, the following varieties have been named and described by J.G. Jeffreys (1867), var. alba, white and very large, up to 200 mm. in length, the interior of the aperture often bright orange in colour, var. ventricosa thinner, the aperture often greatly expanded, var. striata, elongate, with strong spiral striae, especially on the upper whorls and var. gracilis, slender, thinner, and spirally ridged, a rare form found off S. Ireland. Sinistral (left-handed) monsters also occur, which are in no way related to the normally sinistral N. contraria (L.).

With the exception of the typical form and occasionally the var. alba in the north, none of the above-mentioned varieties are likely to be obtained by shore collecting. All live in deep water and can be collected only by dredging or from fishing boats.

References

Jeffreys, J.G., 1867, British Conchology, 4 vols., London.
Harmer, F.W., 1914-1925, The Pliocene Mollusca of Great Britain, Palaeontographical Soc., 2 vols.
Golikov, A.N., 1963, The Moll. gen. Neptunea Bolten. Fauna SSSR. Zool. Inst. Akad. Nauk. SSSR. 5.
Strauch, F., 1972, Phylogenese, Adaptation und Migration einiger nordischer mariner Molluskengenera (Neptunea, etc.). Abh. senckenb. naturforsch. Ges. 531.

T. Pain.

(Part of this article first appeared in "The Conchologists' Newsletter No. 50, Sept. 1974).

NOTES ON ITINERARY I, GEOLOGISTS' ASSOCIATION GUIDE No. 12, "The Estuarine Region of Suffolk and Essex," by J.T.Greensmith, R.G.Blezard, C.R.Bristow, R.Markham and E.V.Tucker. 1973.

My itineraries to Orford and Bawdsey ("IA") and to Walton-on-the-Naze and Wrabness ("IB") had a certain amount of editing, most of which I approve of, but there are a number of additions which are not mine and which I feel should be noted in case they are quoted under my name sometime in the future!

p.2: -the introductory paragraph ("This excursion....." to ".....Ardennes region") is an addition.
p.4, para.3: -'Mya truncata in life position': -most appear to be nearly, but not quite, in life position.
p.4, para.3:--"which covers large areas....." to ".....Rhine delta complex" is an addition.
p.4, para.5: -"normal conformable" is not my wording.
p.6, para.4: -"The Clay is about 3.5 m. thick" should be "Up to 3.5 m. of the Clay may be seen" (it is thicker than this, going below sea level).
p.6, para.4: -"only organic remains visible" should be "only organic remains usually visible".
p.7, para.3: -removal of the Red Crag would make the Coralline Crag an outlier! (as it would then be encircled by London Clay); it is almost an 'inlier' now.
p.7, para.3: -"lower 'Crag Division'" should be "lower 'shelly sands Division'".
p.10,para.6: -"The band, quite different in appearance....." to ".....in the Skagerrak area" is an addition.
p.10, para.6: -'platimore' has been added in a wrong way; 'platimore' is an old local term for the foreshore clay surface. The pyritic wood is 'copperas'.
p.11, para.1: -most, if not all, of the Red Crag capping the hill above the promenade has been eroded away.

The geological map (fig.1, page 3) is based on a 6" map I made c. 1960; the solid-line geological boundaries are after my map, the dotted lines and a small area with solid lines S.E. of Sudbourne Church were not mapped by me.

Since the M.S. notes for the itineraries were sent in, a number of papers have appeared giving further information on the localities:-

CHILLESFORD.

Dixon, R.G. 1972. "A Review of the Chillesford Beds". Ipswich Geol. Group Bull. 11, pp. 2-9.
West, R.G. & P.E.P. Norton. 1974. "The Icenian Crag of southeast Suffolk". Phil. Trans. Roy. Soc. London, B., vol. 269, pp. 1-28.

WALTON-ON-THE-NAZE.

Quaternary Research Association, 1973 Clacton meeting handbook, for Red Crag by A.R.Boatman, and overlying silts by C. Turner.
George, W.H. 1972. "Report of Field Meeting to Walton-on-the-Naze, Essex". Tertiary Times, vol. 1, pp. 124 - 5.

R. Markham.

SEDIMENTARY CHARACTERISTICS OF THE RED CRAG.

The term Red Crag was originally applied to the iron stained unconsolidated shelly sands of North East Essex and South East Suffolk. The Red Crag is now known to include non-shelly iron coated sands, clean sands and clay. The deposit occurs in a triangular shaped area having a base line along the coast between Walton-on-Naze and Orford and then extending inland to an apex near Lavenham in Suffolk. The base of the Red Crag lies at about 17 metres above present day mean sea level. Over most of their extent the beds are buried by later sediments and exposures are confined to coastal cliffs, river banks and pits. In North East Essex the deposits occur as isolated outcrops but north of the River Stour the Red Crag consists of a series of large linear sand bodies.

The area of deposition was in a near-shore marine environment which had a maximum water depth of about 30 metres. The sub-Red Crag surface, which consists of London Clay, slopes at a very shallow angle towards the east. The London Clay was folded in pre-Red Crag times by tectonic activity into a series of ridges and depressions. Bivalve borings and surface pitting occurs in several areas. Occasionally the sub-Red Crag surface has become coated with metallic oxides or impregnated with calcium carbonate but both of these features are considered to be post-depositional.

In overall composition the Red Crag deposits show a considerable degree of uniformity. However, within closely defined limits, micro-variation is considerable both laterally and vertically. The chief factors affecting variation are the amount and size of shell debris, the proportions of metallic oxide coated and uncoated particles, overall size distribution and degree of sorting.

The two major components of the Red Crag are quartz grains and shell debris. The present degree of metallic oxide coating on each of the components depends largely on the conditions in the earlier source areas and the extent of subsequent diagenesis. Considerable quantities of phosphatic nodules occur in the depressions in the sub-Red Crag surface. Pebbles of quartz, quartzite and chert together with mud clasts and armoured mud balls are found within the shelly-sand matrix. Locally silty-clay forms a major component but it is not widespread.

Sedimentary structures within the Red Crag are best considered separately in each of the three units into which the deposit can be sub-divided. These stratigraphical sub-divisions consist of the basal beds, occuring in isolated pockets, the Lower Red Crag characterised by the steeply dipping cross-layered shelly sands and the non-shelly sands forming the Upper Red Crag.

The basal beds, which occupy depressions in the sub-Red Crag surface, vary in thickness from 5 - 20 cm.. They are usually grey in colour and consist of a mixture of clean quartz grains and varying amounts of finely divided shell debris. The near horizontal orientation of these beds resulted from their method of depostion. In many localities these beds overlie deposits of phoshatic nodules that accumulated in the depressions.

The Lower Red Crag consists mainly of the characteristic cross-layered shelly-sands that represent phases of sand body migration. These cross-layered units frequently show large scale cross-layer ing, formed by the main flow current, overlying small scale, reversed dipping, cross-layering formed by the associated backflow currents. A considerable degree of interweaving of the toe of foreset beds and backflow beds is evident at Bawdsey. Trough cross-layering, representing reactivation of foreset beds by cross-flow currents is present in a few localities. At several sites bottomset beds are exposed sometimes being inter-bedded between two units of cross-layered shelly-sands. Where these bottomset beds are composed of fine grained sands, small sand diapirs frequently formed but the latter structures are comparatively rare. Occasionally and usually at the base of the Lower Red Crag are lenses composed of alternating beds of fine grained sands and silts containing well developed ripple trains. The latter structures sometimes pass laterally into Flaser bedding. In addition some lenses show slump structures while others contain 'rollers' embedded in a matrix of structure-less shelly-sands. The 'rollers' consist of a hollow tubular structure composed of metallic oxides surrounded by concentric layers of quartz

grains and shell fragments cemented by metallic oxides. Pseudo-nodular structures (Walton-on-Naze, Brightwell) and pseudo-stratification (Walton-on-Naze, Bawdsey) are both post-depositional in origin and formed as a result of the migration of metallic ions in ground water. The individual units of the Lower Red Crag vary from a few centimetres to 5 metres in thickness. Available evidence suggests that the whole of this sub-division had a maximum thickness of about 9 metres.

The Upper Red Crag is composed of medium and fine grained sands coated with metallic oxides. Some parts of this unit are insitu decalcified Lower Red Crag beds and other parts re-worked sands. Ghost cross-layering occurs where the unit is decalcified Lower Red Crag, but the dip of the foreset beds is usually less than that in the unaltered Lower Red Crag. The re-worked sands contain ripple trains in some areas while in others they exhibit an abundance of sand diapars.

An analysis of the sedimentary structures indicates that they were formed mainly by tidal currents, the few minor exceptions being formed during diagenesis. The direction of the flood currents were predominantly to the west between south-west and north-west while the ebb currents were mainly towards the north-east. Locally current directions were very variable due to the inter-action of the main currents with the submerged sand bodies. The main currents were responsible for moulding the deposit into a series of linear sand complexes while the local variations in current direction produced some of the minor features within the sand bodies. Post Red Crag reworking and redistribution of sediments has tended to even out the variations in thickness of the original deposit.

Due to technical problems it is not possible to estimate current velocities but the thin iron-pans deposited under very quiet conditions and the presence of large fabric elements, mainly found in the bottomset beds, which indicate powerful bottom currents testify to the wide range of current velocities that prevailed.

A.R.C. Boatman.

FINANCIAL STATEMENT : GEOLOGICAL GROUP, 1975.

EXPENDITURE.	£.p.
Postage, Newsletters 48-51.	19.72
Postage, Bulletins 16, 17.	7.92
Envelopes, Newsletters 48-51.	1.55
Envelopes, Bulletins 16, 17.	3.42
Stencils, Newsletters 48-51.	35
Stencils, Bulletins 16, 17.	3.08
Duplicating Paper	11.96
Petrol for pump (Gedgrave dig)	75
	£48.75

INCOME.	£.p.
Subscriptions (1975)	46.25
Subscriptions (late for 1974)	2.25
Interest on Bank Account	3.97
	£52.47

Carried forward to 1976 : £3.72.

There is also £32.43 in the bank account which has been carried forward from previous years; this will be used for fieldwork equipment and towards future publications.

R.A.D.M..

NOTES ON EDWARD CHARLESWORTH, 1813 - 1893.

Edward Charlesworth was born in Clapham, Surrey, in September 1813. He spent much of his early life and school years in Suffolk where he was an early and youthful investigator of the Crag pits; he separated the Red Crag and Coralline Crag in 1835 (Phil. Mag., scr. 3, vol. vii, p. 81).

Edward Charlesworth had early connections with several museums. Greenough's Presidential Address to the Geological Society in 1835 noted that "Mr. Charlesworth has placed in our Museum some valuable specomens collected at Stutton in Suffolk". At this time, Charlesworth was elected an Honorary Curator of an early Ipswich Museum, soon to be followed by an appointment on the staff of the British Museum, and afterwards as an Assistant to the Museum of the Zoological Society of London in Leicester Square. In 1837 Charlesworth became (until 1840) Proprietor and Editor of Loudon's "Magazine of Natural History", in which year and journal (N.S., vol. 1, p.225) he gave what seems to be the earliest scientific reference to fossils in Ipswich Museum (giant shark teeth from the Red Crag).

In 1840 Charlesworth accepted an offer to go to Central America, but the visit was shortened to only a few months.

In 1844 he was appointed Curator to the Museum of the Yorkshire Philosophical Society in York, which post he held until 1858.

In 1846 he brought out the "London Geological Journal" (three numbers only, ceased 1847) to which he contributed a paper on Mosasaurus (Jnl. no. 1, Sept. 1846, pp. 23-32).

In 1848 Charlesworth organised the "British Natural History Society" for the collection of Hampshire Tertiary fossils (more especially those from Barton Cliff, which he had first visited in 1833) and distribution as sets amongst members in return for a small subscription. About 2,000 sets of specimens were issued.

In 1869 he was engaged by Ipswich Museum to name and arrange the Crag shells, and in May of that year, at the first meeting of the Ipswich Science Gossip Society, he gave a desciption of the collection of Red Crag fossils given to the Museum by Mr. Edward Packard (the Mayor).

Later in his life, Charlesworth became a dealer in fossils, living in London.

In 1869-1870 he was selling sets of molluscan stone-borers of the Red Crag. Buyers of his specimens included William Reed of York (who obtained the unique series exhibited at a meeting of the Norwich Geological Society) and Mr. E. Grimwade, Mayor of Ipswich (who presented his set to Ipswich Museum).

Charlesworth purchased the Crag collection of Mr. W. Whincopp of Woodbridge in 1870; much of this he sold to William Reed, who later donated it to York Museum.

Mr. James Baker of Woodbridge died in 1873, and his Suffolk Crag collection was advertised for sale in the 'Atheneum'; the collection consisted of over 4,000 specimens including teeth of Mastodon, Rhinoceros, Hipparion, Tapir, Hyaena, Deer, and shells, fish and reptile remains. Edward Charlesworth bought Baker's collection fro his executors, and the 'Ipswich Journal' of 11th. May announced the removal of the collection (by Charlesworth) to London. Mr. Waterhouse, Keeper of Geology Department, British Museum, made a selection of the Baker fossils for that Museum, including 5 of the 23 tapir molars in the collection. Much of the Baker collection was purchased by William Reed, and later donated to Yorkshire Museum.

In 1874 Mr. Whincopp died, and Charlesworth purchased the greater part of his fossils acquired since 1870; many of these he sold to William Reed and are now in York Museum.

With the Baker and Whincopp collections, Charlesworth selected one or two large series of the various fossils, which still left duplicates and triplicates of numerous other fossils. William Reed probably had the finest private collection of Crag fossils in England.

From about 1875 to 1878, Edward Charlesworth's 'Orford Castle Fossil Exploration' (Crag Investigation Fund) was in progress, buying crag fossils from the diggers engaged in workings to obtain phosphate ("coprolite") from a 'cutting in the River Marshes near Orford Castle, Suffolk'. During this period over 150 collections of these fossils were delivered to subscribers. Specimens may be seen in Ipswich Museum, bearing the characteristic labels 'Coralline Crag' (or 'Red Crag') and 'Near Orford Castle'. In connection with

this, a M.S. note (in Ipswich Museum) by Edward Charlesworth gives a list of 13 papers (Crag information) sent free of charge to all Subscribers to the Orford Castle series of fossils; the second paper 'List of Fossils found in the Orford Castle (Boyton) Cutting' is of particular interest as it gives the parish in which the fossils were found, Boyton seeming more likely than Orford as a source of both Coralline and Red Crag fossils.

In 1883 the 'British Natural History Society' was again distributing sets of specimens to subscribers, examples being:

Crag	35 specimens,	20 species,	7s. 6d.
Chalk	16 " ,	12 " ,	7s. 6d.
Carboniferous Limestone	20 " ,	15 " ,	7s. 6d.

Each specimen (unless it was too large) was sent in one of Charlesworth's well-known circular glass-topped boxes, which could be returned, or kept for a small additional payment.

Also in 1883, upon the death of Mr. Amey of Felixstowe, the Amey crag collection came into Edward Charlesworth's possession, and was disposed of in the same way as with the Baker collection. A molar tooth of a young mastodon was presented by William Reed to the York Museum.

A M.S. list of some of the Purchasers of Charlesworth's Collections of Suffolk Crag Mammalian and other Vertebrate Fossils is kept in Ipswich Museum, and includes the British Museum, Geological Museum, museums at Dublin, Liverpool, Oxford, etc., and a number of private individuals. Another M.S. note mentions the 'unique molar' of 'Mastodon borsoni' purchased by Mr. Wm. Reed and given by him to York Museum.

Edward Charlesworth retired to Saffron Walden, Essex, where he died July 1893. Obituaries appeared in the Geological Magazine (1893, ser. iii, vol.10, pp. 526-28) and the Quarterly Journal of the Geological Society of London (Proceedings, 1894, vol. 50, pp. 47-50). It is interesting to note that he took an active part in the establishment of the "Society for the Prevention of Cruelty to Children".

A list of Charlesworth's articles on local geology is given below.

1835. "On the Crag of part of Essex and Suffolk". Proc. Geol. Soc., vol.ii, no. 41, p. 195.

1835. "Observations on the Crag-formation and its Organic Remains: with a View to establish a Division of the Tertiary Strata overlying the London Clay in Suffolk". Phil. Mag., ser. 3, vol. vii, p. 81; (abstract in Proc. Geol. Soc., vol. ii, no. 41,p.195.

1835. "Reply to Mr. Woodward's Remarks on the Coralline Crag; with Observations on Certain Errors which may affect the determination of the Age of Tertiary Deposits". Phil. Mag., ser. 3, vol. vii, p. 464.

1836. "On the Crag of Suffolk, and on the Fallacies connected with the Method now usually employed for ascertaining the relative Age of Tertiary Deposits". Phil. Mag., ser. 3, vol. viii, p. 529. See also (under different title): Edin. New Phil. Journ., vol. xxii, p. 110; Rep. Brit. Assoc. for 1836; Mag. Nat. Hist., vol. ix, p. 537; (Abstract (?in full) in 'Records of General Science', vol. iv, p. 465).

1837. "A Notice of the Remains of Vertebrated Animals found in the Tertiary Beds of Norfolk and Suffolk". Rep. Brit. Assoc. for 1836, Sections, p. 84 (in full in 1838).

1837. "Observations on the Crag, and on the Fallacies involved in the present System of Classification of Tertiary Deposits". Phil. Mag., ser. 3, vol. x, p. 1.

1837. "Notice of the Occurrence of Voluta Lamberti on the Suffolk Coast; with Observations upon its Claim to rank with existing Species". Mag. Nat. Hist., ser. 2, vol. i, p.35.

1837. "Observations upon Voluta Lamberti, with a Description of a gigantic Species of Terebratula from the Coralline Crag". Mag. Nat. Hist., ser. 2, vol. i, p. 90.

1837. "Notice of a new Fossil Shell from the Coast of Suffolk". Mag. Nat. Hist., ser. 2, vol. i, p. 218.

1837. "Notice of the Teeth of Carcharias megalodon occurring in the Red Crag of Suffolk". Mag. Nat. Hist., ser. 2, vol. i, p. 225.

1838. "A Notice of the Remains of Vertebrated Animals occurring in Tertiary Beds of Norfolk and Suffolk". Mag. Nat. Hist., ser. 2, vol. ii, p. 40.

1839. "Illustrated Geological Notices. 1. On the discovery of a Portion of an Opposum's Jaw in the London Clay near Woodbridge, Suffolk. 2. On some Fossil Teeth of the Genus Lamna from the same Deposit". Mag. Nat. Hist. ser. 2, vol. iii, p. 448.

1845. "On the Occurrence of the Genus Physeter (or Sperm Whale) in the Red Crag of Felixstowe". Proc. Geol. Soc., vol. iv, no. 99, p. 286, and Quart. Journ. Geol. Soc., vol. i, p. 40.

1846. "On the occurrence of a species of Mosasaurus in the Chalk of England, and on the discovery of Flint within the pulp-cavities of its teeth". London Geological Journal, no.1, Sept. 1846, pp. 23 - 32, Pls. 4, 5.

1859. "On the Fossil Remains of the Mammoth found in the bed of the German Ocean, in the East and South-east portion of England". Proc. Geol. Assoc., vol. i, p. 15.

1868. "On the Prospective Annihilation of the Suffolk Red Crag Phosphatic Stones, "Coprolite"." Norwich Mercury, 10 Oct., & Geol. Mag., vol. v, p. 577.

1868. "The Large Fossil Tooth in the Pakefield Cliff". Land and Water, 14 March.

1868. "On the discovery, at Whitlingham, of the Tooth of the Mastodon". (Norwich Geol. Soc., May 5). Norwich Mercury.

1868. "On the Crag Fossils in the Norwich Museum". (Norwich Geol. Soc.): Norwich Mercury, June 6.

1872. "On Perforated Stones from the Suffolk Crag". Eastern Daily Press, April 6.

1872. "Exhibition and description of some remarkable objects found in the Suffolk Crag Formation simulating human workmanship". Pall Mall Gazette, April 10.

1872. ("Perforated Sharks' Teeth found in the Red Crag of Suffolk"). Pall Mall Gazette, April 10.

1872. ("Exhibition and Description of Objects found in the Red Crag of Suffolk simulating Hu man Workmanship"). Journ. Anthrop. Inst., vol. ii, no.1,p.91. ("Primeval Man and the Suffolk Crag").(from a report of an Edward Charlesworth communication).(source?).

1878. "Fossil Exploration of Suffolk Crag (Orford Castle), and Hampshire Eocene Cliffs". pp. 8. London. Privately printed.

Charlesworth also added notes to the following-

Clarke, W.B. 1838. "Letter in reference to the alleged occurrence of the bones of terrestrial mammalia in the red and coralline Crag of Suffolk". Mag. Nat. Hist., ser. 2, vol. ii, p. 224.

Desnoyers, J. 1838. "Considerations upon the position of the Tertiary System to which the Faluns of the Loire and the Crag of England ought to be referred; and upon the difficulty of determining their relative age solely by the law of the proportional number of fossil species analogous to species now in existence". Mag. Nat. Hist., ser. 2, vol. ii, p. 111 (partly translated from Bull. Soc. Géol. France, t. viii, p. 203, (1837).).

Lankester, E.R. 1877. "The Crag Fossils in the Ipswich Museum". Suffolk Chronicle, August 4.

R. Markham.