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CONTENTS

A DESCRIPTION OF EXPOSURES IN A PIT AT STOWMARKET, SUFFOLK.

INTRODUCTION

The pit is a complex of exposures, some fresh where work is in progress, and others degraded or confused by backfilling. The deposits that appear are entirely of Pleistocene age but show a number of distinct facies and discontinuities. The pit is at present worked on a small scale for high grade moulding sand, obtained from the Iowest bed exposed.

SUCCESSION OF DEPOSITS

The composite succession is as follows, from the base upwards. (See Fig. 1).

(a) Ferruginious sand.
(b_1) Quartz-rich clayey sand and gravel.
(b_2) Silt, filling channel in top of b_1.
(b_3) Sand, filling pockets in top of b_1.
(c) Shelly outwash sand and gravel.
(d) Stratified silty clay and silty sand.
(e) Chalky boulder clay.
(f) Coarse gravel, filling pockets in top of e.

The complete sequence is not seen in all faces, and there is considerable lateral change both in thickness and facies of some horizons.

DESCRIPTION OF DEPOSITS

There follows a more detailed description of each bed.

(a) FERRUGINOUS SAND

Pale orange to brown, completely stone-free sand with occasional thin silty scams. The bedding appears generally horizontal, with some current bedding towards the top. A maximum of 5m. was seen but the base was not reached.

(b_1) QUARTZ GRAVEL

Red brown colour in bulk, due to clay fraction. The washed sample appears pale, the coarse sand and fine gravel being almost entirely quartz. The coarser gravel is comprised, of almost 65% flint and 30% quartz and pale quartzite, both fractions providing similar sized pebbles, most of which are rounded. The deposit is finer grained in places. A maximum of about 2.5m. was exposed.

(b_2) BROWN SILT

Brown sandy silt with occasional small quartz grains and siliceous pebbles, infilling channel (or hollow) cut in b_1 in section A (see Fig.2). A similar deposit was seen in a pocket in the top of b_1 in section B.

(b_3) SAND POCKETS

Pale buff sand filling small pockets in the top of (b_1), seen in sections A and C.

The top of these deposits, $b_1 – b_3$, is truncated and the junction b - c appears as a relatively major discontinuity.

(c) SHELLY SAND AND GRAVEL

Current bedded clean sand and gravel. Coarser gravel at base with some shell debris, grading up into sand with fine gravel and much shell debris. The gravel is subangular with about 65% flint and 30% quartz and quartzite. There is also a small proportion of ironstone fragments. The quartz however is smaller and more rounded, than most of the flint. Sufficient identifiable shell fragments were collected to establish their origin as the Red Crag.

Although not seen in the sections, this deposit is in places cemented by calcite, as exhibited by large boulders lying on the surface.

(d) STRATIFIED SEDIMENTS

A series of stratified sediments of variable grade rest on the two gravels. Although rot yet studied in detail, these deposits appear to be waterlain clays and silty sands; mainly brown and relatively stone free.

A layer of rolled clay pebbles occurs at the base. About 0.5m. above the base, in section C, in a clay horizon, numerous irregular calcareous nodules wore found. These small concretions (20 - 40mm.) also occur in the modern weathering horizon of some clays, and have also been seen in the Brickearth at Stutton (Ipswichian) and Lower Loam at Swanscombe (Hoxnian).

This deposit rests unconformably on b_1 in face C, and on c in faces A and. B. The top was not obvious but passed into horizon e.

(e) CHALKY BOULDER CLAY

Completely unsorted buff coloured stony clay, in places sandy, containing mainly chalk and flint, and other erratics which have not been studied.

In face E, elongated, lenses and wisps of highly calcareous matrix probably represent large smeared-out chalk erratics as occur in the Marly Drift of North Norfolk.

In face F, the boulder clay rests directly on deposit a.

(f) COARSE ANGULAR GRAVEL

Although the top of the boulder clay has not been closely studied, small (approx. 0.5m depth and width) pockets of very angular pale coloured flints in an unsorted sandy matrix were noticed. Whether these are natural deposits or artificial drainage systems was not immediately apparent.

BESCRIPTION OF EXPOSURES

A summary of the succession seen in the faces shown in Fig.2, is as follows:-

Face A	Face B	Face C	Face D	Face E	Face F
e	e	e	f	e	e
d	d	d	c	d	a
c	c	b_3			
b_2b_3	b_2	b_1			
b_1	b_1	a			
a	a				

CONCLUSIONS

From this preliminary investigation of the deposits and their relationships in the pit at Stowmarket, the following tentative and provisional correlations can be made.

The ferruginous sand, a, appears to be waterlain and from its position and nature is considered to be decalcified (or non-shelly) Red Crag.

The gravel, b, above, with its high proportion, by weight, of quartz can be correlated with other similar deposits that lie below the boulder clay in East Anglia and have been given various names such as Pebble Gravels, Bure Valley Beds, etc. They are possibly pre-Lowestoftian.

The shelly gravel, c, is a glacial outwash deposit that happens to have derived, some material from a shelly Red Crag exposure. (The remainder appears to have come from the underlying gravel and the chalk). The deposit is probably related, to the overlying till and similar gravel occurs elsewhere in the Gipping Valley. The waterlain sediments, d, are possibly ice-dammed lake deposits or the infilling of subglacial depressions by the melting of stagnant ice. The boulder clay, e, is characteristic of deposits in this area attributed to the Gippingian glacial period, and as the underlying deposits d and c, are seemingly related to the till, they would also belong to this period.

The angular gravel, f; if naturally deposited, could represent solifluction of the same or a later cold, period.

It is apparent that the sequence here consists of deposits attributable to several different phases of the Pleistocene, deposited under different environmental conditions. To obtain more definite evidence concerning their origin and correlation with other localities, work will continue in a more systematic and quantitative manner.

P. Grainger

Fig. 1 Composite Section

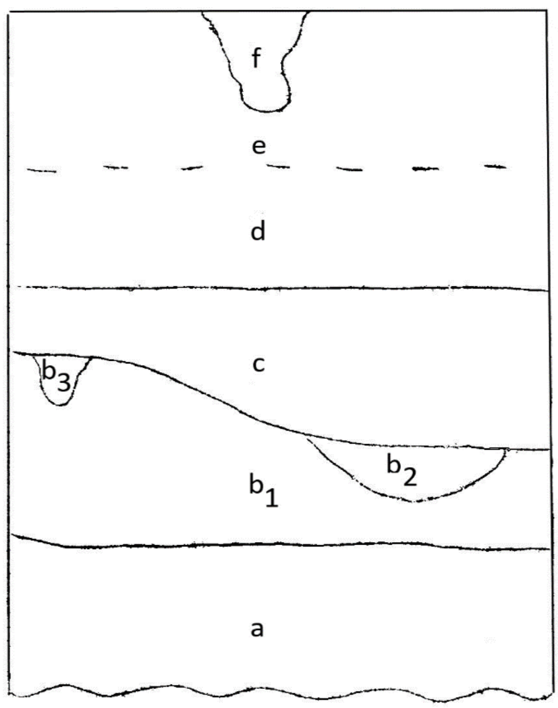
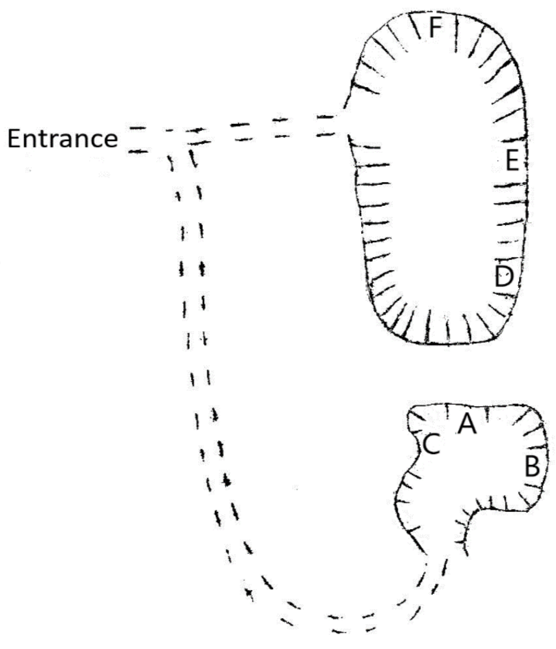


Fig. 2 Plan of Site



THE BUDLEIGH SALTERTON PEBBLE BED

The Budleigh Salterton Pebble Bed outcrops on the South Devon coast a Budleigh Salterton and strikes northwards for about ten miles, to Ottery St Mary, where lateral variation results in a grit facies and the Uffculme conglomerates. The Pebble Bed itself consists of about I00 feet of ellipsoidal quartzite (mainly) pebbles in a red sand, matrix; and contains some impersistent lenses and beds of sand rock. The bed dips gently eastwards at 4 or 5°, and forms part of the Devonshire New Red Rock Series.

STRATIGRAPHIC POSITION

The Permo-Triassic sediments lie unconformably upon Carboniferous and Devonian sediments, and are overlain unconformably by Jurassic (Lias) or, in some places, the Rhaetic. Division within the New Red is straightforward only in very general terms; minor lithological divisions are difficult to correlate owing to the irregular nature of sedimentation and impersistent horizons.

<table>
<tr><td rowspan="7">New Red Sandstone</td><td rowspan="3">Triassic</td><td>Upper Marls</td><td rowspan="3">Otter Sandstones</td></tr>
<tr><td>Upper Sandstones</td></tr>
<tr><td>Budleigh Pebble Bed</td></tr>
<tr><td rowspan="3">Permian</td><td>Lower Marls</td><td>Littlehambeds</td></tr>
<tr><td>Lower Sandstones</td><td>Exe Group</td></tr>
<tr><td rowspan="2">Breccia Group</td><td>Teignhead Group</td></tr>
<tr><td>Carboniferous</td><td>Marldon Group</td></tr>
</table>

SHORE SECTION

a) UPPER MARLS

Red marls - variegated greenish grey; sometimes green and mottled red due to percolating iron solutions. Upper beds lose calcareous nature, but become gypsiferous. The marls occur in massive, well differentiated beds with no lamination; they suffer sub-cuboidal fracture, and fallen blocks exhibit spherical weathering. Along bedding planes are numerous calcareous concretions known as "potato stones" - with an internal cavity lined, with calcite. The gypsum occurs in 1 – 2ins. veins, with rocksalt pseudomorphs. Irving considers this to be of true Keuper age, and. comparable to that at Garden Cliff, Westbury on Severn (see 9.2.69). These grade through sandy marls to:

b) UPPER SANDSTONES

Red sandstones and rock sands with some yellow/buff patches and lenses of marl and clay; conglomeratic beds and pebbles in false bedding lines. Sometimes calcitic giving calcareous weathering; a near limestone is found in the middle of the bed which Ussher says is an intensified, calcareous band - Blake said, this could represent the Muschelkalk sea. Calcite and iron nodules are found, and sometimes hard pans. Organic remains have been found in this division - an ossiferous zone at Sidmouth (in top of group) has produced Hyperodepodon, Labyrinthedon and Estheria. Much current bedding, with sun cracks and ripple marks in the upper part.

c) BUDLEIGH SALTERTON PEBBLE BED

Consists of a false bedded, 80 ft sequence of pebbles and scatttered subangular grits intercalated with dark roe or buff sands. Irving considered this a Middle Bunter facies, while Ussher thought it a homotaxic equivalent of the Muschelkalk (1878) - later, in 1902 he changed this view, and put the Pebble Bed at the base of the Trias (for Geol. Surv.). There is not strong evidence for an angular unconformity - there may be a 1° difference - between the Pebble beds and the underlying Red marls. However, the surface of the marls is slightly irregular, and. coated with limonite, which follows the irregularities and seems to fill interstitial pore space of the pebbles above, i.e. a deposit by infiltration due to lithological differences. The boundary is certainly sharp and it is reasonable for a major boundary (?) to be put here whether unconformable or not.

d) LOWER RED MARLS

Variegated green-grey; slightly calcitic in upper part. Appear for a further mile in the cliff, westwards from the Pebble Bed. Many sandstone intercalations.

e) LOWER SANDSTONE

Red rock sands and hard sandstones - uniformly red; pass into and intercalated with seams of breccia and gravel (e.g. at Clyst St. Mary, seen 20.3.70). Irvine includes Ussher's Lower Sandstone group into breccia group as one complex with local lithological differentiation of breccias, sandstones and clays; beds in different localities of the same character and composition arc not necessarily contemporaneous, or occupying the same stratigraphical position. Thus many different phases are represented.

f) BRECCIA GROUP

Red sandstones and large angular grits and breccias containing Devonian shale fragments; crude stratification and large scale current bedding; Deep rich red colour, and variable thickness.

Thus it generally appears that the beds below the Budleigh Pebble Bed maintain the Dyassic order of the German series, and they all join together to form the one Geological system. If one accepts that the Budlegh Pebble Bed forms the base of the Triassic, it must also be homotaxic with the Midland's Bunter since Hull, Whitaker and others believe that Hyperodepodon, Labyrinthodon are Keuper in age. (ie the Upper Sandstones are Keuper in age).

ANALYSIS OF THE BUDLEIGH PEBBLE BED

The pebbles are generally subangular to subrounded with a low degree of sphericity, and ranging in. size from sand to 8-9 inches in. diameter. The most abundant pebble type is a bard compact sandstone (sometimes almost quartzitic), which may contain mica flakes or feldspars. Other pebbles of sedimentary origin, include grits, slate, agate, abort and limestone, of Devonian, Silurian or Ordovician derivation. One limestone pebble had an external layer 1.5mm thick of Beekite, an hydrated form of silica, in a perfect concentric growth pattern.

Some of the sandstone pebbles contained fossils, which, when tabulated with their provinces, show that a certain amount of material must have come from a Central European basin - in particular from the Grès Armoricain and Normandy (May sandstone). Vicary end Salter devoted time for a study of fossil derivation and came to this same conclusion.

Pebbles of metamorphic origin, do not seem to be common, but mica schist with cassiterite, a baked slate with felsite veins, and an altered breccia rock were found.

The pebbles of igneous origin can be divided, into four main groups, each pebble being a characteristic rock type:

a) Contact zones and minor apophyses:-

Orthophyres, quartz porphyry, murchisonite (fresh sanidine), greisen shimmer aggregates (felted cryptocrystalline mass of white micaceous material crowded with inclusions - no parallel structures; probably formed by decomposition of kyanite, often forming an unaltered, core, and other alumino-silicates), vein pyrite. This group seems to form the bulk of the igneous derived pebbles.

b) Felsites:-

Range from pegmatitic to micrpegmatitic to glassy and. vesicular; some varieties of schorlaceous material are included in this group; most of the group is identifiable with the Dartmoor complex.

c) Andesites and basalts.

d) Granite:-

Wholly identifiable with Dartmoor.

Worth attributed the origin of the pebbles to local sources, the most important of which was Dartmoor. Scrivener, however, says that the occurrence of Murchisonite is highly untypical of granites, and thus Dartmoor can not be the source area. If Dartmoor had been elevated by Triassic times, surely both could happen? Laming has shown by radiometric dating that the Dartmoor granite was formed 295 million years ago; this dates it at Carboniferous, due to the 250 million year age for the Carboniferous - Permian boundary. Thus, some of the pebbles at any rate, could have been of local origin.

2) THE MATRIX

The matrix is of a sandy aspect, the grains varying from angular to “millet-seed” rounded, and sometimes with a high degree of sphericity. The grains nearly all have a hematite coating, which acts as a cement and gives the Pebble Bed its characteristic red colour.

Thomas found that three-quarters of the grains had a specific gravities over 2.56, though this figure varied slightly along the strike of the Pebble Bed. The percentage of heavy minerals remained constant in any one vertical section. Thomas considered the assemblage an Armorican one for several reasons. The minerals suggest a metamorphic area, but since he could not find any staurolite in Devon or Cornwall metamorphic rocks, he implied that the source area must have been the Armorican massif and the schists and gneisses of Brittany. He worked out a system of palaeo-currents based on the relative mineral percentages of the sands at different localities and the size and roundness of the grains. He argued that different degrees of rounding in grains of the same size, of a particular mineral, indicated a certain variety of source, and he concluded that some material was local in origin.

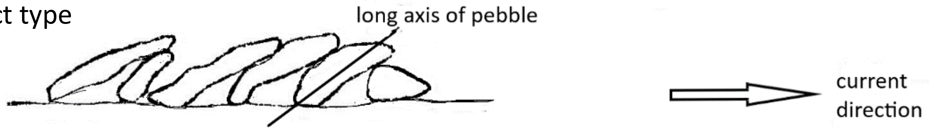
Generally the grains were more rounded in the North, indicating more grinding of material, and thus longer distances travelled; the grains also tended to be smaller. An important local “Crediton current" from the west shows a definite Dartmoor assemblage, bringing an influx of new heavy minerals.

Groves, on the other hand seems to disagree entirely with this opinion, suggesting an entirely local origin, or a northerly current. He says that individually, the mineral species do no more than suggest the POSSIBILITY of a Dartmoor provenance. Possibility is strengthened by relative abundance, varietal features and nature of inclusions, and associations (almost the same criteria as Thomas). For example, zircon with octahedrite, tabular anatase, monazite and manganese garnet are in varietal agreement with known Dartmoor species. However, the lack of monazite surely shows that little granite was exposed. Groves says that, though rare, monazite is in association with rare purple zircons and it is this that (somehow) accounts for a northerly origin.

SEDIMENTARY STRUCTURES

The most important sedimentary structures in the Pebble Bed are imbrication structures. Two types occur:-

i) compact type



In the compact type, the pebbles are aligned with their long axis directed in the same direction as that of the current which deposited, them; thus, there is the smallest resistance to the current and the greatest resistance to movement.

ii) Isolate types

In the isolate type, a pebble on the surface is gradually undercut by currents until a hollow is formed, in which the pebble eventually lies. Palaeo-currents can be measured, and. show a movement from the south.

The only other type of structure seen at Budleigh was false "bedding, of which the size and dip suggested an aquatic environment. At certain horizons within the sands intercolated with the pebbles, worm burrows, rain pits and desiccation cracks are said to be found (Laming). This would indicate a semi-arid environment.

PALAEOGEOGRAPHY

i) GLOBAL POSITION

From palaeomagnetic evidence, a position near the equator can be inferred (Laming). This can be backed up by examining the Dawlish sandstones, Clyst St. Mary; here are millet seed sands showing cross bedding, the units being up to 30ft thick and 200ft long. These dunes are both wedge shaped and horseshoe shaped (Barchans), and aeolian transport can be inferred (also, the rounded grains have a microscopically frosted surface, with a modern hematite coating). Wind directions can be measured from these dunes, which are typically unidirectional, and show a south-south-east origin. Today, similar deposits and conditions can only be found, in the low latitudes within the Trade Winds Belt (i.e. between 15°and 30° N or S).

ii) ENVIRONMENT

Accounts of the environment in which the Pebble Bed was laid down are conflicting, but the advent of the Bed indicates one of two things; either, there was the breaking of a barrier to the south allowing the incursion of material into a fresh water or marine sea or lake; or, there was a natural extension of local sources of derivation

Laming, Worth and Lloyd, maintained the idea of water transport over a wide area with varying force; torrential rainfall would, have accounted for this, occurring in short sharp downpours. This certainly would have resulted in the subangular fragments, and, together with an arid climate, would account for the fresh feldspar and reddened colouring of the bed. However, opinions differ as to whether this process was via wadi-type formations or due to sheet transport. Somervail concluded that a glacial climate was responsible!

Also associated with these ideas, are the fanglomerates and alluvial fans of mountainous regions (comparable to Kashmir and Persia today). The Dartmoor granite formed an elevated dome, and. water flowing eastwards would give such accumulations of angular debris, which may have been swept into lakes where normal sands were deposited. The topography was thus either composed of mountains with deep valleys and fans, as in the Himalayas, or a red desert with playa lakes, as in central Australia.

Scrivener disagrees with both these views, saving that the Pebble Bed was formed as a beach deposit in a large lake, the pebbles being obtained from cliffs and by long-shore drift (due to the wind, system) from the south. The water was charged with iron in solution, which was precipitated as ferric hydrate or oxide, and which would, have made life impossible. He says there are no radial dip structures to indicate fans, and no cracked pebbles (cracking is due to the diurnal temperature variations in deserts).

This theory can account for local and foreign, material, and Scrivener says that even if this sea was greater than 50 miles in diameter, subangular pebbles are still possible. At the same time, rivers brought alluvium from a warm, moist land lying to the west, and brought much iron oxide from eroded laterised rocks, giving the red colour. The iron may have come from the Culm rocks, which contained pyrite, or from mineral deposits from the granite, or organic colloids. Throughout New Red times, however, there must have been a steady climatic change - the climate getting drier - to account for the evaporate conditions during Keuper times.

DERIVED FOSSILS FROM THE BUDLEIGH PEBBLE BED

The following list contains some of the more common derived fossils from the Budleigh Pebble Bed, with their provenance, where known.

Plant	Verillum	Armorica
	Daedalus	
Annelida	Trachyderma serrata	
Trilobita	Homalontus brengniati	Normandy
	Phacops incertus	Normandy, Rennes
	Calymene tristani	Normandy, Spain
	Myocaris lutrria	
Brachiopoda	Lingula lessueuri	
	L. hawkei	
	L. rovaulti	
	L. brimonti	
	Leptaena vicaryi	
	Porambonites	
	Orthis pulvinata	
	0. redux	Spain, Bohemia, Normandy
	0. budleighensis	
	Spirifer antiquissimus	
	S. vermeuili	
	S. davidis	
	Rhynchonella	
Mollusca	Modiolopsis obliquus	
	M. armorici	Normandy
	M. liratus	Normandy
	M. lingualis	
	Hippomya ringeus	
	Lyrodesma caelata	
	0rthonota grammysioides	
	Clidophorus amydales	Armorica
	Naranjoana	Spain
	Ctenodonta bertrandi	Armorica
	Palaearea secunda	
	Solen	
	Belerophon	
	Orthoceras	

TABLE SHOWING THE MOST COMMON 20 MINERALS IN ORDER OF FREQUENCY, WITH THEIR TYPICAL MODE OF OCCURENCE.

Mineral			Occurrence when primary
Quartz	Trig.	SiO_2	ig., met. rocks
Staurolite - up to 20%	Orth.	$A1_4FeSi_2O_{10}(OH)_2$	medium grade met.
Orthoclase – up to 6%	Mono.	$KAlSi_3O_8$	ig., met. rocks
Rutile - plentiful	Tetrag.	TiO_2	Ig. access., met. min. and alteration
Anatase - plentiful	Tetrag.	TiO_2	vein min.
Zircon – plentiful	Tetrag.	$ZrSiO_4$	acid ig. access.
Biotite - plentiful	Mono.	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	ig., met. rocks
Muscovite - some	Mono.	$KAl_2(AlSi_3O_{10})(OH)_2$	ig., met. rocks
Ilmenite	Trig.	$FeTiO_3$	ig. min. assoc. with basic rocks
Fluorite	Cubic	CaF_2	usually in veins
Microcline - some	Trig.	$KAlSi_3O_8$	ig., met. rocks
Kyanite - some	Trig.	Al_2SiO_3	med. grade regional met.
Cassiterite - some	Tetrag.	SnO_2	hydrothermal & metasomatic min.

Brookite - some	Orth.	TiO_2	vein min.
Sillimanite - some	Orth.	Al_2SiO_5	high grade reg. met.
Apatite - some	Hex.	$Ca_5(PO_4)_3(F,Cl,OH)$	ig., met. or organic
Garnet - some	Cubic	$(Fe,Mg,Mn)_3Al_2\ (SiO_4)_3$	typically met. rocks
Magnetite - some	Cubic	Fe_3O_4	ig. Accessory, met. min.
Sphene - rare	Mono.	$CaTiSiO_5$	int. and acid accessory min.
Tourmaline - rare	Trig.	$Na(Mg,Fe)_3Al6(BO_3)_3Si_6O_{18})(OH)_4$	vein, pegmatite & met. access.

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Hull	1892	Quart. Journ. Geol. Soc.	vol. 48
Hutchins	1963	Geol. Mag.	vol. 100
Irving	1888	Quart. Journ. Geol. Soc.	vol. 44
Laming	1965	Nature	vol. 207
Laming	1966	Journ. Sed. Petrology	vol. 36
Salter	1864	Quart. Journ. Geol. Soc.	vol. 20
Scrivener	1948	Geol. Mag.	vol. 85
Thomas	1902	Quart. Journ. Geol. Soc.	vol. 58
Thomas	1909	Quart. Journ. Geol. Soc.	vol. 65
Thomas	1940	Proc. Geol. Assoc.	vol. 51
Ussher	1876	Quart. Journ. Geol. Soc.	vol. 32
Whitaker	1869	Quart. Journ. Geol. Soc.	vol. 25
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R. Dixon.

REPORT ON THE QUATERNARY RESEARCH ASSOCIATION MEETING IN EAST ANGLIA, 3-7 April, 1970.

East Anglia contains localities which are the type sites for much of the British Quaternary, based, on early work in this field. It also contains areas where recent work is yielding valuable information or chronology and process. Although good, coastal sections are exposed, correlation is made difficult by the lack of exposures inland.

Four main areas were visited at this meeting.

i) <u>The Waveney Valley</u>

This area provides direct chronological evidence, from biogenic deposits of Hoxnian and Ipswichian interglacials, and related glacial deposits. The position of terraces suggests that the present valley system of the larger rivers in East Anglia was initiated, in Gipping times, (post-Hoxnian, pre-Ipswichian).

ii) <u>The coast from Lowestoft to Weybourne</u>

Two elements are present in the coastal sections. Firstly, the Cromer Forest Bed Series with ample organic remains, below which no glacigenic deposits have been found. And secondly, a series of glacigenic deposits with no organic remains, that are correlated entirely on lithological grounds. These glacigenic sediments change laterally from a simple undisturbed sequence to the south-east, to an intensely contorted sequence, incorporating massive chalk rafts, in the north-west near Sidestrand.

This "contorted drift' presents three main, problems. One, the unravelling of the stratigraphic sequence in the zone of intense glacitectonics; two, the correlation with the undisturbed sediments to the south-east; and three, the origin and process of apparently stratified, tills, chalk rafts and other structures.

The freshness of the exposures has in the past boon maintained by marine erosion, but attempts are now being made to halt this process along much of the coast. Opportunity was thereby provided for seeing various forms of erosion in action (mudflows, sand-runs, gullies, etc), and also the effectiveness of different protective systems,

iii) North Norfolk

Various geomorphic features, moraines and sandur plains, occur, but the lack of exposures makes possible several interpretations of their origin, all feasible but none certain. For example, a conical hill of sand and gravel standing just apart from a major sandur plain could be an ice-contact feature or a remnant of the former extent of the plain, left by erosion. These ice-marginal features are difficult to correlate with the nearby coastal exposures.

iv) Norwich Area

The remapping of the Norwich Geological Sheet and work by the Mineral Assessment Unit of the IGS have produced, much new data from this area, some of which disagrees with previous geomorphic interpretations. Distinguishing between Norwich Crag sands and glacial sands is difficult in places, but a technique for deducing environmental history of sediments by studying sand grain surfo.ee morphology has proved successful.

Again, correlation between this area and the other three is difficult.

In conclusion, although this is the classic area of Quaternary study in Britain, its history during this ere- is largely uncertain. A great many conclusions reached in tin past have been based, on only a few, or even one, criteria. Quantitative measurement of every conceivable parameter of these deposits is necessary to enable better correlations to be made.

P. Grainger

NOTES ON A TEMPORARY EXPOSURE AT MARKS TEY, ESSEX.

During 1969 construction of the new Colchester by-pass necessitated an excavation at TL 9192391, the site of an underpass. The floor of this excavation coincided with the water table, an employee of the contractors mentioning a maximum depth of 26 ft. The writer was able to briefly visit the site in July, and observed the following general succession:-

topsoil
lodgement till
- non-sequence
gravels with sands
white sand

Notes on beds:

The topsoil had been removed locally, along with most of the boulder clay; thus the thicknesses could, not be estimated. The boulder clay has a high Chalk-rubble content, with blue- and-white and yellow flints, some scattered Palaeozoic sandstone pebbles: in addition a smoothed abrogate: of quartz crystals was found.

General observation suggested the long axes of these pebbles to be aligned NW-SE, indicating movement from the NE. This data is indicative that this till is associated with the Upper Chalky Drift of Gipping age, (Baden-Powell, 1948). The colour is strongly red, approaching cherry. Below this bed a non-sequence was distinguishable.

The gravels exhibited vertical and lateral variation, but crude stratification is seen on correlating the accompanying sections. The gravel fraction is dominantly yellow-brown flint, but not Kentish type, commonly with water-smoothed thermal fractures. A little quartzite of undetermined stratigraphical origin occurs.

Below these gravels, and apparently without break, occur white sands, the base of which was not exposed. It is an uncommonly well sorted, unconsolidated, sharp sand, very pure and white. Stray pebbles and similar just do not occur. Megascopic examination of samples from B, C, D, (see plan) showed a uniform grain size of 0.25 – 0.5mm, but from A, all grains were less than 0.25mm. A fluvial origin is indicated by the subangular outlines of the grains, which are generally lightly coated with rockflour. Compositions 90% rock crystal; 5% milky quartz; 5% yellow flint. Small scale current bedding at D confirmed the fluvial origin. (See sketch). This bedding is from the south, perhaps an atypical local current.

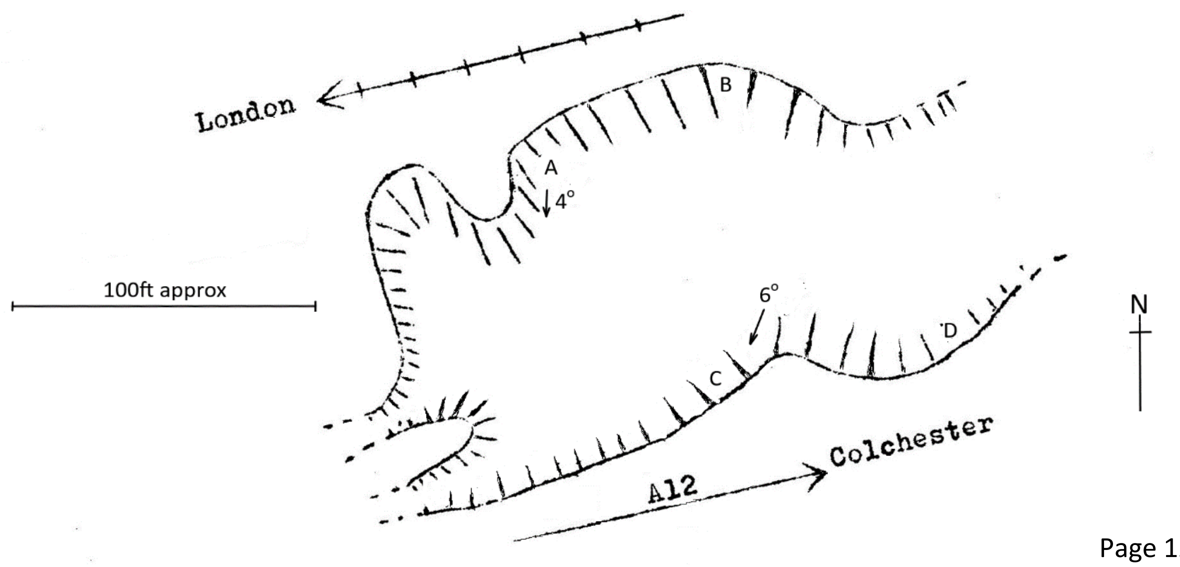
The road construction contractors have a large plant working these sands for concrete manufacture at (TL 924239), where they are seen to extend well below the water table.

Interpretation:

If it is accepted that the till is of Gipping age, 230,000 BP. (Zeuner, 1958), the underlying non-sequence will represent the Hoxnian Interglacial, which is recorded nearby in the famous varved clays of the brickworks. The relationship between these two outcrops has not been determined by the writer. Thus the ice-contact strata beneath may be associated with the Lowestoft Glacial, 435,000 BP (ibid). Alternatively they could be due to a halt of the ice margin, followed by an advance which deposited the till, i.e. the whole sequence being of Gipping age. The sands were probably deposited into a lake, probably a short-lived lake. One cannot dismiss the possibility that the current bedding direction is due to flow from an. ice outlier on the Raylegh Hills. No drag or push is seen in the strata, showing that deposition was more important than erosion, which is what one would expect at this distance from the ice dispersal centre

The writer would be pleased to hear any other interpretations of the situation, which readers may deduce from the limited evidence presented. The present series of A12 road improvement schemes provide an excellent series of exposures through the Essex Quaternary, and the writer hopes this opportunity will be utilised.

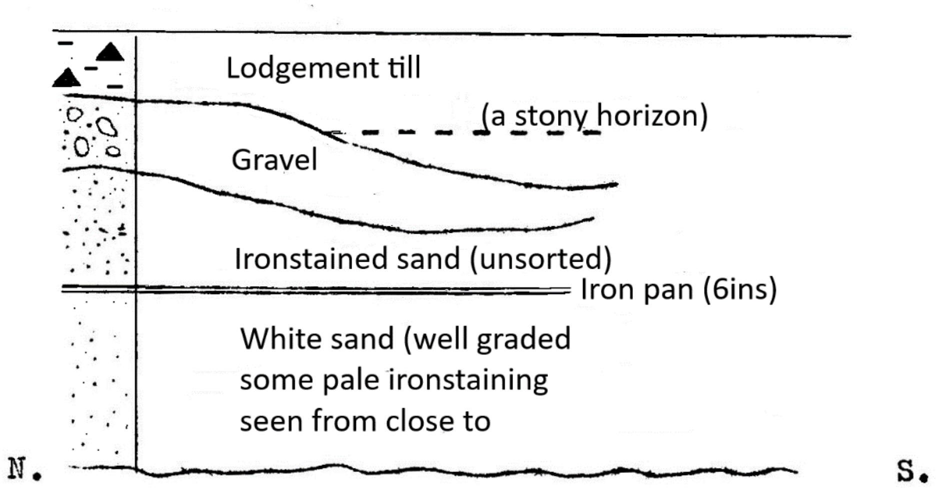
Plan of excavation with apparent dips.



Description of sections

A	B	C	D
6ft Upper Chalky Drift seen 6ft Sand and gravel with clay lenses. 9ins gravel bands at base and 2ft up 3ft White sand exposed	6ft Upper Chalky Drift seen 6ft Sand and gravel with clay lenses. 9ins gravel bands at base and 2ft up 6ft White sand exposed	10ft Upper Chalky Drift seen 4ft Ironstained sand with 18ins flint gravel at base, dipping at 6° 5-6ft White sand exposed	10ft Upper Chalky Drift seen 2-3ft very assorted gravels. 3-4ft Ironstained sands. Strong pan 2-3ins, at base. 5ft White sand exposed

Exposure at D



References

Baden-Powell, D. F. W., 1948. Chalky Boulder clays of Norfolk and Suffolk.
West, R. G., 1963. Problems of the British Quaternary.
Zeuner, F. E., 1958. Dating the Past.

G. E. Fletcher.

A SHORT NOTE ON THE POST 0FFICE SITE AT MARTLESHAM.

Quite extensive excavations have been carried out in connection with the new Post Office Research Station at Martlesham Heath, near Ipswich. The following observations were made on one short visit to the site on 3 July 1970.

The section then exposed showed at the base, up to 0.5m of much comminuted shelly Red Crag. Above this was about 7m of decalcified crag, with prominent current bedding. This deposit contained a relatively high percentage of gravel and coarse sand, mainly pebbles and well rounded grains. Horizons of ferruginous clay were also present, and numerous vertical burrows of various types ranging from 3 to 20mm in diameter. Overlying this, 2 - 3m of sand and gravel was seen. This deposit also showed cross bedding and. channelled into the Crag sand; a bed of coarse gravel with cobbles was present at its base, in places. The gravel appeared mainly subangular to subrounded with a fairly high percentage of quartz. The ferruginous staining of the Crag passed up into this gravel.

The succession and facies here are very similar to those at the Waldringfield Heath Pit, which almost adjoins this site.

P. Grainger and J. Holden

INTRODUCTORY NOTES ON THE LOCAL EOCENE DEPOSITS

The Eocene deposits of East Anglia lie at the north-east edge of the Eocene rocks of South East England; they rest unconformably on Senonian Chalk and are themselves unconformably overlain by Crag deposits. They outcrop in Essex and. South-East Suffolk, and have been found in boreholes in North-East Suffolk and East Norfolk.

The Eocene beds fall into two main groups;-

ii. London Clay.

i. Lower London Tertiaries.

The following descriptions apply mainly to the Ipswich area.

LOWER LONDON TERTIARIES

A variable series of clays, sands and pebble beds, which may be divided into:

c. Oldhaven Beds / Blackheath Beds.

b. Reading Beds / Woolwich Beds.

a. Thanet Beds.

These divisions are lithological and stratigraphical only; it is not yet possible to correlate them palaeontologically with beds bearing the same names in the London area. The lowest division may be of Paleocene age.

THANET BEDS

About 2.5 metres of greenish, glauconitic clay with a basal bed of green-coated flints. Casts of foraminifera have been recorded and pieces of fossil wood are occasionally found.

READING BEDS / WOOLWICH BEDS

Pale yellow sands, about six metres thick, often with clay pebbles. The deposits are usually regarded as of freshwater origin. No fossils have been found in situ, but plant remains and marine fossils (of uncertain in situ position) are recorded.

Large sandstone blocks ('Sarsens”) occasionally occur within these sands

Green and red mottled clays are found within the ‘Reading Beds' in southern Ipswich.

OLDHAVEN BEDS / BLACKHEATH BEDS

About one metre of grey sand containing flint pebbles, occasional teeth of sharks (Odantaspis), marine molluscs (including Astarte, Corbula, and Ostrea), and rare mammals (Hyracotherium). This fauna and its relationships are in need of revision.

LONDON CLAY

A bluish-grey,or brown, clay: about 30 metres thick in S.E. Suffolk. Occasional bands of nodular calcareous mudstone (cementstone; septaria,- with calcite veins) are found, and there is a thin basal bed of black flint pebbles.

Pieces of wood (often pyritised) are often to be found, and animal fossils recorded, include molluscs (Euspirus, Arctica, Modiolus), crabs, Sharks (Odontaspis), turtles, and mammal's (Hyracotherium).

Small crystals of gypsum are common at some localities. In the past, the clay has been used for brickmaking, the mudstone nodules in buildings (e.g. Orford Castle), and pyrite nodules ('copperas’) in the manufacture of sulphuric acid. Derived fossils from the London Clay are sometimes found in the Red Crag.

(These notes were originally made for a meeting of geologists in Ipswich)

R.A.D. Markham.

NOTES ON THE PITS AT BRAMFORD AND GREAT BLAKENHAM

BRUSH'S PIT, BRAMFORD (formerly Coe's Pit)

In August 1970, mollusc remains were found in the stone-bed generally taken to be the Basement Bed of the Red Crag. Fragile casts and moulds of gastropods include a sinistral species (possibly <u>Neptunea contraria</u>) and a few dextral specimens. A bed of mussels (possibly <u>Mytilus edulis</u>), many with both valves joined, was also found; these are preserved in the original calcium carbonate. It is possible that only shells containing calcite are represented.

Recent sections have also shown the junction of the ferruginous 'Crag Sand' and the overlying pale-coloured, quartz-rich gravel to be a sharp break and not a gradation.

In 'The Geology of the Country around Ipswich' by P. G. H. Boswell (Mem.Geol.Surv.,1927, p.17) the Reading Beds are described as resting upon an irregular surface of, and filling pockets in, division (e) of the Thanet Beds. However, it may been seen in the sections at the present day that division (e) is separated from the underlying (d) by a distinct break (i.e. there is no gradation), (e) contains small stones (also noted by Boswell), and (e) appears to grade up into the Reading Beds at some sections. Thus the local 'Reading Beds1 may perhaps be extended to include the uppermost division (e) of the 'Thanet Beds'.

GREAT BLAKENHAM (Cement Works Pits)

Collecting of erratics in the blue (Lowestoft) boulder clay in 1967 showed that Hunstanton Red Rock was not an unusual in situ material. Previous work has suggested the Red Rock to be a marker erratic of the Gipping Till. Further work on the direction, of travel of the ice is obviously needed.

Reddish sands containing phosphatic nodules and phosphatised bones sometimes occur in depressions in the top of the Chalk, underneath the pale-coloured sand which lies below the till; they add to evidence showing the former distribution of the Red Crag.

R. A. D. Markham.

PUBLICATIONS AND MEETINGS IN 1969 - 1970

<u>Publications</u>

Newsletters nos.
18 (16 Dec 1969; 2pp.)
19 (7 Feb 1970; 1p.)
20 (9 May 1970; 1p.)
21 (3 July 1970; 1p.)
22 (13 Aug 1970; 1p.)

Bulletins nos.
7 (Autumn 1969; 16pp.)
8 (September 1970, for Spring 1970; 20pp.).

<u>Meetings</u>

Sun. 21 Sept. 1969 - Great Blakenham.
Sat. 15 Nov. - lecture,"100 years old, - a look at the predecessors of the Ipswich & District Natural History Society", by R. Markham. (Joint meeting with the Ipswich & District Natural History Society).
Sat. 29 Nov. - Ipswich museum, informal meeting, 'Local Chalk Fossils'.

Sun. 28 Dec.	- Bramford old brickyard.
Thur. 1 Jan. 1970	- Annual indoor Meeting.
Sat. 7 Feb.	- Ipswich Museum, informal meeting, 'Crag Bivalve Molluscs'.
Sun. 8 March	- Sudbourne Park.
Sun. 17 May	- Bucklesham.
Thu. 11 June	- Caistor near Norwich (Joint meeting with Geological Society of Norfolk).
Thurs. 9 July	- Great Blakenham (Joint meeting with Geological Society of Norfolk).
Sat 25 July	- Waldringfield Heath.
Tues. 4 Aug.	- Bramford.
Thur. 20 Aug.	- Bucklesham.

Members were also able to participate in the following meetings of a local transport society;-

26-29 April 1970	- Germany
3 May 1970	- Brighton

FINANCE (September 1969 - August 1970)

Expenditure

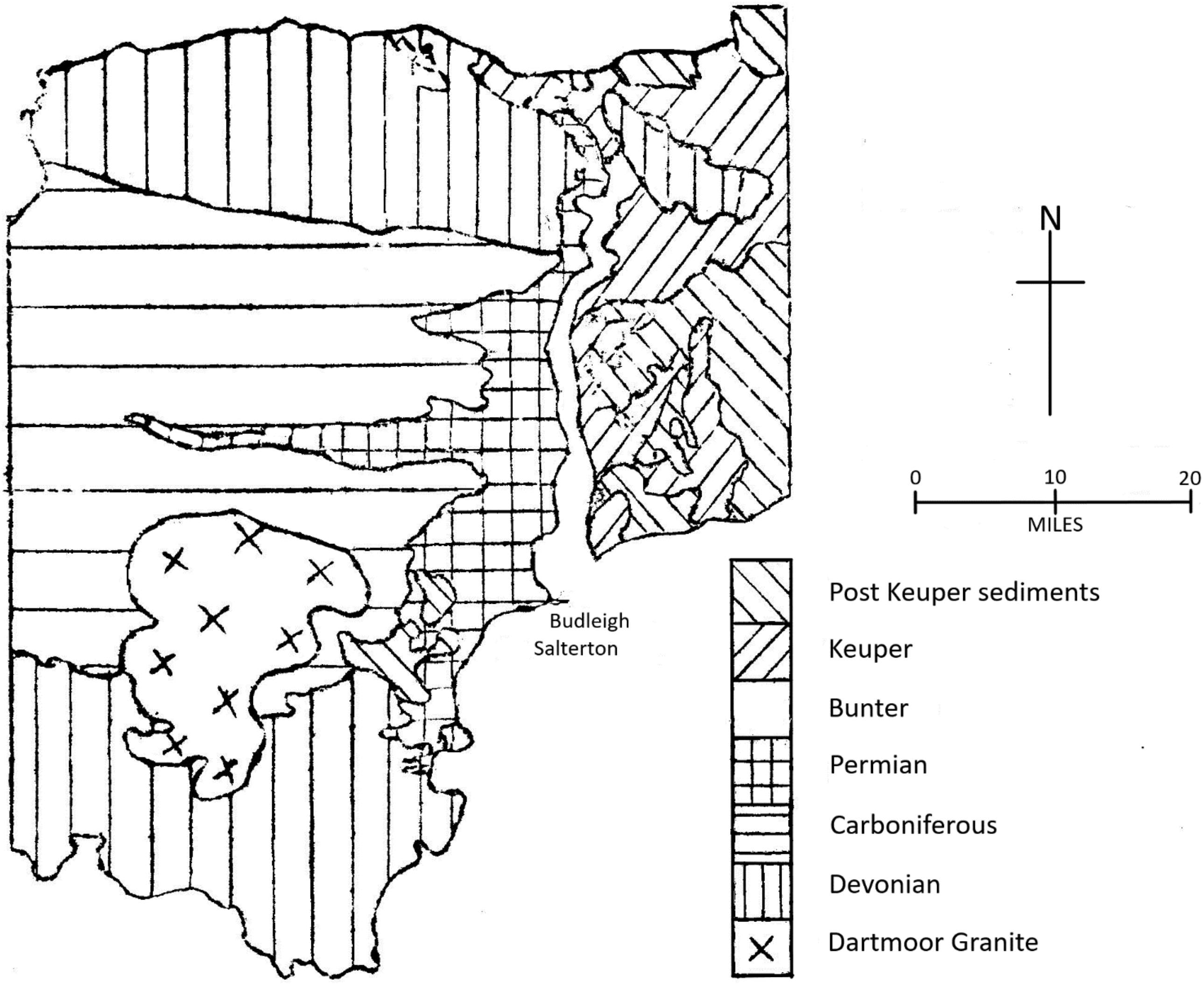
	£.	s.	d.
Postage, Newsletters 18-22	4	15	8
Postage, Bulletins 7 & 8	1	17	0
Envelopes, Newsletters 18-22		9	11
Envelopes, Bulletins 7 & 8	1	7	8
Stencils, Newsletters 18-22		7	0
Stencils, Bulletins 7 & 8	2	2	0
Duplicating Paper	4	13	8
	£15	12s	11d

Income

	£.	s.	d.
Carried forward from 1968-1969	3	14	6
Subscriptions	16	10	6
Donation		2	0
Interest on Bank Account		10	6
	£20	17s	6d
Carried forward to 1970 - 1971	£5	4s	7d

R. M. & P. G.

Regional Geology around South Devon - New Red Series



Palaeogeographical map of Pebble Bed times