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ORDINARY GENERAL MEETING.*

REV. DR. WALKER, F.L.S., IN THE CHAIR.

The Minutes of the last Meeting were read by Professor E. Hull in the absence of the Hon. Secretary.

The following paper was read by the Author :—

EOLITHIC IMPLEMENTS. By the Rev. R. ASHINGTON BULLEN, B.A., F.L.S., F.G.S. (With seven Plates.)

CONTENTS.

§ I. *Eoliths distinct from Palæoliths and Neoliths.*—The now generally accepted types of the best known stone implements made by man have been divided into two groups, representative of two great periods, the "Palæolithic" (those of the *old* stone age) and the "Neolithic"

* Monday, 18th June, 1900.

(those of the *new* stone age). Other terms have been suggested recently. The late Sir J. W. Dawson, F.R.S., has adopted "palanthropic" and "neanthropic" as expressive of the same series of facts. But the terms palæolithic and neolithic, for which we are indebted to Sir John Lubbock (Lord Avebury), are not likely now to be displaced from the position they have held so long.

The geological distinction between these two types of implements is that the Palæolithic implements* are of forms which were used by men contemporary with the now extinct mammalia—the cave-lion, cave-bear, mammoth, cave-hyæna, species of rhinoceros and hippopotamus, the Irish deer, etc.; while the Neolithic implements (though some of them nearly resemble the Palæolithic) are either found scattered on the surface and generally unstained, or are unearthed from burial mounds, where they have constituted part of the interment.

But, although the terms "palæolithic" and "neolithic" are used in the above senses, the forms of tools and weapons included under these terms have lingered in one district or another down to recent or comparatively recent times:—the Palæolithic in Tasmania,† Egypt,‡ and North America;§ the Neolithic in Egypt, North America,‖ New Guinea and other islands of Melanesia, South America, and numerous other places. Their occurrence in North America¶ is a testimony to the late retreat of the ice-sheet there at the close of the glacial epoch.

§ II. *Eoliths: their name and authenticity.*—We turn now, however, to a third class of stone tools which, unlike the palæolithic and neolithic, has not yet passed beyond the stage of criticism into that of general acceptance.

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* H. B. Woodward, *Geology of England and Wales*, 2nd Ed., p. 479. Evans, *Ancient Stone Implements*, p. 472.

† Prestwich, *Controverted Questions in Geology*, p. 72. Dr. E. Tylor, *Journ. Anthrop. Institute*, November, 1893, p. 141.

‡ Forbes, *Bulletin Liverpool Museum II*, Nos. 3 and 4, p. 115.

§ Mercer, *Antiquity of Man in the Delaware Valley*, p. 6, says:—"Beyond doubt it has been demonstrated in the last five years that North-American Indians continually manufactured chipped stones more or less resembling the Drift types, and in fact scattered the whole surface of the United States with them." Evans, *Ancient Stone Implements*, 2nd Ed., *passim*.

‖ Boyle, *Archæological Report*, Toronto, 1896–97, p. 49, Figs. 6–10.

¶ Dr. E. W. Claypole, *American Geologist*, November, 1896, p. 306.

Nor can we blame the doubters; for in such a case as this the believers must justify the claims of these very old implements to acceptance on reasonable grounds.

At the same time we must remind the critics that—

> "The novel doctrine may be right
> In spite of cries of danger;
> The best yard-dog will bark and bite
> Alike at every stranger."

It has been proposed to call these particular stone tools "eoliths," or "tools of the *early* stone age," and on the analogy of palæolith and neolith.

As will be seen later on, they are of far earlier date than the accepted palæoliths, and we must use a scientific term compounded of two Greek words if we are to keep to a scientific nomenclature, agreeable to the established usage among naturalists. The ugly expression "plateaulith" has been proposed; but it is as hybrid a word as "bicycle" (Latin and Greek), and "cablegram" (English and Greek), for plateaulith is French and Greek. Purity of terminology pleads for "Eolith," which will be the term adopted in this paper.

Sometimes the Eolithic Men are wrongly referred to as "Plateau Men." This is incorrect, because those men of the earliest Stone Age did not live on the Plateau, nor even see it. As explained later on they must have lived on the heights afterwards reduced by natural causes to the Wealden Island and to the present Wealden Hills.

The so-called Palæolithic Men subsequently lived on the Plateau and left their tools and implements there.

§ III. *Eoliths determined by Prestwich.*—Sir (then Mr.) Joseph Prestwich, in 1859, in working out the Quaternary gravels of the Somme Valley, especially with reference to the tools of palæolithic man, became interested in the occurrence of many roughly chipped flints, such as those with which M. Boucher de Perthes, after twenty-seven years' enthusiastic labours, had acquainted the scientific world.

Many years afterwards Prestwich's attention was attracted to the remarkable series of peculiarly worked flints, of several distinct types, that Mr. Benjamin Harrison, of Ightham, had amassed from the Kent plateau, near Ash, at heights of 500 to 700 feet and over, O.D.*

* See A. M. Bell, "The Tale of the Flint," *Longman's Magazine*, January, 1898, pp. 214–225, for an account of Mr. Harrison's work.

In 1890 Dr. Prestwich laid before the scientific world his views as to these rude stone tools being of human origin.

His reasons for accepting these dressed stones as having been worked into shape were briefly :—

1. They arrange themselves into definite groups according to their forms.
2. The parallelism of the flakes struck off the surfaces is not due to natural or accidental causes.
3. Possible uses can be suggested for some of them as tools and implements.
4. The style of work is the same for those of which the uses are obscure.*

The other causes suggested as capable of producing the same rudely chipped edges of these plateau flints are the action of frost, of river floods, or of waves on a sea-beach.

§ IV. *The action of Frost and Cold. Dawson and Jones.*— Sir J. W. Dawson, F.R.S.,† in writing of the broken flints on natural desert surfaces, and on the sites of old towns and similar places, says, "one error in regard to this natural breakage deserves notice. It is said it has been caused by the alternate expansion and contraction of the flint from changes of temperature. But flint is not easily broken in this way. I have exposed piles of chalk flints for years to the frosts of a Canadian winter, alternating with rain and mild weather; and though a few very good flakes and piercers were produced, this was only from the surfaces already broken; and the number of specimens was very small. The actual cause is the pounding of heavy stones borne along by torrents, or driven by surf; and the fragments produced in this way are often very similar to those produced by hammering."

It will be seen that Dawson here is speaking only of the general form of flakes produced, and not of hammered edges. The work on the plateau flints is very often on the blunt and not the sharp edges of the flint.

Professor Rupert Jones has been collecting for years specimens of flint accidentally and naturally fractured, having any resemblance to man's stone tools; but these are are mostly of small size and have not the general facies of the flints of the plateau.

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* *Controverted Questions*, p. 62.

† *Leisure Hour*, 1884, p. 490, "Rough Notes of a Naturalist's Visit to Egypt."

His words are:—"That there are, even in gravel-walks, small flints of analogous shapes, but by no means identical with those of the plateau-gravel, is quite true, and some approach to their peculiar shapes may occasionally be seen elsewhere, but the 'Eoliths' are distinct. Doubtless frost in splitting stones can form more or less parallel-sided flakes, often concave and thin on one edge, and convex and thick on the other, and that the thin edge may be readily modified by natural and accidental causes; but the hooked and hollow-curved plateau implements have the concave edge thick, and intentionally chipped and hammered."*

§ V. *Torrent- or river-action.*—Many of the eoliths show contusions caused by rapidly moving water, but the contusion is on the chipped surfaces by which man had previously converted them into implements. It has blunted and obliterated the originally sharp margins of the parallel depressions, which have truncated one another by a series of intentional blows round a roughly regular edge; but such contusion was not the cause of chipping and is (in all cases which I have examined) demonstrably posterior to it in point of time.

It must be remembered that water resists compression (that is the principle of the Bramah press, hydraulic jack, etc.), and in the collision of flint stones one on another by water in violent motion, the water becomes at the same time an elastic cushion between them as they are jostled together; for the greater the aqueous force that flings them together the greater the compression of the water between them, and *pro ratâ* the weaker the resultant collision.

However strongly the suggestion has been made, that aqueous agencies have produced the chipped or hacked edges of these plateau flints, it is a mere assertion; no one has yet produced a series of examples, due to known aqueous agency, whether fluviatile or marine, actually resembling eoliths.

So far then Sir Joseph Prestwich's theory of their human origin holds the field.

§ VI. *Eoliths: their ochreous stain or colour.*—The stain on

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* *Journ. Anthrop. Inst.*, 1898, p. 53. Mr. W. Cunnington, F.G.S., boldly referred the production of the various apparent flakes and chippings on the Kentish Eoliths to the influence of successive glacial periods in his paper on the "Non-authenticity of Plateau Implements" (*Natural Science*, vol. xi, No. 69, p. 332).

the flints of the Plateau drift is not always of the same tint. In some cases the colour is a deep dull brown,* in others there is more polish and a consequently brighter and richer colour, and in some few the tint is of a warm red. This latter tint also occurs, I know, in flints from the glacial gravels of Wells, Norfolk.

§ VII. *The Red-Clay-with-Flints.*—This brown or red stain is not derived from the colouring matter of the "red-clay-with-flints."

Mr. W. Whitaker, F.R.S.,† considers "that the clay-with-flints may be of many ages, and may be forming even at the present day, and that it is owing in great part to the slow decomposition of the chalk under atmospheric action." To the residual flints and earthy matter "would be added the clayey and loamy wash from the Tertiary lands, and the remains of beds of that age left in pipes and hollows in the chalk."

In 1891, I made several excavations in the red-clay-with-flints, varying from three to eight feet deep, in the "Great North Field" and "Paradise" above Dunstall Priory, Shoreham, Kent, in search for eolithic implements, in each case down to the undisturbed chalk. Among the objects in this red clay was an abundance of green-coated flints from the Thanet Sand, pebbles of the Woolwich-and-Reading beds, and Tertiary ferruginous Sandstone (Diestian), with angular fragments of flint as well as whole flints.

In Otford Lane, near Halstead, on the other side of the Darent Valley, in the strawberry lands near Stockham Wood, a bed of entire or complete, dissolved-out, that is residual flints, occurs beneath the "red-clay-with-flints" with the thickness of three or four feet.

At Goodberry Farm, near Woodlands, there is no "red-clay-with-flints," but undisturbed Woolwich-and-Reading red and buff clays, overspread with plateau drift flints.

But whatever the nature of the clay upon the chalk, the ochreous plateau drift always occurs above the clay and never in it.

In this red clay natural flint flakes appear quite white and soft. The reason given for this is that the alumina of the clay has such power to extract the water of crystallization

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* Hence the Eoliths are sometimes alluded to as "Old Brownies."

† *Geol. of London*, vol. i, pp. 282–285 (Geol. Survey Memoir).

from the flint that the natural flint flakes in the clay are not stained but bleached, and are soft and light. They are also so completely desiccated by the clay that when placed in water they absorb it, and the air escaping through the water makes an effervescing sound.

The soft white flints in the red clay are quite different from the hard compact ochreous flints of the plateau gravels; and hence the red clay cannot have been the cause of the brown stain.

§ VIII. *The ferruginous gravel.*—Specimens of plateau gravel from Madam's Court Hill and Shepherd's Barn, Shoreham, Kent, and from Blean near Canterbury, have on them evidences of having lain in a ferruginous matrix. Dr. Prestwich was much interested in these specimens. Mr. B. Harrison has also several, showing the same ferruginous incrustation upon them from the following localities in Kent, Parsonage Farm near Ash, Chimhams, between Kingsdown and Farningham, Terry's Lodge above Wrotham.

The distance from Blean to Madam's Court Hill is not less than forty miles.

It is evident, from the wide extent of the localities from which eoliths so encrusted have been obtained, that the ferruginous bed or probably iron pan, from which these eoliths and plateau gravels were derived, must have been of correspondingly wide extent on that now vanished Wealden range from which they have been carried by aqueous action in parallel directions.

It is remarkable that the gravel at Parsonage Farm, from which many eoliths have been obtained, and where special excavations were made at the suggestion of the British Association in 1894, is also of the same character above mentioned, viz., an iron pan so hard that it had to be broken with the pick-axe.

When we call to mind the very large number of fragments of ferruginous sandstone of Tertiary age which occur on and in the red-clay-with-flints, when we remember the ferruginous Diestian Sands at Lenham, Paddlesworth, and Les Noires Mottes, near Calais, we are strongly tempted to consider that these early Pliocene Crag beds, so widely extended in Pliocene times, must have been the source of the iron matrix in and from which, by percolation of water, these eoliths and gravels received their ochreous stain of various tints.

The staining of flint is a somewhat obscure subject; but

its physical and chemical structure* may account for the varying tints assumed in the same staining medium.

It has been suggested by some that the Eoliths owe their colour to the local gravel in which some of them are found, but the conditions of the superficial deposits do not admit of this solution of the question.

§ IX. *Eoliths: their possible uses.*—Eoliths group themselves into certain well-defined classes or types. These types, in some instances at least, bear rude resemblances to tools or weapons of which the use is known; but in others, beyond the chipped and battered edges, eolithic man has left little trace of his agency upon them. However, this uncertainty as to the intention of the makers and users of these implements need not trouble us, as there are many stone implements the applications of which are unknown.

§ X. *The uses of some old Implements obscure.*—Mr. W. J. Lewis Abbott has pointed out that the use of the small exquisitely worked trapezoidal Neoliths, from the Hastings Kitchen-Middens, the Valley of the Meuse, etc., has not been explained.

In Dr. Grierson's Museum, Thornhill, N.B., there are some long heavy stones, of modern date, bearing very little trace of man's handiwork, and yet they are known to have been used in the Orkneys in modern times as weights for tethering cows, a use no stranger would attribute to them from their shape.

The small stone balls with beautifully worked surfaces, from various parts of Scotland and Ireland, are of uncertain use.† Even their age is doubtful.

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* *Report of U.S. National Museum*, 1897, Plates XVI–XIX.

The great variation in the intimate structure of flint is well illustrated by Mr. Thomas Wilson, Curator of the Division of Prehistoric Archæology, Smithsonian Institution, U.S.A. The mineralogical descriptions are by Dr. G. P. Merrill.

The English flints illustrated from the microscope in Plate XVI are from Brandon, Grimes Graves, and Dorchester (Dorset).

The specimen from Brandon, while generally chalcedonic in character, "shows minute amorphous yellowish and black particles, which are presumably ferruginous and carbonaceous matter." In other instances (not English) he mentions chalcedonic silica with interstitial calcite. It is certain that flint, while mainly consisting of silica, is not homogeneous in structure, and therefore flints will lend themselves to the reception of ferruginous and other stain according to their varying composition and porosity.

† Evans, *Stone Implements*, pp. 420–421. See also Anderson, *Scotland in Pagan Times* (ed. 1883), pp. 122, 220, 232, 249, for implements of stone, bone, and bronze, of which the uses are unknown.

Recently, Mr. T. Wilson* has drawn attention to some very remarkable prehistoric implements, "principally from the Ohio and Mississippi valleys, all of flint in curious and rare forms, believed to be entirely without utility, and solely to gratify an artistic desire. None of them are spear or arrow-heads, and none of them appear to have been made for any service," unless indeed they were for personal wear as *totems*.

It certainly is remarkable that so comparatively civilized a person as neolithic man, who in some localities was acquainted with agriculture, weaving, fishing, and such arts, should leave behind him any implements for which no use can now be suggested with any degree of certainty, although his arts in an improved manner are still those of civilization.

It is not to be wondered so much that Eolithic man, whose very home has disappeared from the face of the earth, should have left behind him tools for which, not being savages, we find it very difficult to suggest uses.

But it is not improbable that, his wants being reduced to their lowest terms, he clad himself in skins, used fire,† made use of wood and the sinews of animals for various primitive appliances; and in hunting, poison and pitfalls may have been the means of obtaining his ends rather than direct attack.

§ XI. *Eoliths: their shapes and probable uses.*—We have evidence of the use by modern North American Indians of flint implements of the most primitive type. Prestwich‡ figures one such which shows very little sign of work, but is of undoubted authenticity, as the following extract from his life§ shows. It occurs in a letter from Dr. Blackmore. "When I say 'implements,' the word would perhaps give a wrong impression, as the specimens found are rather natural or accidental forms of flint that have been taken up, used a few times and then thrown away, but the evidence of use to any one accustomed to the usual forms of flints is unmistakable. As far as I can judge, the early

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* *Report U.S. National Museum*, 1897, p. 943, Plate XL.

† Dr. H. P. Blackmore (Prestwich, *Life*, p. 376), has found evidence of fire in the gravels at Alderbury near Salisbury, from which eoliths (but not palæoliths) have been obtained.

‡ *Controverted Questions*, p. 69.

§ *Ibid.*, p. 363.

savage had two ideas in the selection and use of these conveniently shaped stones, viz., hammering and scraping —and this is just what one would have expected. Some years since the late Professor Leidy gave me a stone scraper which was used by a tribe of North American Indians for dressing buffalo skins: it was an ordinary smooth quartzite pebble, split in half with the thin sharp edge carefully removed, exactly like the plateau Eocene pebbles described in your paper."

Our authority, Dr. Prestwich,* divides the eoliths into the eighteen types according to their shapes.

The edges in Prestwich's Group I. are blunt; and in this Mr. Montgomerie Bell, although accepting them as of human workmanship, finds a difficulty.

But is there really a difficulty? The tools called "sleekers" used in the early part of the century by tanners for removing fat from skins before tanning, were of wood, flat, blunt, and of square form. At present a *blunt* steel blade is used with a wooden back, as I have satisfied myself at Barrow's Tannery, Redhill, and at the Shalford Tannery, both in Surrey. Carpenters also used a blunt steel scraper about 40 years ago. Moreover, some undoubted neoliths are trimmed to a blunt edge: I have one such from Pakefield and others from Newnham near Cambridge, and Clapham Hill near Whitstable.

Among the implements from the plateau are several squarish eoliths with flaked and chipped edges (Plate IV, Figs. 1, 2)† analogues of the above mentioned sleekers. Probably the round scrapers also were used in dressing skins.

Another set of tools characteristic of the plateau drift is the double-shoulder scraper (Plate IV, Fig. 5).‡ Some of these have the chips struck off at the same general angle and on the same side of each shoulder. These are probably scrapers.

There are others, however, in which the chips were struck off at the same general angle, but the resultant surfaces are on opposite sides of the two curves respectively. They thus form a boring tool; for, if the point were worked into

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* *Controverted Questions*, pp. 69, 70, and 71. The type collection is now in the British Museum (Natural History), Cromwell Road.

† Prestwich, *Controverted Questions*, Plate I, Fig. 1, p. 80.

‡ Prestwich, *Ibid.*, Plate VII, Figs. 20–25; Plate XII, Fig. 40.

any material, such as a sapling or some soft wood, for instance, these chipped surfaces would always present cutting edges to the material operated on as the tool was rotated. They are analogous to the "engineer's bit." These drills occur in the plateau gravels in a series from the bluntest point up to a fine boring tool.

They resemble in their general idea the beautifully worked points of the bone-needle-borers described and figured in the *Reliquiæ Aquitanicæ*, pp. 134, 141. Of course I do not suggest that the larger and coarser borers were used for making needles, only that the general idea of the piercer is the same.

Mr. B. Harrison, from evidence of travellers who have seen his collection,* is of opinion that Eolithic man used some of the scraper-stones for rubbing the hard skin of the foot to prevent painful cracks and corns which cause lameness. For the same reason he believes that some of the larger curved stones were used for scraping the limbs and body to soften and supple the skin. At any rate it is certain that the luxurious Romans used the strigil or scraper made of horn or metal,† to add to the comfort of the baths (*thermæ*), and kept slaves for the purpose of scraping them with that instrument. This practice of scraping the body after the bath was seemingly derived from the Greeks, among whom it may have survived from early times. An instrument (στλεγγίς)‡ (at Sparta made of reeds, elsewhere of metal) was used to scrape the limbs and body after the bath, and the exertions of the palæstra, in the latter case in order to remove the oil and sand from the body after a wrestling match. Its form στρεγγίς is akin to the Latin strigil. The anointing was probably post-Homeric, but that is no evidence that the scraping was not a more ancient practice. At any rate the possibility of the scraping of the body with hollow scrapers to conduce to its comfort is not to be dismissed with a gibe.§

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* *Transactions of S.E. Union of Scientific Societies*, 1899, pp. 15, 16.

† Lewis and Short's Latin Dictionary, *sub* "strigil."

‡ Guhl and Koner, *Life of the Greeks and Romans*, p. 220.

§ Consult Becker, Gallus, *Excursus I*, p. 394 (Longman's "Silver Library"). Ramsay, *Manual of Roman Antiquities*, 10th Ed., 1876, p. 434. See also Professor T. Rupert Jones, *Nat. Science*, October, 1894, para. 5, p. 272, for the probable wants of Eolithic man and consequent implements.

Cf. Martial, XIV, 51.—

"Pergamus has misit, *curvo destringere ferro*."

§ XII. *Eoliths: their Geological Age and their History.*—Our interest in the rude ochreous implements of the Kentish plateau centres in their unique position, at a higher level than the Pleistocene High-level Gravels, and in their consequently greater age, ante-dating the Glacial Epoch. When Sir Joseph Prestwich, having finished his monumental work on geology and resigned his Oxford Professorship, was able to devote himself to local geology, his prescience at once discerned this fact, and his writings are storehouses of information on this subject.

These eoliths have been found at levels from 400 to 700 feet O.D.* by their discoverer, Mr. B. Harrison†, by Mr. de Barri Crawshay,‡ Mr. Montgomerie Bell,‡ Mr. W. J. Lewis Abbott,§ Mr. Santer Kennard,‖ Mr. O. A. Shrubsole,¶ Mr. H. Stopes, Mr. A. E. Salter, Mr. Lasham, by myself,** and others.

In 1894 the British Association made a grant for excavating on the crest of the North Downs in a carefully selected spot, under a Committee consisting of Sir John Evans, F.R.S., Professor H. G. Seeley, F.R.S., and the late Sir Joseph Prestwich, F.R.S., under which committee Mr. B. Harrison worked, carefully recording the progress of the excavation of the various pits sunk under their direction.

In a pit sunk on Parsonage Farm, Ash (Pit No. II), the following section was clearly made out to my own knowledge :—

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* Ordnance datum or mean high-water mark of H.M. Ordnance Survey used in estimating contours of hills, etc.

† Prestwich, "Drift Stages of the Darent Valley," *Quart. Journ. Geol. Soc.*, vol. xlvii. "Occurrence of Palæolithic Flint imp'ements—Ightham," *Quart. Journ. Geol. Soc.*, vol. xlv. "Primitive character of Flint Implements, etc.," Kent, *Journ. Anthrop. Inst.*, 1892.

‡ Bell, *Journ. Anthrop. Instit.*, 1894, pp. 263-284, *obiter*.

§ Abbott, *Nat. Science*, April, 1894, "Plateau Man in Kent."

‖ Kennard, *Nat. Science*, January, 1898, p. 31.

¶ *Journ. Anthrop. Inst.*, 1894, p. 44, etc

** Bullen, *Nat. Science*, February, 1898, pp. 108, 110, 111.

	Approximate depths. ft.	in.
Dark sandy soil	1	6
Grey and yellow sandy loam	4	6
Iron sand, pebbles, and large rough flints and worked stones	1	0
Grey loam and yellow sandy gravel and worked stones	1	0
Stiff black soil and worked stones	1	0
Orange, red, brown or grey loam, and few pebbles	18	0

Below which depth the section was not continued.

(See also *Report of British Association for* 1895, p. 349.)

I visited this section with Mr. B. Harrison on December 24th, 1894, and saw this old pre-glacial gravel, and below the 6-foot level took out a well-defined squarish "sleeker" and other rudely flaked flints.

In writing of these pits and others opened by Mr. B. Harrison near the same spot Mr. A. Santer Kennard says: "In all these pits, at a depth of 8 feet from the surface, a bed of gravel, varying from 6 to 12 inches in thickness, was found. The gravel was cemented by iron and was so hard that a pick was needed to break it up. The underlying sandy loam, which was pierced for a further depth of 19 feet, is probably of early Tertiary age."

The position of these excavations near the face of the chalk escarpment, at a height of over 700 feet O.D., shows that they were anterior to the Glacial Epoch. They are not gravels of that age, being gravels in a ferruginous cement, whereas the glacial gravel deposits lie at a far lower level, in the bottoms of the chalk valleys, below the 250 feet contour line, and sometimes attain a thickness of 30 feet. Bones of musk-ox, mammoth, horse, etc., as well as land shells, occur in the latter gravels.*

The manner of the deposition of these plateau gravels has been ably stated by Sir Joseph Prestwich, F.R.S.,† and Professor T. Rupert Jones, F.R.S.‡

As the latter wrote at a later date, in consultation with

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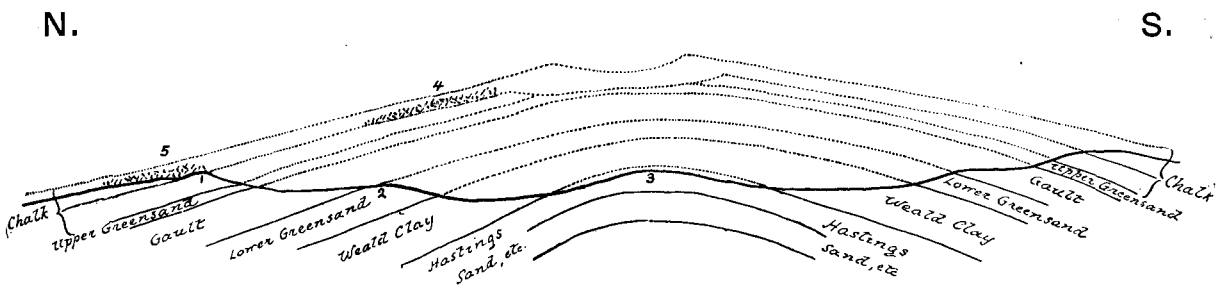
* See also Kennard, *Nat. Science*, January, 1898, p. 33.

† *Quart. Journ. Geol. Soc.*, vol. xlvi, May, 1890, p. 179, sections 7 to 13, and elsewhere.

‡ *Nat. Science*, October, 1894, p. 269, etc.

FIG. 1.—SECTION IN OUTLINE OF THE STRATA FORMING THE OLD WEALDEN RANGE, AND THE CRETACEOUS BEDS OF THE NORTH AND SOUTH DOWNS.



1. Limpsfield (Botley Hill). 2, Oldbury Hill, 3. Crowborough.

his old friend, it will be well to quote his conclusions *in extenso*.*

"The great changes of land surface in this part of the European area were referred—firstly, to the movements accompanying the elevation of the Pyrenees, when the chalk became dry land, with its uplands, valleys, and estuaries; at that time the Wealden area formed an island in the Thanet-Sands sea.

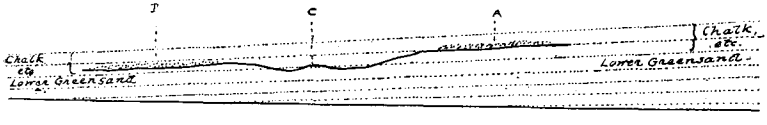
"Some rivers afterwards brought down the clays and sands which now constitute the 'Woolwich-and-Reading' beds. With some submergence other Tertiary beds were formed, probably extending over a part of what is now the Wealden Area.

"Secondly, this area with its stratified coatings was raised up (after the formation of the London Clay) by movements accompanying the elevation of the Alps, by the lateral pressure caused by the earth's contraction. The other Tertiary beds (of Paris, Bracklesham, etc.) had helped to shallow the sea surrounding the island of the Weald, which was ultimately to be an elevated, elliptical, weather-worn, and sea-eaten dome of great height.

"Fig. 1. Diagram showing roughly the relative position of the formations constituting the Wealden Anticlinal between the North and South Downs (1. Limpsfield (Botley Hill), 877 feet; 2. Oldbury, 620 feet; 3. Crowborough, 803 feet); also their successive denudations, and the original place of the Old Gravel (4), some of which was brought down by natural agencies to the Chalk Plateau (5) now existing.

"Fig. 2. Diagram showing the possible position of the

FIG. 2.—SECTION OF THE STRATA FORMING THE NORTHERN SLOPE OF THE OLD WEALDEN RANGE, WHEN THE BROWN GRAVELS CAME TO A LOWER LEVEL.



A. Old Gravel at higher level.
B. Old Gravel at lower level.

* *Op. cit.*, pp. 270–3.

Lower Greensand outcrop (C) when the Old Gravel (A) was being transferred from the higher (A) to the lower (B) level of the chalk by natural agencies along a continuous surface. The strata are set at too high an angle in Fig. 1 to show what is required here.

"(A) Old Gravel in place. (B) Plateau Gravel derived from the Old Gravel. (C) Outcrop of the Lower Greensand.

"The successive stages were:—

"1. When the elevation of the Wealden area attained its maximum, there was certainly a considerable thickness of chalk on the surface, and this was necessarily exposed to marine and atmospheric denudation.

"2. The immediate result of this was the wearing away of the chalk and the trituration of the washed-out flints; and thus the formation of a great bed of shingle—that of the Thanet Sands.

"3. With continued wave-action, these shingle-banks were washed away and distributed at a lower level, to be the Pebble-beds of the 'Woolwich-and-Reading' series, which had been formed in the meantime by rivers from the hill-ranges. The pebble-beds can now be seen at Addington, Blackheath, etc., extending to the very edge of the present chalk escarpment.

"4. The deposits of this stage were next removed in part; and in course of time the Diestian beds were laid against the flanks of the lowered and perhaps sinking range. Of these strata some limited patches, such as the Lenham beds, remain here and there on what are now the Chalk Downs.

"5. One or more accumulations of chalk-flint débris were formed at or about this stage of the history of the old Wealden Range or Island, and were probably characterized by the presence of iron-oxide in greater quantity than in the common ferruginous gravels of the south-east of England at present.

"Man, being present, used such pieces of the flint as suited his requirements. Probably, at first, with little or no alteration of form; but afterwards he applied them with definite modification of their shapes to meet his wants in killing, skinning, cutting, fire-making, rubbing, pounding, scraping, drilling, knocking, breaking, chopping, digging, etc., that is in tooling and other processes.

"Such implements he made and left there, on that old, very old, probably pre-glacial ground (see Fig. 1).

"6. This gravel extended down the side of the 'dome'

perhaps tailing down the slopes of uplands by slips, slides, and slushings, probably by more than one stage, after its formation; or, during a succeeding age, the sea cutting away the lessening dome, or torrents scoring the hill-sides, removed the more or less extensive deposits of ferruginous gravel, with the rude implements left upon it, and spread out the much worn relics on the slopes of the chalk below. Here they are now found on the isolated plateau; and they lie on the 'red-clay-with-flints,' that had been in process of formation previously, for ages, by the gradual solution of the chalk below, and the settlement of argillaceous and sandy matter from the overlying and gradually disappearing Tertiaries. This was coextensive with the chalk-surface, and on it lies some of the transported ochreous gravel, together with Tertiary pebbles, less worn flint stones, and some *débris* of the Lower Greensand, which the wave-line had then reached. The presence of chert fragments from the Lower Greensand proves that the current of driftage (or the tailing of the gravel) must have passed over the outcrop of the Lower Greensand, and therefore here from south to north, on a continuous surface (see Fig. 2).

"7. Subsequently the outlying chalk (now the plateau above referred to, sloping from an elevation of about 800 feet on the south to 400 feet and less on the north) was cut off by denudation in the Glacial period from the remaining uplands of the once lofty range, the Weald-clay Valley lying below the escarpment of the L.G.S. at the foot of the diminished dome, and the Holmesdale of Gault Valley at the foot of the chalk escarpment (see Fig. 1).

"The Diestian or Lenham beds were formed in the early Pliocene period, and the denudation probably began directly afterwards, at about the time of the Red or the Chillesford Crag, in late Pliocene or Post-Pliocene times; and as the old ferruginous gravel had not only been formed but had been brought to a lower level before that time, it must be regarded as of pre-Glacial age.

"A similar series of occurrences and geological results evidently took place on the south side of the old Wealden uplands, giving origin to the brown-coated rude implements at Friston, near Eastbourne, in Sussex."

As the Kentish chalk plateau is the classic ground whence the first specimens of eoliths were obtained, it has been necessary to give the geological evidence for their antiquity *in extenso*.

Furthermore, in the sculpturing of the Wealden hill-ranges glacial agency must have had a large share, as we learn from Prestwich's memoirs above referred to and insisted on in the extract from Professor Rupert Jones's paper at p. 17, and that from Mr. A. Santer Kennard, p. 13. In my old parish in Kent (Shoreham), in the churchyard, at a depth of about 3 feet, an indurated chalk-rubble (locally called "chart") occurs, which was so hard that it blunted the best pick-axes, and its rocky character caused my sexton much trouble. It was from this stratum, but on the other side of the river, at Mill Hill, Shoreham, at about 240 feet O.D., that the tusk of *Elephas primigenius* was obtained, which passed into the possession of Sir Joseph Prestwich.

§ XIII. *Other Observers: S. J. B. Skertchley, O. Fisher, H. Hicks, O. A. Shrubsole, W. J. L. Abbott, C. Reid, J. Lomas, R. A. Bullen, H. P. Blackmore, H. B. Woodward, G. A. J. Cole.*—Since 1890 various workers have been elucidating the epoch of man's appearance, and their labours with singular unanimity have all pointed to the pre-glacial advent of man in Britain.

Omitting the finding of a well-marked flake of human workmanship by Skertchley in 1879, which has the support* of Rev. Osmond Fisher, M.A., F.G.S., who visited the spot, and is a first-class authority, and omitting also the equally important testimony of Dr. Henry Hicks, F.R.S.† (late President of the Geological Society), we will pass to other records of pre-glacial man.

In 1894, and previously, Mr. O. A. Shrubsole, F.G.S., found in deposits of Southern Drift at a general level of 400 feet above O.D., on an elongated plateau between Easthampstead, Berks, and Ash Common, near Aldershot, several implements of a rude and primitive character. He did not come across the common types of highly finished palæolithic implement, such as those of the Somme, Thames, and other valleys.‡

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* *Cambridge Philosoph. Soc.*, vol. iii, pt. vii, p. 288.

† *Quart. Journ. Geol. Soc.*, vol. liv (1898), p. ci.

‡ *Journ. Anthrop. Inst.*, "On Flint Implements of a Primitive Type from Old (Pre-Glacial) Hill-gravels in Berkshire," August, 1894, pp. 44–49. See Dr. Blackmore's remarks farther on concerning Alderbury.

These implements from Berkshire may be referred to three general types :—

1. "Large implements with rounded butt.
2. "Grooved or hollowed scrapers.
3. "Fragments of flint worked at the point only."

These implements are of the general character of plateau-type implements, being slightly but distinctly worked, and rude in form. The gravels from which they were obtained are of the same age as the plateau gravels of Kent. They are, moreover, at a much higher level than the pleistocene gravels of the Thames Basin. They are accepted as pre-glacial (Southern Drift).

In 1897 Mr. W. J. Lewis Abbott, F.G.S.,* an acute observer of the younger school of British geologists, found four implements near Sherringham, Norfolk (one of which bears an *éraillure* or secondary small flake-mark on the bulb of percussion, a hall-mark of man's handiwork).†

Of these four implements, one was found embedded in the iron-pan of the "Elephant Bed," and the others on it, but having the purple black stain characteristic of the flints found in that deposit. Mr. Clement Reid, F.G.S. (as quoted by Mr. Abbott), says, "I have always considered that, if implements were found in the Forest-Bed, it would be at Runton (on the Norfolk coast near Sherringham), although up to the present I have been unable to find any."‡

This discovery by Mr. Abbott puts man in the pre-glacial epoch to which the Cromer Forest-Bed belongs.

Again, in 1898 Mr. Joseph Lomas, F.G.S., of the University College, Liverpool, found in the shell-bearing sands and gravel on Moel Tryfaen two implements which Mr. Abbott gives weighty reasons for accepting as of human workmanship, but his argument is too lengthy to be reproduced here.

Mr. Lomas§ says, "The boulders associated with the flints without exception came from the north. The probability, then, is strong that the flints came from the north. Unless some concealed outcrop of chalk occurs somewhere in the

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* *Nat. Science*, vol. x, No. 60, pp. 89–90.

† *Op. cit.*, p. 95. "I found one well-bulbed flake, partly of the same stain, but partly of a rich brown, on the beach at Bawdsey in Suffolk in 1896, but from the locality it may belong to the Red Crag."

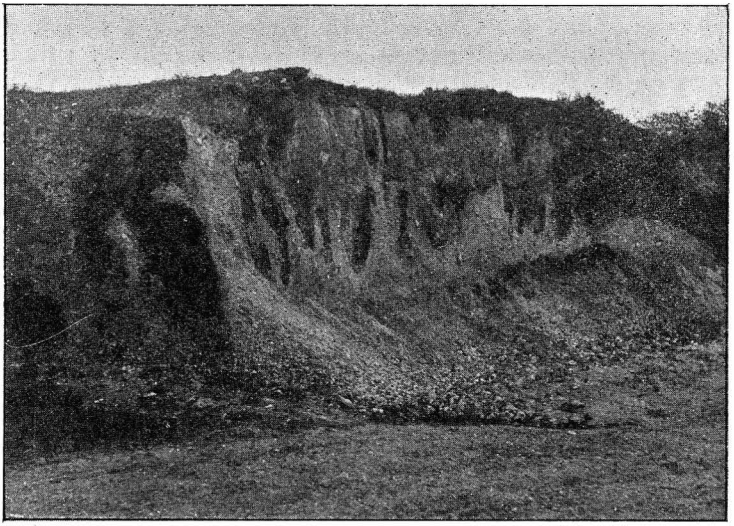
‡ *Ibid.*

§ Lomas, "On some Flint Implements found in the Glacial Deposits of Cheshire and N. Wales," Liverpool, *Arkell*, p. 12.

Irish sea, the only source of the flints is Antrim. They, as a rule, possess the physical character peculiar to Antrim flints."

In 1893 and 1898 I obtained from gravels of glacial age* west of Wells, Norfolk, implements of a rude type, one of them *in situ* at 4 feet down in the sand and gravel. This gravel pit is known now as Morter's, formerly Cadamy's, and is about 300 yards south of the Wells to Holkham Railway. The railway is metalled from the gravel of the cuttings between Wells and Holkham, and between Wells and Fakenham, in which these gravels cap the disturbed chalk.

FIG. 3.—MORTER'S GRAVEL PIT, WEST SIDE.



The following is Rev. O. Fisher's description of the railway-cutting west of Wells:—

"The deep channels cut out of the chalk surface by these (ice) bergs are to be found farther to the west (of Kelland and Weybourn). There is a splendid section of such a one in the railway-cutting between Holkham and Wells. The width of it is 120 yards. It is filled with coarse bouldered gravel and fine calcareous sand, containing abundantly frag-

* Rev. O. Fisher, M.A., F.G.S., "On the Denudations of Norfolk," *Geol. Mag.*, 1868, p. 551. See also Drift Map 68 N.W. of Geol. Survey.

ments of chalk foraminifera and occasionally a fragment of *Cardium edule*. Here we have the coarser materials from which the finer particles have been carried off to form loam elsewhere."

These gravels being thus demonstrably glacial, the contained implements are pre-Glacial, transported probably across the sea from the Lincoln or Yorkshire coast. Although these gravels were deposited in Glacial times, all the flints need not have been striated. From the undoubted Chalky-Boulder-Clay of Little Stukeley very few of the chalk flints are ice-scratched: from an undisturbed deposit dug out in making a rain-water reservoir 12 feet deep and 10 feet in diameter I only found two flints with striæ—they are now in the possession of Dr. G. J. Hinde, F.R.S.

In his paper in the *Anthropological Journal*, Mr. J. Allen Brown points out how nearly the eoliths and the palæoliths are associated. From his long study of stone implements he satisfies himself that the eoliths, palæoliths, and neoliths are closely related without any great lapses of time.

But fortunately we have still further direct evidence of the age of pre-glacial man in the researches of Dr. H. P. Blackmore, of Salisbury. He had previously worked successfully in the gravels of Alderbury Hill, near Salisbury, which according to Prestwich belong to the southern drift,* and are therefore of the same age as the plateau gravels of Kent. His magnificent series of eoliths from these gravels have convinced so cautious a geologist as Mr. H. B. Woodward, F.R.S., who said† he had recently seen, in Dr. Blackmore's museum at Salisbury, a series of the eolithic implements; and he was much impressed by the apparent evidences of design which they afforded. He has also, under the guidance of Dr. Blackmore, examined the plateau gravel at Alderbury whence many of the flints have been obtained; and these were considered to have been hacked rather than chipped into their present forms. It was noteworthy that Dr. Blackmore had never obtained a single palæolithic implement from this plateau gravel, whereas in lower-level gravels near Salisbury such implements do occur, and among them

* *Quart. Journ. Geol. Soc.*, 1890, vol. xlvi, p. 181. "Alderbury Hill, three miles from Salisbury, was capped by gravel full of chert and rag-stone, like the southern drift of the Thames Basin."

† *Quart. Journ. Geol. Soc.*, 1898, p. 297. Discussion on Mr. W. Cunnington's paper on "Palæolithic Implements from Plateau Gravels."

were specimens which have been fashioned after the same type as some "eoliths" but more highly finished.

Since 1898 Dr. Blackmore has been anxious to get a more definite geological date for the eoliths, and has had the good fortune to find eoliths in the *Elephas meridionalis* gravels of Dewlish, in Dorset. He has generously placed the announcement of these discoveries at my disposal; and the Victoria Institute has the honour of the first statement of these important facts.

Dr. Blackmore's statement to me by letter is as follows:—

"The Alderbury gravels were looked upon by Prestwich as a good example of Southern Drift. Before he had definitely arranged the various beds of gravel, they were looked upon as Pliocene, but the absence of fossils, shells, or mammals always left the question of age somewhat doubtful. They certainly rest upon the Bagshot Sands, are at a much higher level than the river drift, which furnishes both flint palæolithic implements and a very good list of Pleistocene mammals and shells.

"There is one point worth noting: the Alderbury gravels are largely dug for road-metalling, and for the last twenty years search has been made for the ordinary palæolithic type of implements both by myself, the workmen who dig the gravel, and other good field-geologists, but in vain. Nothing of this kind has turned up, although they are found in fair abundance in the lower-river-drift gravels of the neighbourhood.

"But since one's eyes have learned to recognize eolithic forms and workmanship, plenty have been found in the Alderbury gravels at all levels, some 14 feet deep, which I have taken out of the gravel with my own hands.

"Being very anxious to fix the Pliocene age of these eoliths, rather more than a year ago I went down to Dewlish, in Dorset, with the express purpose of carefully examining the gravel which had furnished the remains of *Elephas meridionalis*, as this was the one spot in the South of England which was regarded as a patch of Pliocene gravel.

"The farmer, Mr. Kent, on whose land the elephant remains were found was fortunately known to me, and he furnished me with two or three labourers. A trench was opened through the deposit of gravel, and there was no difficulty in finding eoliths, stained like the gravel, at the same level and associated with the elephant bones. This was to me most satisfactory and conclusive.

"I may add that my grandfather, Mr. Shorto, first obtained a molar of *Elephas meridionalis* from this locality in 1813; and I was present when Mr. Mansel Pleydell and Rev. Osmond Fisher in 1887 (but then one's eyes had not recognized eoliths) found the remains now in the Dorchester Museum.

"I have not yet published this fact, but you can make use of it, as it is, I believe, the best evidence of undoubted age yet known. The age of the plateau gravels is very difficult to fix; but I believe the presence of eoliths coupled with the absence of the usual river-drift type of palæolithic implement to be a fact quite as eloquent as a Pliocene bone or shell.

"The character of the work on the flints is important. Eoliths are *hacked*,* palæoliths are *chipped*, and neoliths are *flaked*. Hacking, chipping, and flaking are the characteristics of the three stone periods.

"The colour of the flints varies. The dark and deeply stained yellow ones have clearly been derived from an older gravel; on the other hand, those unstained or but little stained, and having the edges of the fractures but little water-worn, could not have travelled far, and are probably nearly, if not quite, contemporaneous with the deposit of the gravel."

Here, then, we have a series of workers in different parts of England whose labours, whether in Kent, Wales, Norfolk, or Dorset, all lead to one and the same result. They all point to the Pre-Glacial age of man, and the labours of Mr. Abbott and Dr. Blackmore both place his remains distinctly in the epoch of *Elephas meridionalis*.

The question then remains what that epoch is to be called.

Mr. H. B. Woodward's summary of the Pliocene strata is as follows† :—

The Pliocene deposits of this country occur chiefly in Norfolk and Suffolk, and they consist of shelly sand, gravel, and laminated clay.

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* This is *generally* true, but deeply ochreous plateau implements with small chippings do occur from the Kent Plateau 450 to 500 feet O.D., and many neoliths are rudely chipped.

† *Geology of England and Wales*, 2nd Ed., p. 455

The beds are subdivided as follows:—

Newer Pliocene.	Cromer Forest-Bed Series.
	Norwich Crag Series.
	Red Crag.
Older Pliocene.	Coralline Crag.

I do not propose to discuss the Crag Series here, but simply to point out that the Cromer Forest-Bed Series occurs immediately above the Weybourne beds* of the Norwich Crag, and below the Glacial beds.

However, Prestwich points out† that the base-line between the Pliocene period and the Quaternary or Pleistocene period is somewhat arbitrary. He places this base line at the top of that very variable deposit the Chillesford Clay and consequently includes the Forest-Bed with remains of *E. meridionalis*, in the Pleistocene period, as the lower member of the Westleton Series.‡

A list of the Forest-Bed flora and fauna is contained in Mr. C. Reid's memoir on *The Geology of the Country round Cromer*, pp. 62–80, and in Mr. E. T. Newton's memoir on *The Vertebrata of the Forest-Bed.* (*Geol. Survey Memoirs*, 1882.) The absence of *E. primigenius* (mammoth) should be noted.

If, then, we follow Prestwich, we shall class eolithic man as belonging to the early Pleistocene; if, on the other hand, we follow Lyell, we shall regard him as of late Pliocene time. The geological facts of the case, however, are the really important points; the nomenclature, however useful as a framework for the scientific appreciation of those facts, is in this instance a secondary consideration.

As Dr. Hicks pointed out in his last Presidential Address at the Annual Meeting of the Geological Society in 1898, "all the evidence tends to show that the so-called Tertiary and Quaternary periods merged gradually one into the other, and were not separated by any great break in Britain. The higher mountains, before the close of the Tertiary period, must have been covered in part by ice and snow, and the so-called "Glacial period" can only have a chronological importance as indicating the increased intensity and climax

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* C. Reid, *Geology of the Country round Cromer*, 1882, descriptions of sections, pp. 25–33; also Fig. 4, p. 33.

† *Geology*, vol. ii, 1888, p. 441.

‡ *Ibid.*, pp. 422–445.

of that cold condition gradually ushered in at the earlier time. For the same reason there is no marked and definite line separating the fauna of the Pliocene from that of the Pleistocene, for we find remains of the animals of the warmer period closely associated with those of the colder in the same deposits, and under conditions which show clearly that they lived in those areas at the same time.*

I cannot do better than conclude this paper with the word of Professor Grenville A. J. Cole†:—

"Surely the existence in the Pliocene period of a man-like animal capable of making implements is to many of us one of the highest probabilities. The close of the Pliocene period has nothing mystic or magical about it, nor is it likely that man sprang fully armed from glacial furrows. Let us ask ourselves candidly on which side of the question does probability lie."

In conclusion I have to thank Professor Rupert Jones, F.R.S., for loan of books and pamphlets, and also for critical help; and Mr. Benjamin Harrison for access to and loan of his specimens.

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* *Quart. Journ. Geol. Soc.*, vol. liv, 1898, p. lxxix.
† *Nat. Science*, October, 1895, p. 295.

APPE

Geological Period.		Geographical Conditions and Climate.		Fauna.
Holocene.	Modern.	Present day.		Present.
	Neolithic Age.	(3) Present day with addition of submarine forests round coast.		*Bos longifrons*, Owen.
Pleistocene.	Post-Glacial.	Palæolithic.	Wet epoch. Cold and dry with glaciers. Warm and moist.	*Bos primigenius*, Cuvier. *Cervus tarandus*, Linn. (5) *Elephas primigenius*, Blum. *Rhinoceros tichorhinus*, Cuvier. (6) *Elephas antiquus*, Falconer. *Rhinoceros megarhinus*, Christol.
	Glacial.		Increasing cold. Submergence. Marine boulder clay.	Arctic.
Newer Pliocene (1) (Lyell). Early (Older) (2). Pleistocene (Prestwich).		Eolithic.	Gradually growing colder. Mild at first (4).	(7) *Elephas meridionalis*, Nesti. *Rhinoceros leptorhinus*, Cuvier.

NOTE.—*Elephas meridionalis* overlaps *Elephas antiquus*, as *E. antiquus* overlaps *Elephas primigenius*, but *E. meridionalis* and *E. primigenius* did not co-exist.

(1) Judd's *Student's Lyell*, pp. 182, 3.
(2) Prestwich, *Geology*, vol. ii, p. 442.
(3) Boyd Dawkins, *Early Man in Britain*, p. 254. Map.
(4) Judd's *Student's Lyell*, p. 170.
(5) Probably an immigrant from India. Scharff, *Hist. of the European Fauna*, p. 253.

NDIX.

Flora.	Synchronism with other regions.	
Present.	1. Iron Age. 2. Bronze Age.	North American Stone Age. South „ „ „ Melanesian „ „ Australian „ „ Egyptian (partly) „ „
Wheat, barley, etc.	3. Polished Stone Epoch. 4. Chipped Stone Epoch.	
Partly Arctic.	Raised beaches and head. Low- and high-level gravels. Brixham Cave. Kent's Hole Cave. Cresswell Caves. Hoxne Gravel. Selsey Bill.	(8) Loess of the Continent. (9) Belgian Caves. French Caves. German Caves, etc.
Arctic.	Moel-Tryfaen Clyde Drift.	(10) Scandinavia. North Germany. France. Italy. Spain. Switzerland. North America. Nicaragua. North Africa.
Gradually changing with increase of cold. Temperature at first.	Plateau-gravels. Dewlish. Cromer Forest-Bed.	(11) Pliocene of the Val d'Arno, Italy, and St. Prest, France.

(6) Probably identical with *Elephas Armeniacus.* Scharff, *op. cit.*, p. 252.
(7) Agrees in all essential characters with *Elephas hysudricus.* Scharff, *op. cit.*, p. 253.
(8) Prestwich, *Geology*, vol. ii, p. 483 and p. 6. Table of Sedimentary Strata.
(9) *Ibid.*, pp. 498 and 504, "Cave Chronology."
(10) *Ibid.*, chap. xxiv.
(11) Prestwich, *Quart. Journ. Geol. Soc.*, vol. xlvi, 1890; Westleton Shingle paper, part ii, p. 174.

EXPLANATION OF THE PLATES.

Plate I. FLINTS FLAKED BY FROST.

Fig. 1. Waterloo Pit, Great Stukeley, Hunts.

Figs. 2, 3, 4. Morter's Pit, Wells, Norfolk.

Plate II. IMPLEMENTS FROM SOUTHERN DRIFT, ALDERBURY, WILTS.

Fig. 1. *In situ*, at depth 14 feet
„ 2. „ „ 6 „
„ 3. „ „ 11 „
} 325 feet O.D.

Plate III. IMPLEMENTS FROM DEWLISH, DORSET, 350 feet O.D.

Figs. 1, 2, 3. From gravel with remains of E. MERIDIONALIS, NESTI.

Plate IV. SOME SUGGESTED USES OF PLATEAU TOOLS.

Fig. 1. Square "sleeker," Parsonage Farm, Ash, British Association, Pit II, *in situ*, below 6 feet in the gravel bed; 700 feet O.D.

„ 2. Square "sleeker," Shepherd's Barn, Shoreham-in-Kent, 500 feet O.D.

„ 3. Round "sleeker," Stockham Wood, Shoreham-in-Kent, 600 feet O.D.

„ 4. Round "sleeker," Shepherd's Barn, Shoreham-in-Kent, 500 feet O.D.

„ 5. Double-shoulder scraper, small variety, Preston Hill, Shoreham, Kent, 500 feet O.D.

Plate V. BORER, SCRAPER, HAMMER.

Fig. 1. Borer, Great Northfield, Shoreham, Kent, 500 feet O.D. Obverse.

„ 2. „ „ „ „ „ Reverse.

„ 3. Scraper or rude spear-head. Sepham Heath, Shoreham, Kent, 600 feet O.D.

„ 4. Hand hammer, glacial gravels, Morter's pit, Wells, Norfolk.

Plate VI. (A.) MASSIVE PLATEAU IMPLEMENTS.

Fig. 1. Bower Lane, Eynsford, Kent (bone crusher, etc.), 500 feet O.D.

„ 2. Parsonage Farm, Ash, Pit III, *in situ* at 8 feet (pointed tool), 700 feet O.D.

„ 3. Well Hill, Shoreham, Kent, 600 feet O.D.

(B.) SMALL PLATEAU IMPLEMENTS WITH FINE CHIPPING.

„ 4. Sepham Heath, Shoreham, Kent (hollow scraper), 600 feet O.D.

„ 5. Sepham Heath (pointed tool), 600 feet O.D.

Plate VII. OCHREOUS PLATEAU FLINTS MOSTLY FROM THE SURFACE WITH LIMONITE INCRUSTATIONS RESEMBLING THOSE FOUND *in situ* IN BRITISH ASSOCIATION PITS AT PARSONAGE FARM, SOUTH ASH.

Fig. 1. South Ash, 500 feet O.D.
„ 2. Shepherd's Barn, 500 feet O.D.
„ 3. Ash, 700 feet O.D.
„ 4. Terry's Lodge (from a shallow excavation), 770 feet O.D.
„ 5. Blean, 200 feet O.D.

NOTE.—Plates II and III are figured from specimens in Dr. H. P. Blackmore's collection.

Plate VI, Fig. 2, and Plate VII, Figs. 1, 3, and 4, are from Mr. Benjamin Harrison's collection.

The rest are from my collection: those implements figured, except Plate V, Fig. 4 (found in 1898) were examined and approved by the late Sir Joseph Prestwich.

Discussion.

The Chairman.—Before inviting the Members present to commence the discussion, I may say that I think you have already by your applause anticipated me in proposing a vote of thanks, which we all owe to the lecturer.

It is a subject that I am not qualified to discuss—or hardly at all—but he has shown himself to be a perfect master of knowledge respecting it, and he has given us a most valuable lesson in geology, as to the various formations in which these flint implements of different form and appearance are found.

I will now ask Professor Rupert Jones to address the meeting.

Professor Rupert Jones.—I really cannot tell you anything more than Mr. Bullen himself has so clearly and definitely put before you.

There are one or two little points on which I would say something.

As a geologist, I should have liked the author to have given more importance, in a popular kind of way, to the height of the Wealden dome that did exist. It is not so easy for people to fancy, or imagine, the real condition of things, as shown on the diagram; but although it was some 2,000 or 3,000 feet in elevation, I believe, you must remember that the same movement, the same crush, the same lateral pressure that brought that up, as a mere crumple of a carpet, raised the Ardennes Mountains ten times as high. So that there is nothing so very wonderful in it to a geologist.

Eoliths and palæoliths sometimes seem to be almost muddled up together—not by our friend the author, but by people in general. As a matter of fact they are found together in some cases, though not quite undistinguished; but they may be found in one place together, and people say they are all of one form; but eoliths are the very earliest condition in which a man can use a clean flint stone, or pebble, with slight degrees of modification which are necessary to make it useful. The palæoliths have been still more mixed up, and possibly people who made the palæoliths were making eoliths originally in the same way, and therefore you find the two together.

Again, neoliths are only a complete and finished form of palæoliths with their smoothly polished surfaces and edges. Still, they are practically distinguishable; but sometimes they are found together, and then people are led to confuse them. But really I think we ought to realize that these stone implements, whatever they are (and the older the better), are really historical evidence, that they are the best historical evidence, when you can define their places of deposit that is, which gives their age, and that they are better than papyrus, better than papers or parchments of history. Why? Because history has been re-written, altered, and amended, altogether losing its character of exact truth. Whereas these, wherever they are found, tell us at once what they are, and where they come from, and how they were made. (Applause.)

Mr. STOPES, in response to the Chairman, said: I am much indebted to you for having the privilege of joining in the discussion of this exceedingly interesting and most able paper. I have only one fault to find with it, and that is that it is altogether too much to be discussed in the limited time at our disposal. As a consequence, without going over the whole ground, which I would like to do, in the few remarks I offer, I will confine myself to two or three points.

I much regret that the author has not emphasized the point that is so rarely realized by people now, viz., that they are living in "the stone age." So much time is expended needlessly, and somewhat fruitlessly, in attempting to define a former age in which men have lived and have worked. A very great deal of effort is made to define, if possible, the limits within which men have lived, and everyone seems to ignore the fact that we still live in "the stone age," that we have people living with us who know little of the use of metals, and who until recently were as ignorant of the earth as the people we are discussing when we speak of the stone age now. I think we should remember that many have come to the conclusion that man lived long ago, and it would be better to attempt to define more truthfully the conditions under which he did live.

I am glad that this discussion carries us back to the early pleistocene. I think it is a pity that all collectors are not geologists, and I will go a step farther and say that it is a still greater pity that all geologists are not collectors. They have

often had the opportunity of collecting information, and if they had written out a list and had kept it, we should have been saved much that is now extremely doubtful and upon which there is conflict of opinion.

I have no hesitation in expressing the belief that pleistocene man did exist, for the reason that will eventually be found—that some of these stones on the table were made by pleistocene man in pleistocene times. I think there is not a stone here that was not made by man, for though they bear signs of natural agency there is much that shows man's handiwork —that they were finished and used by man for a variety of purposes, and the evidence of use is evidenced by the signs of wear on them.

I have brought with me some stones, not being certain whether Mr. Bullen would have some. *Here* is one, which is still more interesting than those other two on the table. It is the same shape and form, but this was originally made by plateau man. It has a ferruginous coating.

[The speaker here exhibited and explained the features of his specimens, including neolithic, palæolithic, and eolithic samples.]

Professor LANGHORNE ORCHARD.—We shall all agree in thanking Mr. Bullen for his interesting paper.

I was very much struck, as he went along, with what may be called hasty generalizations. Some stones are supposed to be the work of man, and it is inferred that if others are like them they too must be the work of man. Some stones which appear to be human implements are found in the early pleistocene, and it is at once conceived that man must have lived in the early pleistocene. That is a style of argument which enthusiasts are very apt to adopt; but I think we ought to be very greatly on our guard in that kind of thing. Perhaps nothing has more hindered the progress of science in the past than hasty generalizations. Professor Huxley well remarked that a scientific man is very careful in saying that he knows a thing in the absence of very complete evidence. Professor Rupert Jones made a good remark in the same direction —that in some levels you find together palæolithic, neolithic, and eolithic. Along with implements made by the old Egyptians and other men of not very great geological antiquity you find these very things, and you conclude that because they are in the same level they are of the same age? "No, not on that account," you

say. What right have you to do it on any other? I think we shall see with Professor Prestwich that man cannot possibly be assigned to an earlier time than the pleistocene. As to the real antiquity of man, I think, on competent authority,* it has completely broken down in every case where it has been attempted to assign man to an earlier date than post-glacial times.

Professor E. HULL.—I should like to say a word with regard to the age of these plateau gravels. I have studied them a good deal in various places—the Isle of Wight, at a level of 400 feet above the sea, and the counties south of the Thames amongst others—and I have satisfied myself that they are certainly not of pliocene age. We know what the pliocene strata of the East of England are very well, but these are entirely different—different in position, and different in character—and the conclusion I have come to is that they are really neither the early pleistocene nor the pliocene, but that they represent the middle pleistocene, in other words, the inter-glacial stage. They are representative of those beds which, in the North of England and Wales, rise to a level of 1,100 and 1,200 feet with sea shells of existing species. If you go south the level decreases and descends to 600 and 400 feet in Hants and Dorset, at which height they are very definitely shown in central Isle of Wight at St. George's Downs. They are separated from the pliocene beds by that great deposit of early boulder clay, or early glacial drift, which is not represented in the South of England at all, but which constitutes an important member of pleistocene series in the North of England, Scotland, and the West of Ireland.

I accept these specimens on the word of Mr. Bullen and Mr. Stopes as unquestionably the work of human art; but I would take a *caveat* in assigning them to the early pleistocene, and *a fortiori* to the pliocene age. I do not think the evidence that Mr. Bullen has afforded is at all convincing, and I do not think that he would himself say that it was convincing with regard to the early pleistocene age.

On the other hand, I venture to think that they are really representative of the middle or inter-glacial period, when there

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* Professor McKenny Hughes, F.R.S.

was the great submergence of the British Islands over the whole area, and when these gravel beds were deposited.

The CHAIRMAN.—Before I ask the lecturer to reply I would ask him if he has seen something which illustrates the deposit in the form of the large and varied collection of stone axes in the Antiquarian Museum of Stockholm. It is a remarkable collection. I do not express an opinion as to their age; but they are contained in a room as large as this, with glass cupboards all round the walls and up to the ceiling. The colours are very remarkable, from a bright orange, brown, and yellow to white. It is a perfect study of beauty to see them, whatever opinions there may be as to their antiquity.

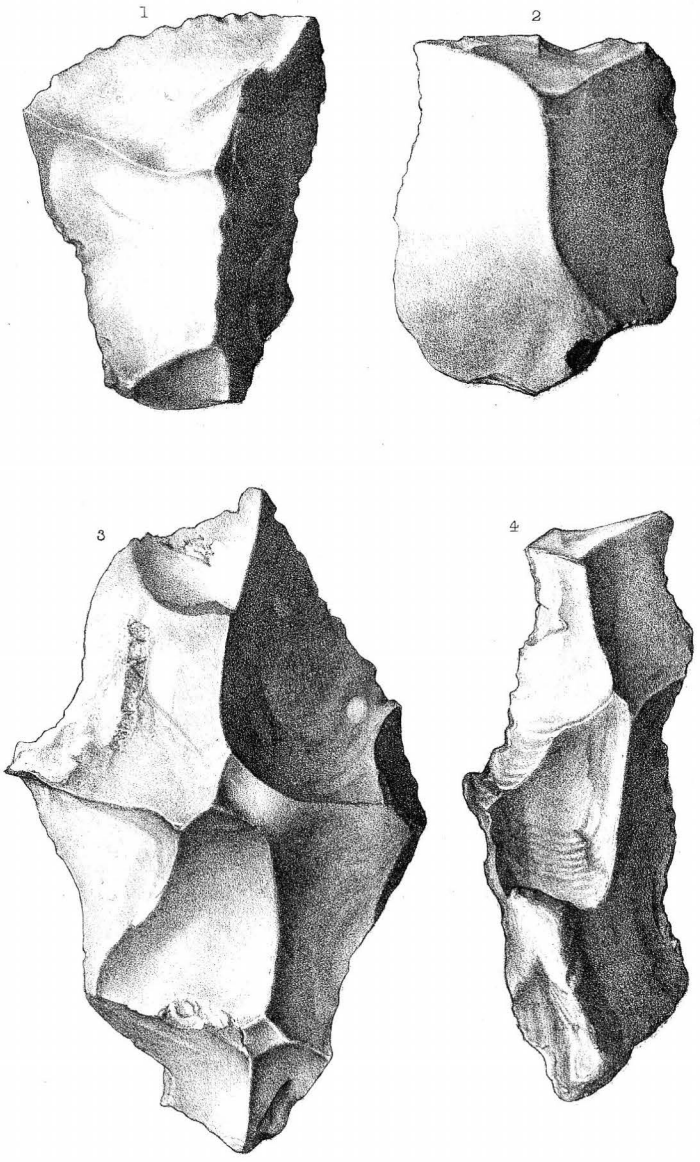
Mr. MARTIN L. ROUSE.—I think the lecturer stated, in regard to the colour of this deposit, that the chocolate colour indicated an immense period of weathering; but, as a fact, are not stones found in these gravels of all colours? In my garden I have been picking up silicious stones for some time past, and I have found them red right through, sometimes with black exteriors, and sometimes with yellow. I understood him to say that these axes were of such enormous age because they turned to that red colour; but may they not have obtained that red colour from the banks? I only put it as a question. Would he give us evidence for being pleistocene?

The Rev. R. A. BULLEN, in reply, said: With regard to the pleistocene age of these implements, I thought I had carefully guarded myself against saying anything about "pleistocene" or "pliocene." I said that the important point in regard to these implements was that Dr. Blackmore has found worked flints in gravel that came from the *Elephas meridionalis* bed, Dewlish, Dorset, that pachyderm died out before the glacial age, and there is no evidence of its having existed into the glacial age. The only real evidence we have that man existed before the glacial age is from the Forest-Bed in the north of Norfolk, of which we know the geological age, and if we find man's implements in connection with remains of *Elephas meridionalis*, we say that man lived at the time of the *Elephas meridionalis*.

I cannot agree with Professor Orchard that there are any "hasty generalizations" in my paper. They are simply statements of fact.

Professor E. HULL, in reply to Mr. Rouse, explained that he

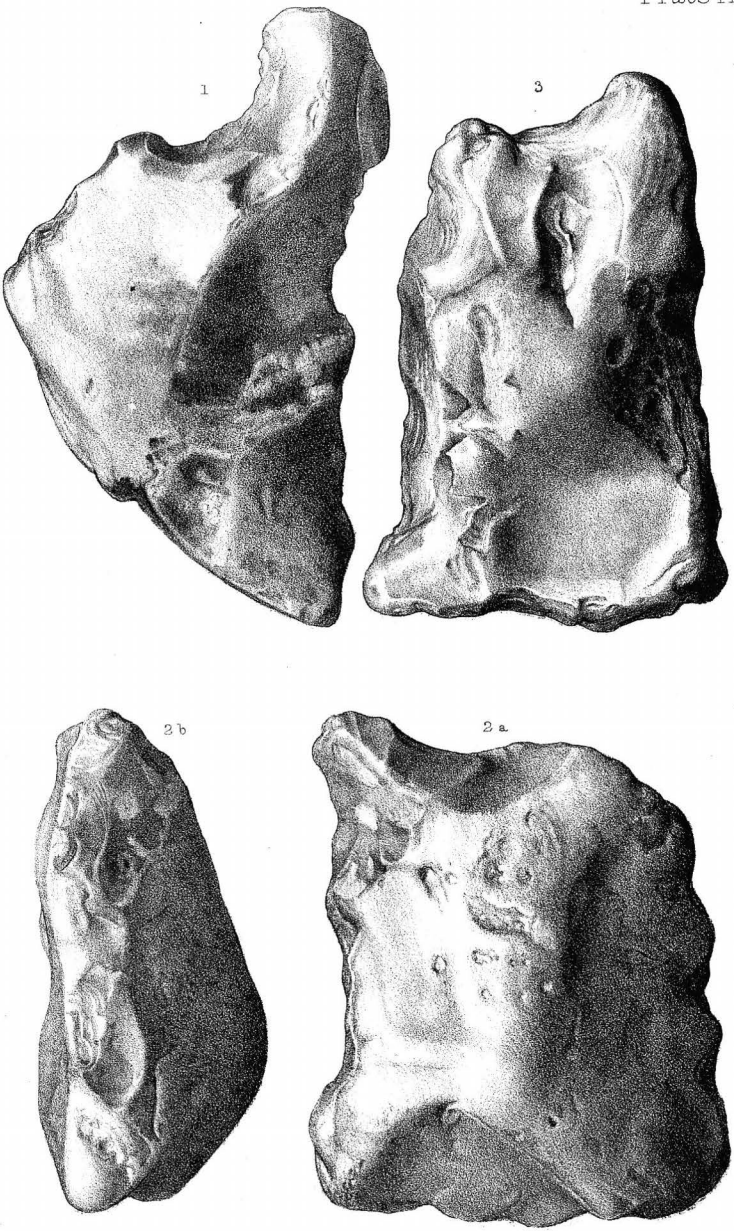
Plate I.



G.M.Woodward, del. et lith.

West, Newman imp.

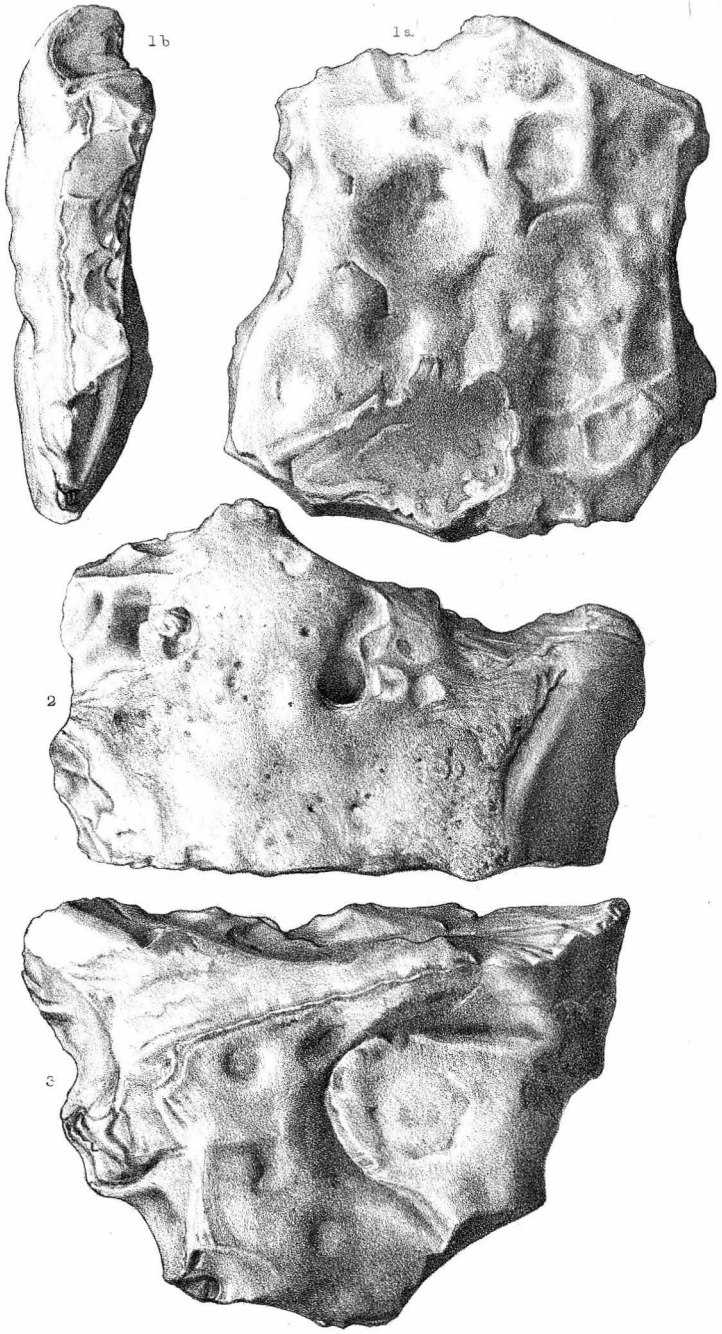
Plate II.



G.M.Woodward del. et lith.

West, Newman imp.

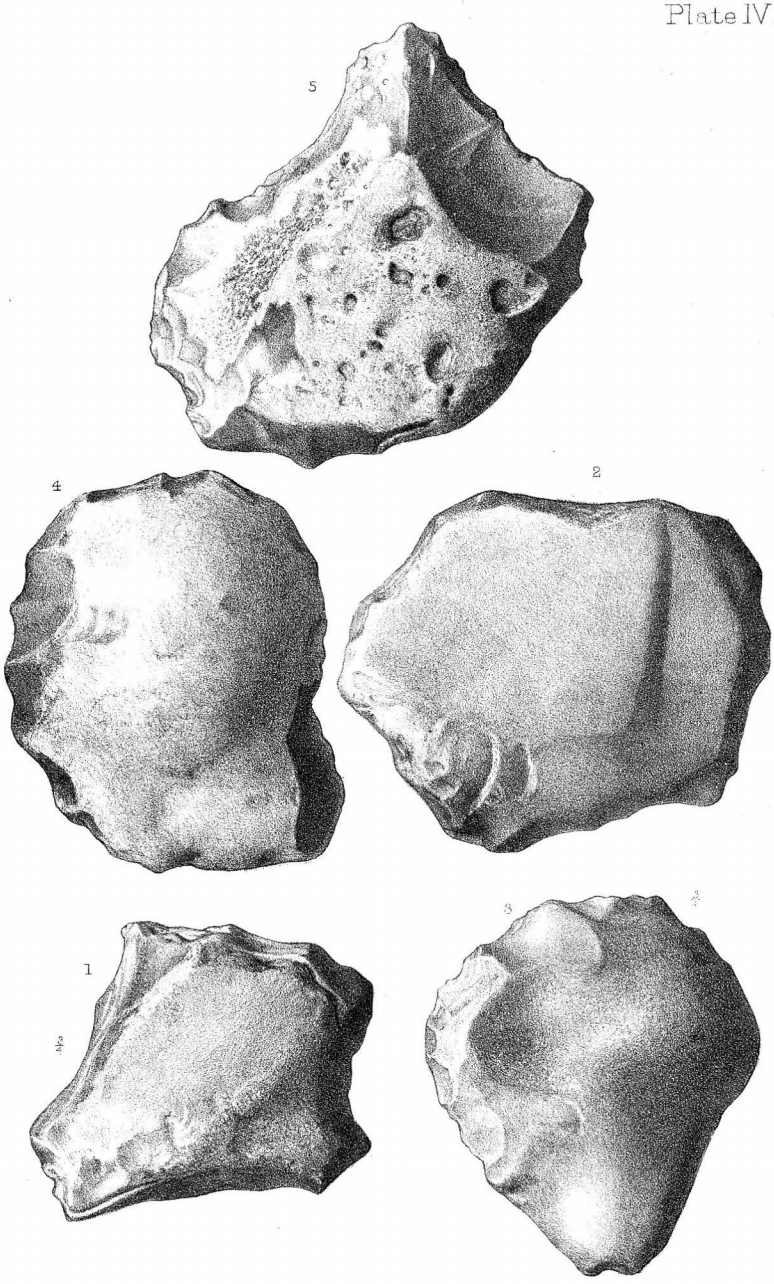
Implements. Alderbury, Wilts.



GM.Woodward, del. et lith. West, Newman imp.

Implements. Dewlish.

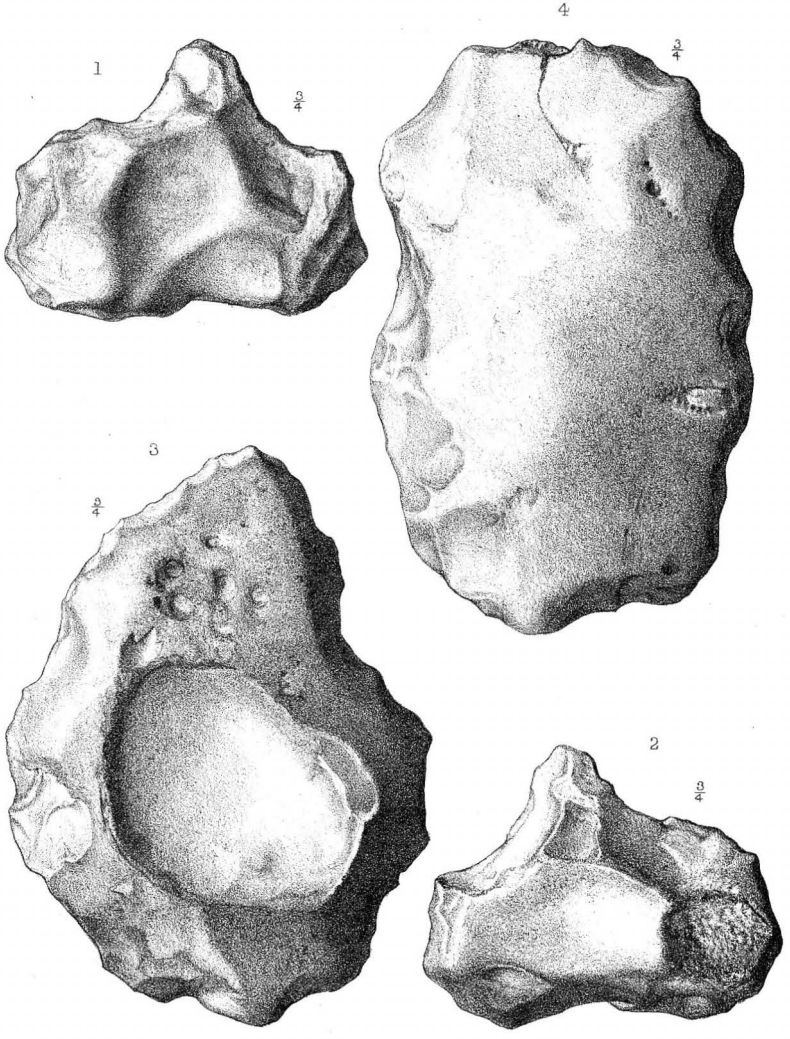
Plate IV.



G.M.Woodward del. et lith.

West Newman imp

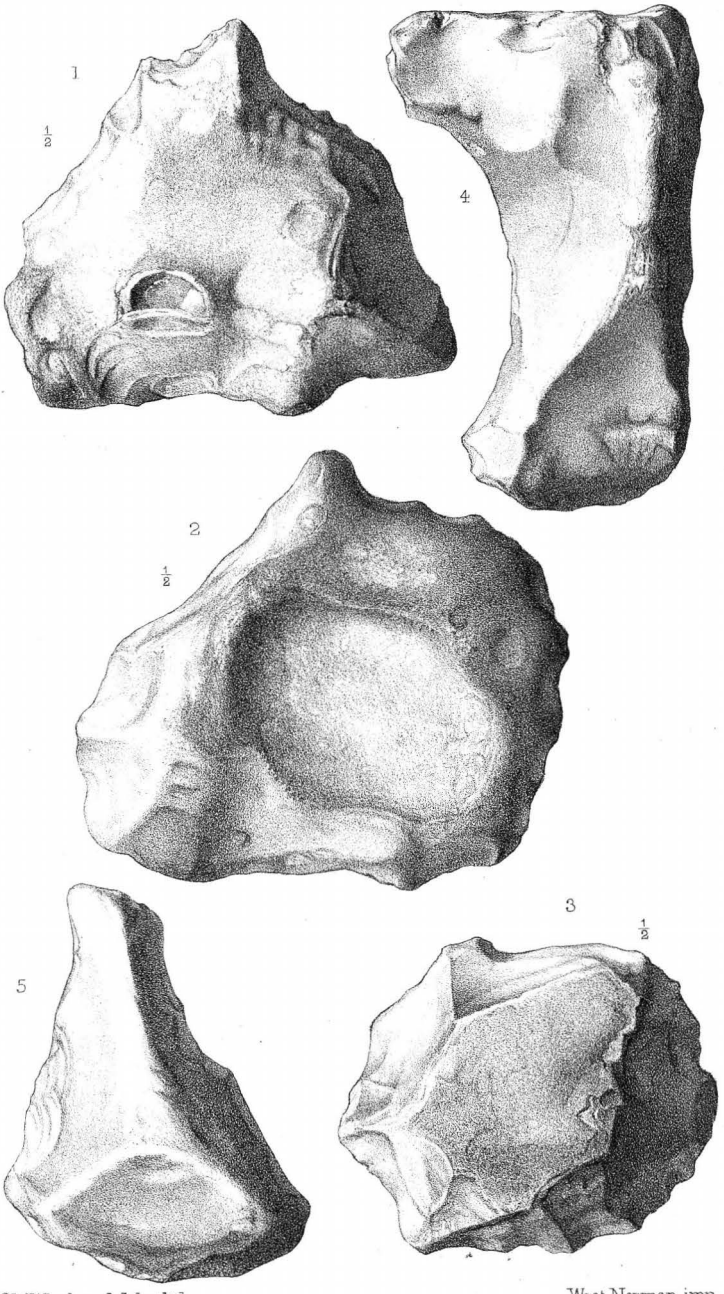
Plate V.



G.M.Woodward del.et lith.

West,Newman imp.

Plate VI.



G.M.Woodward del.et lith.

West, Newman imp.

Plate VII.

1

2

3

4

GM Woodward del.

West, Newman chromo.

intended to say, in regard to the boulder clay, that the excessive cold in the South of England in the pleistocene period would have been quite sufficient to destroy the *Elephas meridionalis* if it existed at that time.

The Rev. R. A. BULLEN (continuing) said: Anything that Professor Hull states commands great respect, but these plateau-gravels of Kent are so far removed in their relative position from demonstrably pleistocene gravel that we must consider them to be pre-glacial. I do not care whether you call them pre-glacial or not; but they certainly have nothing to do with the mid-pleistocene, and if Professor Hull studied the evidence on the spot I think he would come to the same conclusion. It is such a tremendously wide subject that we must be guided by the opinions of specialists.

I have never had the pleasure of seeing the museum at Stockholm. That is a great pleasure to come, I hope. As far as I understand, the implements of which the Chairman spoke are of neolithic age. I think all those who have to do with this subject will say they are not masters of it as yet, but just simply students.

The proceedings terminated.