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XL. *Some Remarks upon the Crag Formation of Norfolk and Suffolk.* By SAMUEL WOODWARD, Esq.

To the Editors of the Philosophical Magazine and Journal.

GENTLEMEN,

PERMIT me, through the medium of your Journal, to offer a few remarks on a paper by Mr. Charlesworth inserted in your Number for August, p. 81.

Feeling a kindred spirit with Mr. Charlesworth in bringing these interesting deposits into notice, and moreover a desire that truth should prevail, I do, in the true spirit of scientific inquiry, state that my views of the subject do not square with those of that gentleman.

In the first place, his red crag is decidedly diluvium or disrupted crag, with an admixture of the oxide of iron, precisely similar to what we witness in the gravel of Norfolk. We have also in this county immense beds of transported crag shells, in the cliffs south and north of Yarmouth, and at Cromer, but with this difference,—they are imbedded in sand*.

Secondly, his term ‘coralline crag’ is not appropriate, as it leads us to suppose that it is composed of corallines, when, in fact, there are none in the Ramsholt bed, which is chiefly adverted to†. Mr. Charlesworth has not mentioned the great coral-reef situate about three quarters of a mile north of Aldborough, which contains (as far as I have observed) neither univalves nor bivalves, except a few *Pectens*. I think he must have had this locality in his mind’s eye, and thus been led to the misnomer‡.

At the close of the prefatory remarks to my Outline of the Geology of Norfolk, I stated, on the authority of a friend, that there was a bed of shells at Ramsholt analogous to those of the *calcaire grossier* of Paris. I subsequently visited this locality, and found that the bed in question was what might be termed *undisturbed crag*, and the superincumbent bed was

[* Mr. Woodward appears to us to have overlooked the great difference between the organic remains of the red and coralline crag, as shown by Mr. Charlesworth.—EDIT.]

[† We apprehend that this designation as applied to the lower crag by Mr. Charlesworth, refers merely to its being characterized by an abundance of *corals*, having no reference to the bodies termed *corallines*. It is exactly analogous to the appellation “coralline oolite” already established in geology.—EDIT.]

[‡ The coralline crag of Aldborough is expressly referred to by Mr. Charlesworth, p. 86.—EDIT.]

transported, being waterworn and fragmented; this was my impression at the time I visited it, and I see no reason to alter my opinion now; neither do I wish to underrate the merits of Mr. Charlesworth's valuable communication, but speak my sentiments in order that truth may be elicited. The undisturbed bed has a layer of corals of the genus *Astrea*, to which the *Ostrea spectrum* (Leathes) and *Balanus sagittata* are frequently attached; the latter is provisionally named *sagittata* by my friend the Rev. G. R. Leathes, from the shape of the accessory valves, which are frequently found *in situ*. This layer of corals is about three feet below the line of junction with the disturbed crag, and in about the same line I found the tooth of a shark two inches in length, of a light blue colour; and was subsequently presented with two others of the same kind, but smaller, by the gentleman who conducted me to the spot*.

It will be inferred from what I have above stated, that I consider the two beds at Ramsholt to be of the same age; and that the red crag, by diluvial agency, has been superimposed upon the undisturbed bed. There is, however, a bed of crag in Suffolk quite distinct from those at Ramsholt. I allude to that exposed on Thorpe Common, about three miles north of Aldborough; it contains shells specifically like those found in the Norfolk beds, with the vertebræ and tubercles of the thorn-back and other bones, common in the pits at Thorpe by Norwich. My impression is that the Norfolk crag, extending as far south as Thorpe by Aldborough, is a newer deposit, and that could it be sunk through at the latter place, the regular Suffolk crag shells would be found. One fact in favour of its more recent origin is, that a few of the characteristic shells of the Suffolk crag have been found in it near Norwich, as *Murex contrarius*, *Pectunculus variabilis*, &c., in a bouldered state.

My view of the tertiary deposits of the eastern coast of England is, that in the antediluvian period this island formed a part of the continent, and that the London clay deposit contains the exuviæ of an inland sea which communicated with

* The gentleman here alluded to is Mr. W. S. Fitch of Ipswich, who does honour to science by his zeal in collecting for the pleasure of enriching the cabinets of others. That gentleman presented me with a bouldered tooth of the shark, black and shining, which measures three inches across its base! I think from its worn state that this must equal any of the Maltese teeth. I cannot close this note without bestowing the meed of praise on my friend S. V. Wood, Esq., of Hasketon, near Woodbridge, whose collection has been so highly and deservedly spoken of by Mr. Charlesworth, for the liberality with which he distributes his treasures.

the ocean towards the south;—that at a subsequent period an irruption of the North Sea took place, forming an estuary across Norfolk; its eastern line running from Cromer towards Lowestoft, and from thence across to Belgium, and its western from Weybourn, by Norwich, Bungay, Ipswich, and a part of Essex, thus communicating with the Paris basin. That the Suffolk beds were deposited before the Norfolk, I conclude from the analogy the former bear to those of the Paris deposit, and the latter bearing a greater specific relation to the recent *Testacea**. The fact of the number of mammalian remains found eastward of the estuary thus laid down, even in the bed of the German Ocean, is considered by most as sufficient evidence that it was once dry land; and that its western border was near the line pointed out, may be affirmed by the number of mammalian remains found imbedded with the littoral rejectamenta. The fine grinder of the mastodon figured by Smith in his “*Strata Identified*,” was found at Witlingham: I have a fragment of another which I found at Bramerton; and recently portions of two other grinders have been found in that locality. Of the elephant I have frequently met with fragments of its tusks; but not of its grinders, until this year, when on a visit to the Thorpe pit, I found a large grinder, of thirteen laminæ, thirteen inches long and five across the grinding surface. Some bones have also been found in Bramerton, as an astragalus, vertebra, &c. Bones of the ox, and horns and teeth of the deer have been repeatedly found in this deposit.

I am, Gentlemen, yours, &c.

Norwich, Aug. 15, 1835.

SAMUEL WOODWARD.

XLI. *On certain Points in Meteorology and Magnetism.*
By Sir G. S. MACKENZIE, Bart., F.R.SS. L. & E., &c.

To the Editors of the Philosophical Magazine and Journal.

GENTLEMEN,

AS there have been marked changes in our climate within a few years, it is desirable that every observation which has apparent importance should be recorded, and the attention of meteorologists called to it. I have made one that

* This opinion was submitted to the Geological Society through Dr. Fitton in 1825, and is noticed in their Proceedings, vol. i. p. 93. [A notice of Mr. Woodward's paper will also be found in Phil. Mag. and Annals, N.S., vol. v. p. 140.—EDIT.]