

## CORRESPONDENCE.

## DR. CROLL'S THEORY OF THE ICE AGE.

SIR,—As Mr. Culverwell's articles in the *MAGAZINE* and the review of Dr. James Geikie's new edition of "The Great Ice Age" have recalled attention to Dr. Croll's celebrated theory, it may be interesting to your readers to hear the opinion of the great astronomer Adams upon the question. In turning over some old letters only yesterday I came upon one dated 28th February, 1866, which I received from him on the subject, in which, after some remarks upon Herschel's art. 184, of which he says he is "not inclined to think there is much in it," he wrote: "I do not myself believe in the change of eccentricity of the earth's orbit being a cause of climatal changes on the earth. The effect, if any, would depend only on the *square* of the eccentricity; and this always remains so very small, that I believe the effect on the earth's mean temperature would be almost insensible. Depend upon it, geologists who look in this direction for the cause of Glacial epochs are entirely on the wrong tack. It seems to me much more likely that the actual act of emission of heat from the sun is variable, than that the change of eccentricity of the orbit should have any sensible effect."

If this be the case, Croll's theory is reduced to Adhémars', who, in his *Révolutions de la Mer*, 2nd edition, 1860, published his view that Glacial epochs were caused by the mere alternate presentation of the north and south poles of the earth to the sun, owing to the precession of the axis; no reference being made by him to changes of eccentricity. It is remarkable that Croll did not know of Adhémars' work when he first published his theory. I had heard two friends talking about it at a meeting of the Geological Society, which led me to buy the book, and finding no allusion to Adhémars in Croll's papers, I drew his attention to it.

In what I have now written I do not wish it to be thought that I am expressing any opinion of my own upon the subject, but I think these matters of ancient history may prove of interest to your readers.

O. FISHER.

HARLSTON, CAMBRIDGE, 7th February, 1895.

PROFESSOR HULL AND THE CAMBRIAN AGE OF THE  
CHARNWOOD CLASTICS.

SIR,—I do not think that Professor Hull's letter in last month's *GEOLOGICAL MAGAZINE* will do much to convince students of the older rocks that the Charnwood clastics are of Cambrian age. He relies chiefly upon the authority of Sedgwick and Jukes. The views of these eminent men on matters coming within their knowledge would undoubtedly carry great weight with the younger generation; but it would be the height of rashness to suggest that they would have continued to adhere to their opinion had they

lived to the present day. Since their time a new chapter of the geological record has been opened. In the Midland Counties large formations have been discovered that bear a much closer relation to the Charnwood rocks than do the Lower Cambrians of North Wales. Professor Hull states that the publication of these results has not led him to alter his opinion. But has he examined the new evidence? Has he studied the Uriconian slates and grits of Shropshire? Does he know the slaty rocks of the Herefordshire Beacon, near Malvern, which in 1880 I correlated with the Salopian pre-Cambrians? Professor Bonney and the Rev. E. Hill have demonstrated that the Charnwood clastics are of volcanic origin, and Mr. Allport has done the same for the Uriconian of Shropshire. Both in hand-specimens and in microscopic slides the rocks of Charnwood and of Shropshire evince the most marked similarity. The slates and grits of the Lower Cambrian of North Wales, on the other hand, are ordinary sediments. Macroscopically, they are somewhat like the Charnwood clastics; microscopically, they are widely different. As Sedgwick and Jukes did not study these rocks under the microscope, they were naturally unaware of this difference. Professor Hull has survived to a happier epoch, and he can judge for himself. He would also find it an interesting task to study the basal Cambrian strata that Professor Lapworth has discovered in Warwickshire, and the volcanic rocks that underlie them. After he has done so, he will find it hard to believe that the shales and quartzites of Nuneaton are the equivalents of the ash-beds and agglomerates of Charnwood. Why Professor Hull should go 90 miles off to correlate the Charnwood clastics with rocks which but superficially resemble them, when he can find formations that really do resemble them within half that distance, is a problem that I must leave the Professor himself to solve.

C. CALLAWAY.

SANDORE, WELLINGTON, SALOP, 8th February, 1895.

#### DESTRUCTION OF ECCLES CHURCH, ON THE NORFOLK COAST.

SIR,—An ancient landmark on the coast of Norfolk, one well known to readers of Lyell's "Principles of Geology," has been destroyed by the breakers during a severe storm, on January 23rd of this year. The old tower of Eccles church has for many years remained as a witness to the destruction of our shores. Since the Conquest, the greater part of the village of Eccles, between Happisburgh and Winterton, has been destroyed. The church itself was abandoned nearly three hundred years ago. In 1833, as noted by Samuel Woodward, its remains were still to be seen partially buried, as it were, within the "Marram Hills" or sand-dunes. In 1862 the hillocks of sand were drifted further inland, and the tower of the church was left standing on the foreshore, several yards below high water-mark, with the basement portion of the nave still showing in places amid the beach sand and shingle. Now the sea has beaten down the tower. It fell in a north-westerly direction in the very teeth of the gale, the sea breaking furiously against the