

the last volume published by the Palæontographical Society. He had found casts of the pith of the *Sigillaria vascularis* which ordinary collectors would call a *Calamite*, and in two specimens of *Dadoxylon* he has met with *Calamites connæformis* as the pith of one, and *C. approximatus* as the pith of the other. *Sternbergia* has long been known to be the pith of *Dadoxylon*, so now the genus *Calamites* in all probability will have to be very considerably modified and some of its species classed with other genera.

“The Hematite Iron Ore Deposits of Whitehaven: Notes on the Aldby Limestone, Cleator Moor,” by W. Brockbank, F.G.S.

The mountain limestone of the Cleator district forms an escarpment to the valley of the river Eden, from Egremont round the base of Dent Fell, towards Cockermouth. It rests upon the old clay-slate of Skiddaw and Dent, and is the outcrop of the Whitehaven coal field. It contains most extensive and valuable deposits of hematite iron ore. The easterly side of this large limestone surface is deeply fissured in every direction, and when the crevices are not filled with till, they are found to contain hematite ore. The escarpment sloping towards the river Eden is made up of breccia of hematite ore and limestone, in large irregular blocks, cemented together into a compact mass. It is so rich with ore at the surface, as to be worth working, and an open quarry was commenced, and a large quantity removed, but the impurity of the product soon led to its abandonment. It is very evident that this face of limestone was at one period covered with a large deposit of hematite ore, since denuded.

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CORRESPONDENCE.

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ON DENUDATION, AND THE CRAGS.

SIR,—Colonel Greenwood’s letter can hardly be considered a reply to my views, because he does not meet my difficulties. Arrayed in seven-leagued boots, he plants one foot in Norfolk, and the other in the valley of the Amazon, and in two sentences fights the battle of denudation over half the globe. But controversy is not my object. I see many appearances which favour the rain theory, and admit that it can explain many facts, and I believe that what Colonel Greenwood says about the migrations of soil is, under present circumstances, quite correct. But although pluvial denudation is now going on here, it is not so everywhere—not so, for instance, in Greenland, nor on the Antarctic continent. Are we sure that what is now the case in Greenland was not the case in this and in many other countries, when the present surface was shaped? I see indications which lead me to suspect such to have been the case. What interpretation does Colonel Greenwood put upon them?

If, instead of reasserting his opinions, which are already sufficiently strongly stated in his very amusing book, he will come down to details, and meet the difficulties which I have pointed out, he may, if he thinks it worth while, convert me and perhaps some others. Particularly I would ask him to explain how the basins

containing the "meres" and "broads" of Norfolk can have been formed by rain; and, more generally, the condition of the subsoil which I have described under the name of "Trail." Col. Greenwood has not appreciated the point I endeavoured to raise respecting the windings of the valley (I must not say of, but) in which the Bure runs; nor yet has he explained the degradation of Lopham ford, but only asserted that it is due to pluvial denudation.

And now, with respect to Mr. Lankester's remarks upon the Crag and its mammalia, I must re-state that it was solely on Mr. Gunn's published authority that I referred *Elephas meridionalis* to the Red Crag. Mr. Whincopp's fine collection does not contain it, unless a piece of ivory may be considered a presumption in its favour. The species, however, is abundant in the Norwich Crag, which is sufficient for my argument. The other species mentioned by Mr. Lankester are, I believe, very rare in the Red Crag, and derivative.

Much remains to be done before it can be decided whether the two Crags in question are, or are not, of the same age. I incline certainly to the opinion that they are so; for they seem to pass gradually one into the other. In the central district of the Crags we find it under Chillesford church, having a close resemblance to the Red Crag at localities to the south, yet still not identical with it. Going on to Sudbourne, in the pit north of the church, and near the top of the hill, a Crag is seen resting on the Coralline, which has an intermediate character. At Thorpe, near Aldburgh, the type is decidedly that of the Norwich Crag.

Something might, perhaps, be learnt from digging at Thorpe, were it not for the water. There the Crag rests upon a sandy clay, which is neither Coralline Crag, Eocene, nor Chalk. So also at Wangford. I used to consider this the Chillesford Clay, but have been led to abandon that view. What is it?

The passage from the Red to the Norwich Crag seems to occur where the two provinces are separated by a ridge of the older Coralline. This may possibly have marked the boundary between two opposing currents, and may either have been due to diminished erosion at their confines, or may have acted as the cause of their demarcation. The current, sweeping up from the south over a bottom of London clay, would, on account of its warmth, contain a mixture of more southern contemporary forms, as seen at Walton-on-the-Naze, and would bring with it *derivata* from the London clay and Miocenes of the south, as in the Suffolk bone-bed; while the other from the north would contain a somewhat more arctic assemblage of species, with fewer and different derived fossils.

The phosphatic nodules, and many of the fossils of the Red Crag, come out of the London clay. Why should not its iron be derived from the pyrites so remarkably abundant in the same formation? An exception may be taken to prove the rule, for at Walton-on-the-Naze we have the Crag resting on the London clay, *but quietly deposited*, so that *Pectunculi* and *Pholades* are frequently found with their valves united, and the most delicate shells are unrolled. It is remarkable that at that place we have no extraneous

fossils, very few phosphatic nodules, and very little iron oxide. This seems to show that Walton was within the influence of a warm current as to temperature (as shown by its species), but from some local cause escaped its eroding action (as shown by the conditions of deposition), and consequently did not receive the foreign bodies which would have required a swift stream to import.

O. FISHER.

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*ELEPHAS MERIDIONALIS* IN THE RED CRAG.

Sir,—Mr. Lankester, in your last number, inquires “What grounds have the Rev. John Gunn and the Rev. O. Fisher for stating that the *E. meridionalis* is found in the Red Crag?” I reply that I saw a specimen—an old much water-worn molar—in the collection of Mr. J. H. Roper, of Lowestoff, Suffolk, merchant. It appeared to have been derived from an older, or basal portion of the Red Crag; and, if so, the *E. meridionalis* is referred back to at least the commencement of that crag, which admits, I believe, of several subdivisions. I quite agree with Mr Lankester that there is “no reason for believing that the specimen of *E. antiquus* mentioned in Palæont. Mon. Vol. II., p. 181, was derived from the Red Crag. Dr. Falconer says that it came from Southwold, where there is no Red Crag at all. A ridge of Coralline Crag at Aldburgh appears to separate the Red from the White Norwich Crag, and there is, as Mr. Prestwich maintains, no instance of superposition of those two crags. I may safely affirm that no specimens of the *Rhinoceros Schleiermacheri*, or *Hipparion*, have been found in Norfolk. Mr. R. Fitch has, I think, some of the *Hyæna antiqua* (?) The *Ursus arvernensis* (so named by M. Lartet) abounds in the Forest-bed, and also the *Rhinoceros Etruscus*. Having noticed the points of reference made to me, I might conclude; but on looking to the next page, I observe that Mr. Fisher is exposed to a raking fire from Colonel Greenwood. As I know that my friend is quite equal to self-defence, I will not further interfere in the fray than to ask how, if the erosion of the valley at Lopham be attributable to either pluvial or fluvial denudation, supposing the water-shed to have been ever on that spot, could the magnificent bed of valley gravel have been deposited on the bank near the ford and the water-shed. I should be glad to be instructed on this point. In a paper, which I read at the British Association at Norwich, I attributed the formation of the water-shed to an upheaval, which may be traced through Norfolk, and which brought the Chalk to the surface at Trimmingham, after it had dipped beneath the beach at Cromer. The river, I conceive, previous to that upheaval, had flowed to the east or to the west, and had deposited that valley gravel. How it came there under either Colonel Greenwood’s or Mr. Fisher’s hypothesis, I do not understand. I suppose that snow-falls are taken into account under pluvial action. The power of these during the Reindeer period must have been very great.—I am, etc.,

JOHN GUNN.

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