

He makes it quite clear that in his criticisms of my work at Malvern he had employed the theological, rather than the scientific, method. I had often said that a gradation between two kinds of rock at Malvern proved the derivation of the one from the other; but then I had previously explained, by an accumulation of details, what I meant by a Malvern gradation. Mr. Blake forgot the details, and suggested that I believe any kind of gradation would prove my case. It is possible to involve any author in apparently contrary opinions, if his sentences may thus be detached from their context.

But Mr. Blake goes on to admit that he does not really suppose me to hold the opinion that "if one rock passes into another, one of them is derived from the other," but he does think I argue on the basis of the following: "The character of the stages by which one rock passes into another in the field *may* suffice of itself to prove that one of them is derived from the other." This is quite another thing, and should have been said at first.

Mr. Blake's use of my illustration of the beef cooking before the fire is rather misleading. The roasting meat undergoes a change, and so do the Malvern rocks during metamorphism. The cook is able to observe the change, and so can the geologist at Malvern. These two points exhaust the analogy as I limited it, and to expand it to cover a special theory of metamorphism is to commit a fallacy in logic.

My critic—perhaps I may say "critics," for Mr. Blake follows in the wake of others—appears to think that no amount of microscopic or outdoor evidence will suffice to prove the conversion of a diorite into a quartzose gneiss (not "quartz-schist," as Mr. Blake inaccurately writes). If this opinion be right, we are shut up in eternal darkness on this question, for no other proof is available. Surely, our ignorance of the chemistry of high temperatures and great pressures ought not to be erected into an insuperable bar against the reception of good field-evidence. Are my critics going to wait until earth-forces can be introduced into the laboratory?

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C. CALLAWAY.

BOULDERS IN A COPROLITE BED AT STANBRIDGE.

SIR,—A bed of "coprolites" is now being worked near Stanbridge, in South Bedfordshire, at a spot about half a mile west of the church, just in the angle formed by the roads from Leighton Buzzard and Billington. The bed resembles in many respects the Cambridge Greensand; its thickness varies within short distances, the maximum being about one foot. Fossils are not abundant, but those found belong to species which occur in the Cambridge Greensand. Mr. Jukes-Browne made a fresh survey of the district some ten or eleven years ago, and determined that the bed, which was at that time exposed in some other pits in the neighbourhood, occurred at the base of the Upper Gault, which in this district is very marly, yielding over 50 per cent. of carbonate of lime.

Two boulders of quartzite have recently been found in the

Stanbridge pit, and were presented to the Woodwardian Museum by Mr. H. Coningsby; they are angular blocks, $10 \times 6 \times 6$ and $7 \times 7 \times 6$ inches in size, and weigh 16 lbs. and 13 lbs. respectively. Attached to their surface are numerous specimens of *Plicatula sigillina*, Woodw., and *Spondylus striatus* (Sow.), and small concretions of iron pyrites. The quartzite is rather coarse-grained, and was originally a quartz-conglomerate.

H. Woods.

NOTE ON THE ERRATIC BLOCKS OF POLARIS BAY AND OTHER LOCALITIES IN NORTH GREENLAND.

SIR,—I should like to place upon record a statement I ought to have published years ago, but which at the time the subject was fresh I thought of too little moment to record. Since then I notice that what I believe to be an erroneous deduction, has been cited by authors of eminence as a fact, without any qualification. The late Dr. Emil Bessels, when in Hall Land, North Greenland, with the "Polaris" Expedition, noticed that the land in the vicinity of the "Polaris" winter quarters was strewn up to elevations of over 1,000 feet with erratic ice-borne boulders, entirely distinct in character from the rocks *in situ*. Bessels, who was a man of high attainments, and a good observer, misled, I believe, by many of these erratics having a superficial resemblance in composition to rocks found in South Greenland, made the sweeping assertion¹ that these erratics came from South Greenland; and that the current and ice-drift in Smith Sound and Robeson Channel, at a former period when these erratics were dispersed, had been from south to north, and not from north to south as is the case to-day. When I sojourned in Grinnell Land, during 1875-76, I was aware of Bessels' opinion, and made many observations on the boulders we met with, and on their distribution. I found them as Bessels described, even on the higher altitudes uncovered by snow, notably on Dean Mount, near the winter quarters of the "Alert," in $82^{\circ} 27' N.$, at an altitude of 1,200 feet. I observed, however, what Bessels seems to have overlooked, that boulders of the same character were strewn over hill-sides and in the valleys down to the present sea-level, and that on some ancient sea-beach at a hundred feet of altitude the stranded boulders were lying under precisely the same conditions as the boulders that now rest on the seashore of to-day, and which have been recently stranded. Grinnell Land is an area of very rapid elevation, and it is only reasonable to argue that the agent that strands the ice-worn boulder to-day on the fore-shore of Grinnell Land is the same as placed the boulders at an altitude of 1,200 feet when that point stood at sea-level. The agent that grounds the erratic of to-day is the ice-raft of the palæocrystic sea, and Bessels was certainly mistaken when he ascribed the origin of these rocks to South Greenland, and to clench his argument had to invoke a change in oceanic circulation to account for the presence of the boulders on the shores of the Polar Ocean. Bessels made a strong point that

¹ Bull. de la Soc. Geog. Paris, p. 298, March, 1875. U.S. Naval Report, 1873, p. 548. Arctic Manual, p. 553, 1875.