CORRESPONDENCE.

THE SUPPOSED DICYNODONT FROM THE ELGIN TRIAS.

SIR,—At the meeting of the British Association at Aberdeen in 1885, much interest was excited by the alleged discovery of *Dicynodon* in the Triassic sandstones of Elgin. Professor Judd stated his belief in the specimen at the time ("Nature," Oct. 15, 1885, p. 573), and said that the specimen was in the hands of Dr. Traquair. In Woodward and Sherborn's "Catalogue" (1890) I notice these authorities place a (?) before the reference, thus indicating the doubtful nature of the find, while Lydekker in vol. ii. "Manual of Palæontology" does not even refer to it. Are we to interpret Dr. Traquair's six years' silence as a withdrawal of the original determination? When an important discovery has been announced, it seems only just that the geological public should hear more about it, and this practice of throwing out vague and unsatisfactory statements is very annoying to those who prefer exact information and rather disparaging to the discoverer, who naturally expects so great a find to be worthy of notice.

G. ROPER.

ON DYNAMO-METAMORPHISM.

SIR,—I think Dr. Irving has not quite understood the reasoning in my short article on Dynamo-metamorphism of a year ago. I wrote, that the part of the work of compression expressed by the product $(P - W)\, w$, where P is the compressing force upon a cubic element of the disturbed mass, W the weight of the cover, and w the height through which the cover has been lifted, was employed in bending and breaking the rock and overcoming friction, and that, since this part of the energy is not reconvertible into mechanical work, it must take the forms of heat and chemical action. He thinks this "last term is surely outside the others altogether"; that is, I suppose, is employed upon the rock external to the portion of it under consideration. But the expression is not very clear, though his illustration in the note (p. 300) seems to show that such is his meaning. He says there that, if a horse or engine draws a series of loaded trucks along a perfectly horizontal line of rails, "work is done in overcoming the friction of the wheels against their axles and against the rails, and in the displacement of a portion of the atmosphere with the movement of the train; but would any one contend that energy was stored up in the train?"

Energy of motion is so obviously stored up in the train that Dr. Irving cannot refer to that. He must refer to the energy imparted to the atmosphere, and to the energy absorbed by friction, which last is distributed between the trucks and the rails. The energy communicated to the air is "outside" the other effects, and so is the energy absorbed by the rails. But the energy absorbed by the friction of the wheels against their axles is partly converted into heat, and is partly employed in producing a molecular change in the iron, rendering it more granular and liable to fracture. I should consider this a case of dynamo-metamorphism. Still it appears to

https://doi.org/10.1017/S0016756800199327 Published online by Cambridge University Press

me that the illustration is not apt. The amount of work to which I refer must be expended on bending and breaking the *particular mass* of rock under consideration, and in shearing the parts of it past one another, and not on the rock outside of it. Hence the energy which is its equivalent has been introduced into the mass; and, energy being indestructible, none of it is lost, and there is now more energy in the mass than there was before. The question which I proposed was simply, what form does that energy take? Is it heat? or is it, as I (perhaps rashly) enquired, chemical energy?

Dr. Irving says that both Mr. Harker and myself have overlooked the one great factor of metamorphism, viz. superheated water. I do not think we either of us proposed to discuss all the causes of metamorphism, but only the mechanical. O. Fisher.

Harlton, Cambridge, 11 *July*, 1891.

DYNAMO-METAMORPHISM AGAIN.

Sir,—A short space will suffice for what I have to say in reply to Dr. Irving (p. 296). I am sorry to have misunderstood, or, as he phrases it 'misrepresented,' him as assuming that the whole of the work passes into heat. I am not sure that even now his position is clear to me. His dictum "chemical combination must generate heat" is intelligible, though, as Mr. Fisher has pointed out, by no means universally accepted by chemists; but simple combination does not cover any of the chemical changes that characterize the metamorphism of rocks. These are "much more complex," and if Dr. Irving believes that in these cases there is always, on the balance, a positive amount of heat generated, he believes that for which no proof whatever is offered.

It is possible that some of the differences between Dr. Irving and myself would resolve into a question of words, if his language were more intelligible to me; but unfortunately his usage of physical terms often bears no relation to the definitions in use among physicists. "Intensity of heat" seems to mean temperature, but what are we to make of the expression (used in taxing another correspondent with confusion of thought) "the energy is presented in the mechanical form of pressure"? The simple word 'deformation' also appears to be employed in some occult sense.

The experiments of Cailletet and Pfaff which I cited are the same as those referred to in the "Report on Slaty Cleavage" mentioned by Dr. Irving. They seem to establish that increased pressure retards chemical changes involving a diminution of density, while Spring's researches tend to show that pressure assists changes involving an increase of density. The two conclusions appear to me not contradictory, but complementary parts of one law. As regards Spring's experiments, Dr. Irving has ludicrously misunderstood me when he implies that I deny the generation of heat by friction during the compression. What I said was that the heat so generated was carefully removed (by conduction). As Major-General McMahon points out (at p. 90 of this volume), M. Spring himself seems to have changed his views as regards the significance of his work, but

https://doi.org/10.1017/S0016756800199327 Published online by Cambridge University Press