

represented as of Caradoc age in the Geological Survey Map, he found a series of Trilobites and other fossils, which induced him to regard these Shineton shales as belonging to the Lower Tremadoc series. He described as new species: *Asaphus Eos*, *Conocoryphe Salteri*, *C. angulifrons*, *Platypeltis Croftii*, *Conophrys Salopiensis*, *Lichapyge cuspidata*, *Lingulella Nicholsoni*, *Metoptoma Sabrinae*, and *Theca lineata*. The author regarded these shales as the equivalents of beds containing *Dictyonema* found near Malvern and at Pedwardine.

Discussion.—Mr. Etheridge differed entirely from the author, and thought the fossils exhibited by him were of Caradoc age.

Mr. Hicks was inclined to refer the fossils to the Upper Llandeilo, but the fragments exhibited were not sufficient to enable the species to be determined.

CORRESPONDENCE.

THE SOURCE OF VOLCANIC HEAT.

SIR,—Were it not for the sincere respect I entertain towards Mr. R. Mallet, I should say there is something ludicrous in the persistence with which he continues to saddle me with the advocacy of one or both of what he, writing *ex cathedra*, pronounces to be “the moribund theories of a thin crust and liquid nucleus, or of Hopkins’s fiery lakes.” You have already, in the note to his paper, referred to proofs that I have rather thrown doubts on both these hypotheses than accepted them. I have been always slow to dogmatize upon the condition of what is so glibly called the nucleus of our globe, seeing how little we can know of it beyond the mere skin, and how ignorant we are of the laws through which extremes of temperature and pressure (not to mention other agencies, such as electric and magnetic currents, diffusion of fluids, imperfect elasticity of solids, solution of solids in fluids, and other chemical changes)¹ may affect the condition of the interior, even on the hypothesis of its condensation from nebular matter. I have rather, from the first, leant to the opinion that the immediate sub-cortical matter of our globe, under varying conditions of heat and pressure, not unfrequently passes, locally, from a solid to a fluid, and even a partially vaporous state, *and back again*. All that I have contended for, and that rather as an undeniable fact than a theory, is that there must exist, within and beneath the vents of active volcanos, considerable masses of more or less liquid matter at an intense temperature (lava), and of indeterminate extent, whether in a vertical or lateral direction. And this much, if not more, Mr. Mallet himself must believe; otherwise, where is he to get the fused matter which he considers to have been forced upwards by hydrostatic pressure to form the immense masses of plutonic rocks?

The only question really at issue between Mr. Mallet and myself relates to the source of the intense internal heat so evidenced in subterranean lava masses; that is, whether it is derived chiefly and directly by conduction or convection, or both, from the heated nucleus of the globe (which Mr. Mallet himself postulates), or

¹ See a paper by Sir W. Thomson on the Dissipation of Energy, in *Nature* of April 9th, 1874.

directly and exclusively from the crushing of the superficial rocks as they follow downwards the shrinking nucleus. The former is my view, the latter Mr. Mallet's. Let us clearly understand each other, and there need be no disagreement between us on other points.

G. POULETT SCOPE.

PALÆOZOIC STARFISHES.

SIR,—In the January Number of this MAGAZINE a list is given of Palæozoic Starfishes. It is not, however, complete yet. Allow me to call your attention to a paper by Simonowitsch (Sitzungsbb., Wiener. Ak. 1871, Band 64), where the following new species were described:—*Aspidosoma petaloïdes*, Sim.; *Asterias acuminatus*, Sim.; *Xenaster margaritatus*; *Xenaster simplex*.

This last genus is a particularly interesting one. All the above are from Devonian beds. The following have also been apparently overlooked:—*Aspidosoma Arnoldii*, Goldf.; *Calaster latescutatus*, Sandb.; *Asterias rhenana*, Müll.

These will considerably enlarge your list of Devonian species.

E. B. TAWNEY.

“CREEPS.”

SIR,—Happening to read, in your March Number, Mr. R. Mallet's letter “In reply to Mr. Scope's Observations, etc.,” the “Creeps” of the Coal-fields, as described in Lyell's Elements, and in Naumann's Lehrbüch der Geognosie, at once occurred to me. Indeed, I should be very happy to learn, and be much obliged to any one who would be so kind as to inform me, whether similar causes might act upon a large scale, producing earthquakes, igneous ejections, and even elevation of mountains.

Supposing a large excavation to have been made by the eroding and dissolving action of subterranean waters (or by other means), a sink-hole or subsidence of the soil may result; but were an uplifting and fracturing of the floor with a rubbing a total impossibility, would this rubbing be sufficient to produce heat? Agreed, heat would result; let us multiply the masses twice, or thrice, perhaps a greater amount of heat arises? Finally: Some part of the earth's crust having, from any reason, lost its stability or power to resist the tension, *creeps* upon a large scale taking place, fissures being produced, rubbings would result, a fragment some miles of width rising slowly, dislocations (*structure en éventail*), upheaval or subsidence of the soil or crust, and igneous ejections or even volcanic phenomena being caused; would such a state of things be at all compatible with the present state of science—or of nature?

“Mi pare però che farebbe veramente un vano sforzo d'ingegno chi volesse spiegare in questo modo le oscillazioni della crosta del globo.”—Stoppani, Corso di Geologia, iii. § 473, 1873.

“Unter diesem von der Mitte aus abwärts wirkenden Druck bildete sich in dem Feldspathgebirge die fächerformige Schieferung aus.”—Studer, Geol. der Schweiz, vol. i. p. 172, 1851.

“Les tremblements de terre, dont la cause est plus mystérieuse, malgré les travaux si remarquables et si précieux de M. Alexis