## ON THE ELEVATION OF MOUNTAIN CHAINS.

SIR,—In reply to the slight notice with which Mr. Scrope has honoured my speculation on volcanic action,[1] I can assure him that nothing was further from my intention than to claim as original what I had learnt from him. It was merely for the sake of brevity that I omitted a reference, which I thought every one could supply. When my paper was read, I used the words, "With respect to the raising of *ejectamenta* in a fissure, it is clearly proved by Scrope, in his work on volcanos, that the force to which it is due is the expansion of aqueous vapour when relieved from pressure." I regret that I did not transfer the sentence in full to your pages.

It will, however, be perceived that although I am indebted to Mr. Scrope for my ideas of the *nature* of a volcanic eruption, my speculation as to its *cause* differs from his theory.

He attributes the elevation of mountains and the trains of volcanoes which often accompany them, to local changes of temperature. "The results of such a local change of temperature would seem to be, first, the dilatation—whether or not amounting to fusion—and, consequent, upward pressure and bodily rise of the expanding matter beneath the centre or medial line of the area affected, but without producing its outward extravasation there; and, secondly, and at the same time, the upward rush and (sooner or later, probably) the external eruption of portions of this heated and fluidified matter through fissures formed towards the margin of the elevated area, and ranging in parallel lines on one or both sides of its central axis of maximum upthrust."[2] It appears, then, that the motive power, in Mr. Scrope's opinion, is the pressure from below of matter expanded by an accession of heat.

I, on the other hand, conceive the elevation of the mountains to be owing to the contraction of the general mass of the earth within its already cooled crust, and suspect a diminution of pressure beneath mountain ranges on account of their being partly supported by their lateral abutments. I conceive the diminution of pressure so caused to induce liquefaction of the subjacent plutonic mass; so that eruption takes place through vents prepared for it—not by the upward pressure of increasingly heated matter, as supposed by Mr. Scrope; but by the crumpling of the crust through lateral pressure caused by a general cooling of the globe. To my mind the difference between these views amounts almost to an interchange of cause and effect.

HARLTON, *near Cambridge.* O. FISHER.

## FISHER.—DENUDATIONS OF NORFOLK.

SIR,—Under this heading your number for December contains a paper by the Rev. O. Fisher. The opening sentence is—"Upon the land-surface a certain amount of the fine material is being carried into the rivers, and by them deposited at the heads of the Broads, or where such do not exist, in the sea. This denudation by *pluvial action* is undoubtedly greater where the land is under the plough than it would be otherwise." The wildest subaerialist will require nothing

[1] GEOL. MAG. Vol. V., p. 493. [2] Scrope's Volcanos, 1862, p. 273.

more than this. Grant this and time, and the entire land must be deposited beneath the sea. So far theoretically. Practically we know that it is so. Practically we know that the entire land has been under the sea. In fact, as I have headed a chapter in Rain and Rivers, "It is only fire that keeps our heads above water." Yet Mr. Fisher, who admits the principle that rain ever has been and actually is now washing the entire land into the sea, begins a sentence (page 557), "The windings of the valleys also appear to be on a larger scale than can be due to such rivers." Why the insignificant valleys which he mentions, nay, the largest valleys in earth, those of the Amazon, Yang Tze, and Mississippi might have been formed without any river at all, by atmospheric disintegration and the erosion of rain. That is, by the *pluvial action* mentioned by Mr. Fisher himself. When these rivers are flooded by rain they are swollen to perhaps twenty times their usual volume; and these rain-floods would occur annually in their valleys whether the rivers existed there or not. That is, instead of constant rivers there would be periodical rivers in the valleys. I have said in Rain and Rivers, that rivers are rain reappearing and returning to the sea. But Mr. Fisher talks of rivers as if they were not rain; and if not, what are they? Evaporation condensed into rain is the *causa causarum*. Rain causes valleys. The largest rivers in the world are by comparison, the effects of this *causa causarum*, and are mere assistants in forming the wondrously magnificent valleys in which they flow (for, perhaps, 4,000 miles), and which are the roads which carry the entire surface of the earth into the sea. This Titanic traffic is brought to them entirely by rain. That is, owing to atmospheric disintegration everything on the surface of the earth which is not living is decaying. Hence, soil; and soil, which is rotted subsoil, is in perpetual formation over the entire surface of the earth, and is perpetually washed down the hill-side into the valley, and along the valley into the sea.

Again, Mr. Fisher says, of what he improperly calls "The valley of the Waveney and the Little Ouse," "If the excavation of this valley had been produced by river-action it is inconceivable how it could have been excavated over the watershed." It is not asserted that the so-called valley is formed by "river action." It is asserted that the low water parting between the *two* valleys has been caused by what caused the two rivers—rain. Mr. Fisher begins with the broad and wholesome doctrine of *pluvial* denudation, here he comes to the narrow one of *fluvial* denudation. That is the doctrine of Sedgwick and Murchison, that denudation is only on lines on the lines of rivers, This is to confuse cause and effect. In joining "Rain and Rivers" together we must remember that rain is the cause, rivers the effect. In a chalk country like Norfolk there is not a single so-called river valley which does not begin with a dry valley, or "rain valley," far above the highest springs of the river. Two opposite rain valleys constantly cut nearly through the dividing ridge. But as long as a water parting remains, and the waters run in opposite directions, we must consider them as two valleys. Mr. Fisher talks of the valleys of the

Waveney and Little Ouse, first as one valley, then as two valleys, then as two valleys inosculating. But the upper part of every so-called river valley on earth is always purely a "rain valley or dry valley" *sine flumine vallis*, as in myriads of cases *entire* valleys are, especially in porous-strata like Chalk. And in nature, at the dividing ridge, each opposite dry valley or water-flow may be seen to stretch its fingers up each opposite water-slope to join hands across the intervening water-parting. Hence the low parts of a dividing ridge alternating with high parts, for which we have the modern northern terms, gap, saddle, col, &c. Hence the southern sierra or serra (saw), and the Latin "juga montium," from the saw-like, or yoke-like ups and downs of dividing ridges. The very name of jugum (hill or yoke) originates here, But these opposite dry valleys, which run up to these low parts of the dividing ridge, these beginnings of valleys are not caused by rivers. They are caused by the cause of rivers—rain.

GEORGE GREENWOOD, Colonel.

BROOKWOOD PARK, ALRESFORD, *December* 7, 1868.

## THE MAMMALIA OF THE CRAG.

SIR,—I observe that the Rev. O. Fisher, at page 547 of your last number, states, on the authority of the Rev. J. Gunn, that *Elephas meridionalis* occurs in the Red Crag. He also speaks of the "Crag period" in such a way as to make it clear that he regards the terrestrial Mammalian fauna of the Suffolk Bone-bed as identical with that of the Mammalian Norfolk Crag. It has always been to me a matter for much regret that the able students of the Norfolk Crags will not give due attention to the facts known as to the Suffolk Crag, for by their assistance the students of the latter might hope to unravel the mysterious history of that strange deposit, the Red Crag. What grounds have the Rev. John Gunn and the Rev. O. Fisher for stating that *E. meridionalis* is found in the Red Crag? The only elephant tooth supposed to come from the Red Crag—known to the late Dr. Falconer—is referred by him to *E. antiquus* (Palæont. Mem. vol. ii. p. 181), and there is no real reason for believing it to be a Red Crag specimen at all. It is true that *Mastodon Arvernensis* is common to the Norfolk and Suffolk deposits; but have you in Norfolk *Rhinoceros Schleiermacheri, Hyœna antiqua, Hipparion* (*Ursus arvernensis* is, I think, found there)? Though the character of the lowest beds of the Suffolk and Norfolk deposits is similar, there seems to me, at present, reason to regard the terrestrial Mammalian fauna of the Suffolk Bone-bed as older than that of the Norfolk Crag generally. It is most important to remember that they are *older than the Coralline Crag.*

E. RAY LANKESTER.

## ON THE OCCURRENCE OF TITANIUM, ETC., IN MAYO.

SIR,—I have lately discovered a new locality for the mineral Titanium, viz., on Cushcamcurragh, a mountain in the townland of Treel, near Newport, Mayo. It occurs in the form of fine crystals of Rutile, imbedded in quartz and schist, in the neighbourhood of a landslip of considerable extent which took place last year at the head