

falling at the edge of the bar, and would give rise to bright and dark parts on the sensitive surface; the bright parts would be extended by molecular irradiation underneath the opaque bar, and would give rise to the irregular brushlike projections mentioned by Mr. Ranyard, instead of the uniform extension obtained when the bar is kept a short distance from the collodion. It is also possible that the irregular curved fluid surface may at certain points, where the bar was not in actual contact with the collodion, have bent the rays of light underneath the bar and given rise to the irregular extension of the image.

JOHN AITKEN

Darroch, Falkirk, July 18

I MUST confess myself at issue with Mr. Stillman as to the result of his experiment with the strip of blackened wood laid upon the collodion film. I have tried a similar experiment, and find the images of bright objects sharply cut off. Even with a film of four thicknesses of collodion and an exposure of ten minutes, I cannot detect the smallest encroachment. The minute brushes mentioned by me in my last week's letter only occasionally occur, and appear to be due to a circulation in the liquid film beneath the opaque object, probably caused by some chemical impurity, for I notice that the brushes only occur when the film beneath the opaque object is soiled.

It cannot be argued that because there is a difference in the amount of irradiation in two pictures taken by different processes (instruments, exposures, and other conditions being similar), that therefore the spreading action must take place within the film, for the plates prepared by the two processes may not be equally sensitive, and the pictures may really correspond to what, with the same process, would be different amounts of exposure. Or again, the relative rates at which faint and intense light imprint themselves in the two processes may differ. Want of sensitiveness to the action of faint light is, I imagine, the reason why irradiation is apparently decreased by the use of the red collodion.

A. COWPER RANYARD

Vapourising Metals by Electricity

IN a paper in NATURE (vol. x. p. 190) Mr. H. Hopkins gave a short description of some experiments on vapourising metals by electricity between two microscopic slides, and said that the layer thus produced can be investigated by a microscope, and employed in various ways to determine the character of the metal.

But the author did not point out the *wonderful drawings* shown by the layer, chiefly when a slight gold sheet is used.

This fact, very interesting in connection with molecular vibrations, has been illustrated by Prof. Magrini in a lecture delivered at the Museum of Florence, some years ago, and translated in *La Revue Scientifique* (t. iv. p. 770), with some woodcuts prepared by Prof. Magrini himself.

A. RODIER

Earth-shrinkings and Terrestrial Magnetism

IN my previous letter (vol. ix. p. 201) I gave some reasons for believing that the earth is shrinking chiefly about its equatorial region, and is being thrust out in the direction of the Poles, and that the distribution of this force may be correlated with that of terrestrial magnetism. As this view is somewhat novel and revolutionary, and if true will lead to considerable modification of the theories generally held on cosmical forces, I wish to support it by some other considerations.

I must predicate, as to a great extent proved, that volcanoes are not found in areas of upheaval. On this point I think the evidence is conclusive, and as I have previously written about it I shall not again enlarge upon it. I must predicate also that the earth as a whole is shrinking. This I tried to show in my previous letter. It follows from these facts that the large areas we know to be rising must be compensated by larger areas that are sinking, and that we may in a measure map these latter areas out by mapping out volcanoes; for, *ex hypothesi*, they occur either in areas of depression or along the border lines of the oscillating land.

Thus occurring, and themselves with the related phenomena of earthquakes, being the most vigorous proofs we have of the mobility of the earth's crust, we may predicate further that they will be found most actively at work where movements of the earth are most vigorously active, and that where they are libe-

rally scattered, there the earth's crust is the most yielding. Now if we examine the distribution of volcanoes from this point of view we shall find that our main position is amply supported. Within the Arctic circle there is only one volcano, so far as we know—that of Jan Mayen. Within the Antarctic there is not one. North of the 60th degree of north latitude we have the volcanoes of Iceland, and three or four in Alaska, and these only. South of the 60th degree of south latitude we have Mount Erebus and its companions in the South Shetlands, and these only. Between the parallels of 40 and 60 the number of volcanoes increases considerably. In the northern hemisphere they probably number over sixty; but the vast majority of these are contained in the semicircular line of volcanoes formed by the Kurile and Aleutian Islands, and which crown that vast area of depression, the Pacific Ocean. In the southern hemisphere we still have exceedingly few, perhaps not more than a dozen, and these along the line of the Andes. It is in the region bounded on the north and south by the 40th parallels of latitude that we find volcanoes distributed in the greatest profusion, and the focus of distribution is even more narrow than this, for it may be bounded in fact by the 20th parallel on each side of the Equator. It is here we have that region described by so many writers in graphic terms, the Eastern Archipelago, with its 109 volcanoes in active operation. "From Papua to Sumatra, every large island," says M. Reclus, "including probably the almost unknown tracts of Borneo, is pierced with one or more volcanic outlets. There are Timor, Flores, Sumbawa, Lornbok, Bali, and Java, which last has no less than 45 volcanoes, 28 of which are in a state of activity, and lastly the beautiful island of Sumatra. Then to the east of Borneo, Ceram, Amboyna, Goloa, the volcano of Ternata, sung by Camoens, Celebes, Mundanao, Mendora, and Luzon; these form across the sea, as it were, two great tracks of fire." (Reclus, "The Earth," 498.) Here also is that wonderful congeries of Pacific volcanoes described by the same graphic author. "The volcanoes of Abrim and Tauna, in the New Hebrides, Turahoro, in the Archipelago of Santa Cruz, and Semoya in the Salomon Islands, succeeding one after the other, connect the knot of the Feejees to the region of the Sunda Islands, where the earth is so often agitated by violent shocks. This region may be considered as the great focus of the lava-streams of our planet." It is within the same narrow limits also that we have the most active signs of movement in the Atlantic basin, namely, in the Little Antilles group of the West India Islands. In regard to the two regions last mentioned, there is a fact remarkably confirming the general position I argued in favour of in a previous letter, namely, that volcanoes are indicative of areas of depression, and which was unknown to me when I wrote it. M. Reclus says—"It is a remarkable fact that the two volcanic groups of the Antilles and the Sunda Islands are situated exactly at the Antipodes one of the other, and also in vicinity of the two poles of flattening, the existence of which on the surface of the globe has been proved by the recent calculations of astronomers. (Op. cit., p. 503.)

These facts seem to me to support very strongly my contention that the earth is shrinking chiefly in its equatorial region. Volcanoes are in my view the mediate and not the immediate results of the shrinking of the earth; earthquakes on the contrary are its immediate result. There is considerable difficulty in mapping out a chart of their frequency and intensity, but we may say safely that such a chart would have a deeply-coloured zone in the equatorial regions, that it is there where earthquakes and especially submarine earthquakes chiefly abound, and abound also in their more vigorous type. This can only be if that area is also the chief area of disturbance of the earth's crust. Another fact which points in the same direction is that discussed by Bischof, namely, that the soundings in the greater oceans increase as we near the equator, this increase taking place relatively to the land masses and not being merely due to the bulging out of the water in those parts by the force of attraction. So that if we accept the level of Africa or the Pampas of Brazil as a mean we shall find the greatest pits and hollows in the crust in the equatorial region.

In regard to the connection of this earth-shrinking with terrestrial magnetism, I wish to quote one or two paragraphs from Dr. Zollner's paper in the "Philosophical Magazine" on the origin of the earth's magnetism, to the conclusions of which, however, I cannot in any way assent. I quote him on the subject of the correlation of earthquakes with magnetic disturbances. He is quoting from Mr. Lamont's work.

"Kreil has given many cases," he says, "where magnetic disturbances coincided with earthquakes; hence he thinks—con-