

liable to earthquake are those near to active or recently active volcanoes, especially the Pacific border (which actually contains 172 out of a total of 225 now active volcanoes); also earthquakes are propagated chiefly *along* valleys or ridges.

The distribution of earthquakes in time has been much discussed, but no periodic law either secular, seasonal, or diurnal, either for the world in general or for any one place, is very clear.

After discussing the synchronism of earthquakes with numerous physical phenomena (positions of heavenly bodies, states of air, &c.), the causes of earthquakes are considered, and the conclusion is drawn that the primary causes are probably terrestrial, such as (1) sudden cracks consequent on over-stretching of the earth's crust during elevation; (2) explosions of steam; (3) collapse of hollows produced by volcanic ejection and by the continuous solution and removal of matter by springs; (4) change of load over large areas due to rise and fall of the tides and to changes in air-pressure.

As to prediction of earthquakes, nothing certain is yet known. In many cases there are noticeable changes in springs and wells preceding earthquakes. One useful warning is, however, obviously possible, viz. the report of an actual earthquake on one side of the Pacific could be at once telegraphed to the other side, thus giving twenty-four hours' warning of the probable advent of a great sea-wave.

As to earth-tremors, two curious cases are quoted: (1) the extra crowds of people in Greenwich Park on public holidays cause extra shaking in the Greenwich Observatory instruments; (2) certain delicate observations projected at Cambridge in 1880-82 proved futile in consequence of the continuous earth-tremors masking the delicate effects sought. To these might now be added in London the tremors produced by the Underground Railway. Systematic record of earth-tremors (micro-seismography) has now been made in Italy in many towns for ten years: these tremors appear to be periodic, and to be connected with the sun's and moon's motions, and with the state of the barometer, and to increase *before* earthquakes, so that there is some hope of possibility of earthquake prediction from this research.

The phenomena of earth-pulsations and -oscillations quoted are numerous and interesting, but space fails to enumerate them.

The work begins with an earthquake-map, and ends with a list (10 pp.) of earthquake-literature.

This work is well worthy of its place in the International Scientific Series, and may be accepted as a monograph on its subject by an accomplished seismologist, who, from his residence in Japan, has had ample opportunities of studying the actual phenomena.

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#### FRICIONAL ELECTRICITY

*Frictional Electricity.* By Thomas P. Treglohan. (London: Longmans, Green, and Co., 1886.)

THIS is a little book written for first beginners in the study of electricity. On the whole it is satisfactory; although the writer betrays curious want of knowledge or

want of judgment here and there. The diagrams are good, and the descriptions fairly clear; and from place to place instructions are given to teachers as to experiments they may make before elementary classes for the purpose of illustrating and bringing home to the learners the various parts of the subject. The construction of simple pieces of apparatus, such as a boy may make for himself, is also described throughout the book and in a number of paragraphs at the end.

There are, however, certain points to which we take serious exception. First, we cannot regard Mr. Treglohan's mode of looking at inductive phenomena as correct or satisfactory. For example, speaking of the electrophorus, he says:—"If, while the conductor rests upon the excited cake and is under the inductive action of it, the upper surface of the conductor be touched by the finger, the free negative passes to the earth, and an equal quantity of positive enters the disk from the earth." The same statement is made on the following page, so that there is no doubt whatever that the statement about the "equal quantity of positive" is really meant. In the diagrams throughout the book too, where discharge as the result of induction is going on two little arrows are shown, one marked + and the other -, and pointing in dissimilar directions. This seems to us particularising with a vengeance the action of two fluids.

On p. 35, under the heading "specific inductive capacity," we are told that "It was established by Prof. Faraday that, for an excited body to act upon a conductor by induction, some substance must exist between the two through which the electricity may be imparted." Shade of Faraday!

At the end of this paragraph, speaking of specific inductive capacity, we are told that "dry air is superior to moist air in this respect." We do not think that any difference has been proved to exist between dry air and moist air, either as to induction or as to conduction; though there is a common misapprehension (shared by the present author, p. 30) of a difference as to this latter quality.

The use of the condensing electroscope seems to be misunderstood by the author. It cannot be used in the way described for testing "lightly charged bodies." Its main use is for testing a weak but continuous source.

There is also an extraordinary paragraph about a white-hot iron ball on p. 107, for which the author seems to make Prof. Guthrie responsible, and in which the experimenter is told to put a white-hot iron ball on the electroscope in order to prove certain statements! We fear the experimenter will not obtain much valuable information from the experiment; and it is *not true* that, with respect to the supposed indifference of a white-hot body to electrification, "in this it resembles the indifference to magnetism of a white-hot iron ball."

A few misprints we have also noticed. Sir William Thomson's name should be spelled without a "p"; iodine and starch paper is coloured blue, not brown, by ozone. Putting aside these defects, however, this little book will probably be found useful to teachers for the elementary stage in the Science and Art Department, for whose benefit, as we are told in the preface, it has been compiled.

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