

PREFACE.

In 1898 I set up a pair of horizontal pendulums adapted to mechanical registration, in the brick "earthquake-proof house" in the University compound, Hongo, Tokyo, and a description of the apparatus with a discussion on the observations obtained was given in Vol. XI of the Jour. Coll. Sc. Imp. Univ. Tokyo. These observations were continued and I have recorded, between July 1898 and Dec. 1899, 246 earthquakes,* which for the sake of convenience are divided according to origins into the following nine groups.

Group I.—Distant earthquakes.

Group II.—Earthquakes which originated off the eastern coast of Hokkaido (Island of Yeso).

Group III.—Earthquakes which originated off the northeastern coast of Honshiu (Main Island).

Group IV.—Earthquakes which originated off the coast of the provinces of Hitachi and Iwaki.

Group V.—Earthquakes which originated off the southern coast of Honshiu (Main Island).

Group VI.—Earthquakes which originated in Kiushiu or off its eastern coast.

Group VII.—Earthquakes which originated in central Japan.

* Not including a few very small local shocks, whose diagrams were too small to be accurately measured.

Group VIII.—Local earthquakes :—

- (a) Those observed at several places.
- (b) Those observed in Tokyo and at one other place.
- (c) Those observed only in Tokyo.

Group IX.—Earthquakes of miscellaneous origins.

Group I includes large earthquakes which originated at great distances from Japan as well as those comparatively small ones which originated under the ocean at such distances from Japan's eastern coast as to be no longer sensible to the ordinary Gray-Milne type seismographs at the meteorological observatories in different parts of the Empire. The majority of the earthquakes in Groups II to IX originated in Japan itself or off its eastern coast and were felt more or less intensely at several places.

In this volume I give the description of some improved forms of the horizontal pendulum apparatus, the list of the earthquakes, and tables showing the chief elements of motion, together with a few remarks and discussions, chiefly on the earthquakes of Group I. In the next volume, I shall give in detail the analysis of the horizontal pendulum diagrams of the 246 earthquakes.

My horizontal pendulums were recently also set up in the Meteorological Observatory of Miyako, the Seismological Observatory of Hitotsubashi (Tokyo), the Imperial University of Kyoto, and the Astronomical Observatory of Mizusawa. The analysis of the diagrams obtained at these places will be published at some future date. Before the end of this year, similar apparatus will be set up in the Imperial Central Meteorological Observatory (Tokyo), and the Meteorological Observatories of Ishinomaki (in the province of Rikuzen); Osaka; Gifu (in the province of Mino); Keelung, Taihoku, Taichu, Tainan and Koshun (in Formosa); Hokoto (Pescadores), etc.

ON INSTRUMENTS TO BE USED FOR MICRO-SEISMIC
OBSERVATIONS.

To observe earthquakes satisfactorily it is necessary to record the two fundamental elements of the seismic motion, namely, the *period*, and the *amount* or *amplitude*. Hence the requirements of the instruments to be used for international observations of earthquakes will be three-fold, as follows:—

Firstly, the rate of motion of the record-receiver must be sufficiently rapid to enable us to measure with accuracy the periods of the different waves of an earthquake. Secondly, the so-called *steady-point* (or *stationary mass*) of a seismograph must be brought so nearly into a state of neutral equilibrium, that the period of its free oscillations is sufficiently long to enable us to distinguish between the real earthquake movements and the motions of the instrument itself. Thirdly, the amount of friction between different parts of the instrument must be reduced to a minimum.

If these conditions be fulfilled, the records from the different apparatus will be comparable with each other and there is no need to set up instruments of a single pattern in all the stations of the world. A very common mistake among seismologists is to put too great a confidence in their instruments and ignore the possibility of the existence of the proper oscillations of the *steady point*. If this source of error be properly cared for, the interpretation of seismograms will become considerably simplified.

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