Note on the Annual Variation of Seismic Frequency in Tokyo and Kyoto.

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With Pl. X.

Introductory. As pointed out in a discussion of the seismic activity for Japan, taken as a whole, the variation of the frequency of the ordinary small shocks, whose number is minimum in the months of June, July, August, and September, is just the reverse of that of the destructive disturbances, whose number is maximum in July and August*. Again, with respect to the recent Japan earthquakes of submarine origin, the annual variation of the small shocks is found to be approximately opposite to that of the stronger or larger ones‡. Relations like these between small and large seismic disturbances are what is to be expected from the nature of an earthquake, which is virtually equivalent to the removal of a weak point in the earth's crust; the more frequent occurrence of small shocks tending to prevent any abnormal accumulation of the underground stress. The non-occurrence of these disturbances, or, an unusually low seismic frequency may, on the other hand, facilitate the occurrence

* F. Omori: "Note on the Earthquake Investigation Committee Catalogue of Japanese Earthquakes." Jour. Sc. Coll., Imp. Tokyo Univ., Vol. XI, 1899.

‡ This number, Pl. XIX.

of great or destructive seismic disturbances. The reversal of the maximum and minimum epochs in the annual variation of large and small seismic shocks is also strikingly shown in the cases of the earthquakes recorded in Tokyo and Kyoto.

Seasonal variation of seismic frequency in Tokyo. The number of destructive and semi-destructive earthquakes, which shook Tokyo (Yedo) since the foundation of the city in 1590 by Tokugawa Iyeyasu, was 18, the first and last of which took place in 1615 and 1894 respectively. Of these, the maximum seasonal number of 7 occurred in Summer, while the minimum number of 3 occurred in Winter and Spring. On the contrary, the mean seasonal number of ordinary small earthquakes, observed instrumentally in Tokyo between 1876 and 1899, was minimum (=19.1 and 18.3) in Summer and Autumn, and maximum (=25.5) in Spring*, as shown in the following table.

Seasonal Seismic Frequency in Tokyo.

Season.	Mean seasonal number of ordinary eqkes. (1876–1899).	Number of destructive and semi-destructive eqkes. (1615–1894).
Spring (March, April, May).	25.5	3
Summer (June, July, August).	19.1	7
Autumn (Sept., Oct., Nov.)	18.3	5
Winter (Dec., Jan., Feb.)	23.9	3

As is graphically shown in Figs. 1 and 2 (Pl. X), the annual variation of the small earthquakes is almost symmetrically opposite to that of the destructive and semi-destructive shocks.

Annual variation of seismic frequency in Kyoto. Of the seismic disturbances recorded in Kyoto between 797, the year

* See the *Publications*, No. 8.

of its foundation, and 1867, when it ceased to be the Imperial capital, 1088 earthquakes were small shocks, and 32 were destructive or semi-destructive in or about the city*. The distribution in the 12 months of the year of these two classes of Kyoto earthquakes are as follows.

Monthly Seismic Frequency in Kyoto. (797–1867).

Month.	Ordinary small eqkes. (1088 shocks.)	Destructive and semi-destructive eqkes. (32 shocks.)
January.	79	3
February.	82	0
March.	110	0
April.	102	0
May.	95	3
June.	91	4
July.	87	5
August.	95	7
September.	74	3
October.	87	2
November.	95	1
December.	91	4

Thus the small earthquakes indicate the maximum monthly number of 110 in March, and the minimum of 74 in September; while the larger ones show the minimum number of zero in February to April, and the maximum number of 7 in August. As will also be seen from the graphical illustrations in Figs. 3 and 4 (Pl. X),

* These numbers are revised results and differ slightly from those given in Jour. Sc. Coll., Imp. Tokyo Univ., Vol. XI.

the annual variations of the two sets of earthquakes are nearly opposite to one another.

Concluding remark. From the foregoing §§, it is evident that we must treat small and large earthquakes separately, in the discussion of seismic frequency with respect to the atmospheric pressure, the position of the moon, etc.

Annual Variation of Tokyo Eqke Frequency.

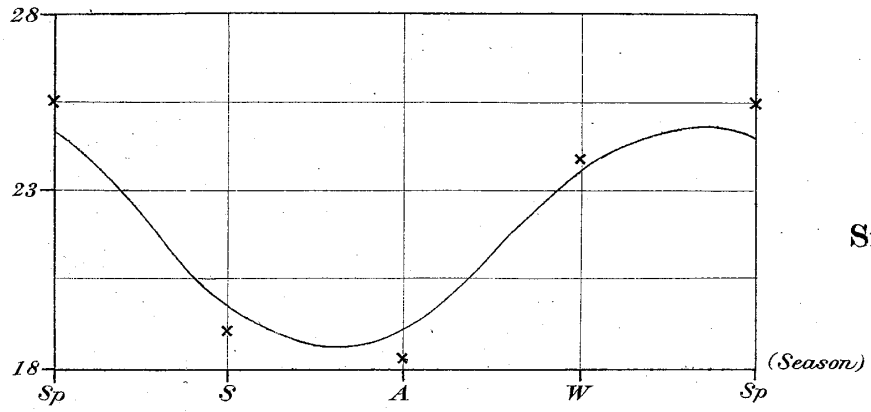

Fig. 1.
Small Eqkes.

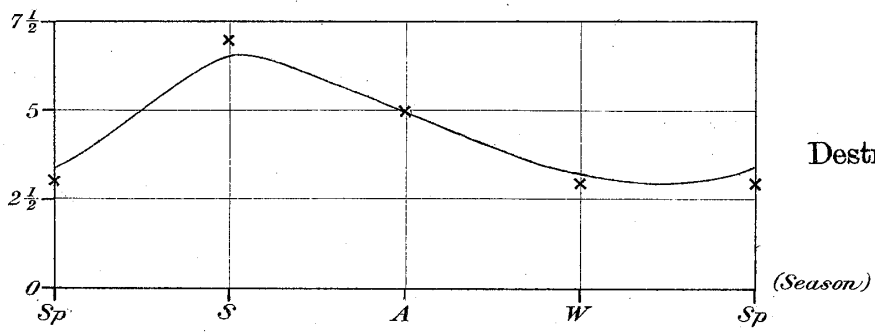

Fig. 2.
Destructive Eqkes.

Annual Variation of Kyoto Eqke Frequency.

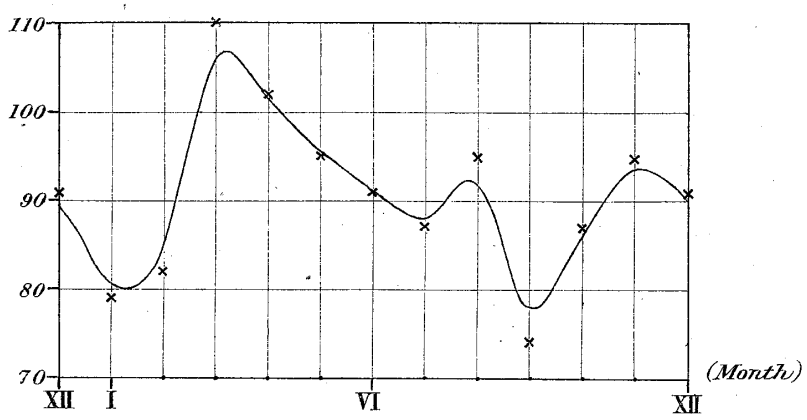

Fig. 3.
Small Eqkes.

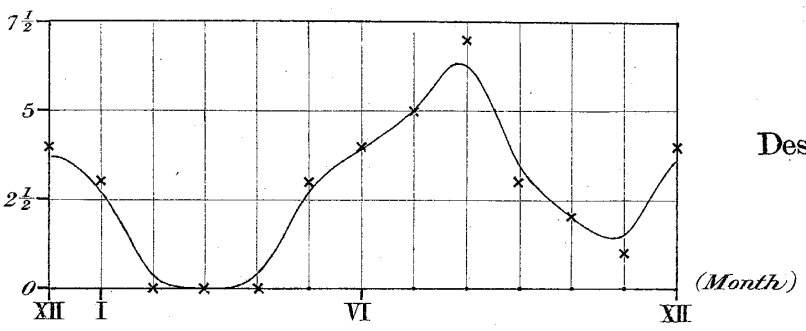

Fig. 4.
Destructive Eqkes.