

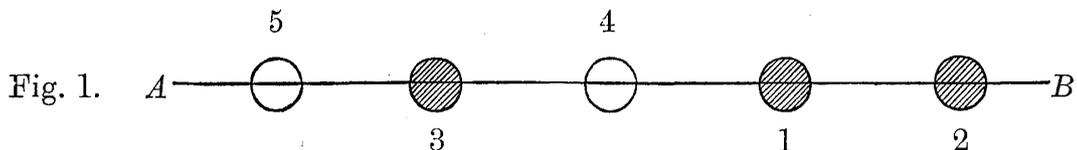
Recent Strong Earthquakes in the Shinano-gawa Valley (Central Japan).

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1. Introduction. Destructive earthquakes, whether great or local, are generally not isolated phenomena, but form groups each of which happen along a seismic zone of greater or less extent; no two violent shocks occurring successively at one and the same place. Thus let A B (Fig. 1) represent a seismic zone; 1, 2,



3, 4 and 5 being different earthquake centres. If now the first two earthquakes took place at 1 and 2 respectively and the 3rd one at 3, the next shock may be expected to occur somewhere at 4. Again, after the occurrence of the earthquakes 1...4, the 5th one may be expected to happen towards either end of the zone under consideration, say at 5.

2. Strong Earthquakes in the Shinano-gawa Valley. The case diagrammatically illustrated in Fig. 1 has exactly been verified by the 5 strong earthquakes, which happened, between the years 1886 and 1899, in the Shinano-gawa valley; the latter

forming one of the active seismic zones in the central part of the Main-Island.* The dates of these 5 earthquakes are as follows:—

- No. 1. July 23, 1886 ; 1.00 A.M.
- ,, 2. July 22, 1887 ; 8.30 P.M.
- ,, 3. Jan. 7, 1890 ; 3.43 P.M.
- ,, 4. Jan. 17, 1897 ; 5.36 A.M.
- ,, 5. Jan. 22, 1899 ; 8.04 A.M.

It may by the way be noted that the first two earthquakes occurred at an almost identical epoch of the year, namely, on 23rd and 22nd of July, while the three remaining ones occurred all in July. This is one of the instances, in which strong or destructive earthquakes belonging to a given seismic zone tend to occur at nearly the same hour in the day, or in the same month of the year. The approximate positions of the epicentres of the 5 earthquakes are indicated in Fig. 2 by the numerals 1, 2, 3, 4, and 5 respectively.

Eqke No. 1 originated at the boundary of the two provinces of Echigo and Shinano, and was strongly felt in the counties of Higashi-Kubiki (Echigo) and Midochi (Shinano), causing a destruction of one house, besides several cases of damage to *dozo* (Japanese ware houses), *ishigaki* (stone retaining walls), etc. Some cracks of the ground were also produced.

Eqke No. 2 originated in the Koshi county, (province of Echigo), where the ground was cracked and water and sand were ejected; some temples being displaced 2 to 6 inches on their foundations, and one person wounded. The shock was also strongly felt in the two counties of Mishima and Minami-Kanbara (Echigo).

* This is the zone marked M in my paper on the Distribution of Recent Japan Earthquakes. The *Bulletin*, No. 2.

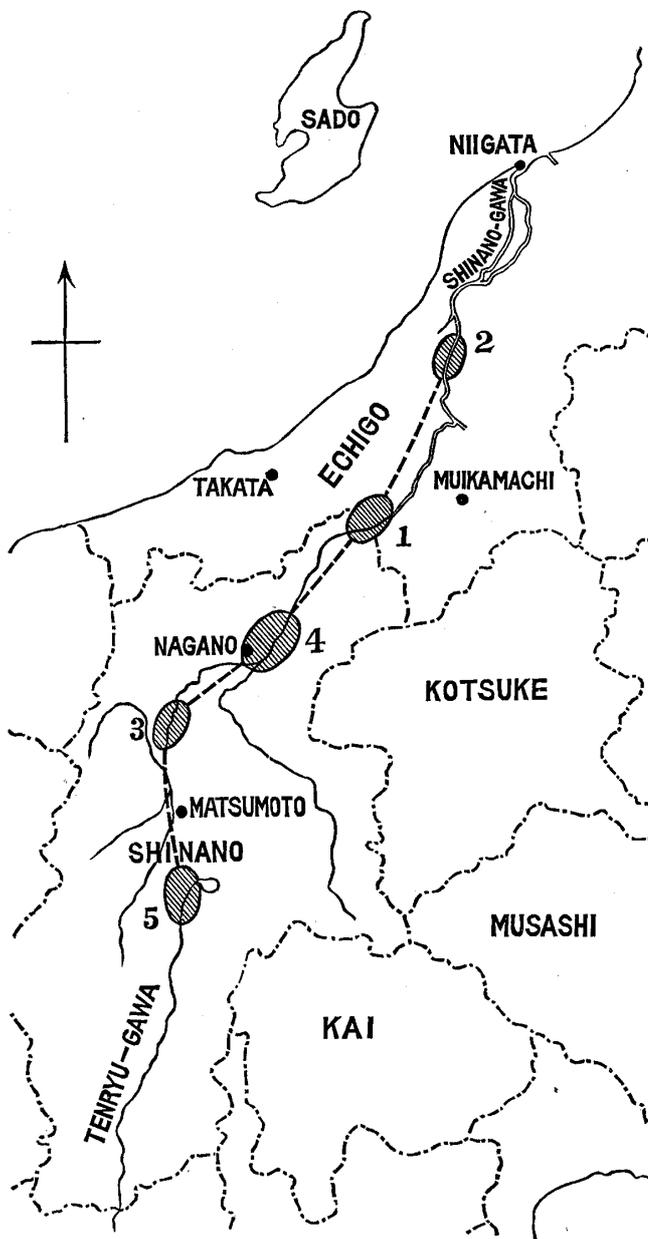


Fig. 2.

Map illustrating the Shinano-gawa Eq. Zone. Small shaded ellipses indicate the approximate positions of the Eq. Origins.

Eqke No. 3 was most severely felt in the counties of Kami-Midochi, Higashi-Chikuma, Kita-Atsumi, and Sarashina (all in the province of Shinano). Houses and *dozos* were damaged, cliffs and roads were cracked, tomb stones were overturned, water and sand were ejected from ground cracks.

Eqke No. 4 was severely felt in an area of about 60 square miles in the two counties of Kami-Takai and Kami-Midochi (in the province of Shinano). The seismic damage was nearly the same as in *Eqke No. 3*, the epicentre being probably situated on the eastern side of the Shinano-gawa.

Eqke No. 5 was strongly felt in the counties of Suwa, Kami Ina, and Higashi-Chikuma (in the province of Shinano), the centre of disturbance being in the vicinity of Lake Suwa. In this case, the motion was not so intense as in the four preceding

shocks, due probably to a greater depth of its origin.

Summary. It will be observed that the 5 earthquakes above described were each a local severe shock, whose damage was limited to cracks of the ground, some injury to buildings, and the like. Further, (2) originated about 33 miles to the NNE of (1), while (3) originated at a greater distance in the opposite direction, at 50 miles to the SW of (1), namely, a little distance to the SE of the town of Ōmachi. Thus it was very likely that the next place to be visited by a strong shock was between (1) and (3). This has been fulfilled by the occurrence of the next earthquake at (4) or the vicinity of the city of Nagano. The famous great earthquake of Zenkōji on May 11, 1844, was of the same character as, but much more violent than, Eqke No. 4.

The occurrence of Eqke No. 5 further southwards was in accordance with the natural order of things to be expected.

3. *Seismic Activity in America, Asia and Europe.* The successive occurrence in recent years of a number of destructive earthquakes along the American and Mediterranean-Himalayan seismic zones* furnish another illustration of the principle explained in § 1, manifested in a grand scale.

* See the *Bulletins*, Nos. 1 and 2.