

The mean radial distance of the centre of the "detached sound area," which varied between 145 and 205 km., comes out to be 177 km. This is not much different from the corresponding average value of 170 km. deduced from the 12 strong Asama-yama explosions in 1909–1913. (See this volume, page 69.) The general mean value of the radial distance in question may be taken to be 172 km.

The "detached sound area" of the Asama-yama is formed almost exclusively to the S.W. from the centre of disturbance, but the investigation respecting the explosion on Jan. 29th, April 6th, and Dec. 15th, in 1914, have demonstrated the possibility, though not in a marked scale, of its existence also to the S.E. or E.N.E. from the volcano. From the consideration of the explosion on Jan. 29th, 1914, we may take the *zone of silence* in a broad sense to signify a complete or partial reduction in the intensity of the detonation consequent to a complete or partial absence of the sound rays proceeding directly from the crater.

CHAPTER VIII. YUNO-TAIRA (ASAMA-YAMA) OBSERVATION OF THE NON-ERUPTIVE VOLCANIC EARTHQUAKES.

61. Volcanic earthquakes. In the following §§ I give a short description of the instrumental diagrams obtained at Yunotaira of a few prominent non-eruptive earthquakes of volcanic nature, whose origin was at or near the Asama-yama. The horizontal tromometers, of the magnification ratio of 100 to 150, had the recording pointers oriented in the two rectangular directions longitudinal and transverse to the centre of the crater. The

movements in these two directions are here provisionally termed the longitudinal and transverse components respectively.*

62. Earthquake of July 24th, 1911, at 5. 56. 44 a.m. At Yuno-taira the earthquake was felt strongly and began with the following well-defined large vibration:—

$$\left\{ \begin{array}{l} \text{1st displacement} = 0.6 \text{ mm., toward } N.76^\circ E. \\ \text{2nd } \quad \quad \quad \quad = 0.9 \quad \quad \quad \quad \quad \quad S.83^\circ W. \end{array} \right.$$

The next motion had the maximum 2a's of 0.99 and 0.79 mm. in the radial and transverse components respectively. The preliminary tremor and the principal portion together lasted 34 sec.

The earthquake was a little smaller than, but quite similar to that at 9.11.45 a.m., on the same day, the origins of the two being evidently close to one another.

63. Earthquake of July 24th, 1911, at 9. 11. 49 a.m. The earthquake, which was felt strongly at Yuno-taira began with a sudden well-defined vibration as follows:—

$$\left\{ \begin{array}{l} \text{1st displacement} = 0.46 \text{ mm., toward } N.73^\circ E. \\ \text{2nd } \quad \quad \quad \quad = 1.3 \quad \quad \quad \quad \quad \quad S.76^\circ W. \end{array} \right.$$

The 3rd displacement was still greater and threw the radial component pointer out of the smoked paper. The max. 2a in the transverse component was 1.22 mm. The total duration of the preliminary tremor and the principal portion was 51 sec.

One of the after-shocks, which took place at 9. 15. 39 a.m., began with the following motion:—

$$\left\{ \begin{array}{l} \text{1st displacement} = 0.017 \text{ mm., toward } S.67^\circ E. \\ \text{2nd } \quad \quad \quad \quad = 0.027 \quad \quad \quad \quad \quad \quad N.53^\circ W. \end{array} \right.$$

* For some of the earthquakes the duration of the preliminary tremor, total duration, and the maximum range of motion already given in the Bulletin, Vol. VI, No. 2 and Vol. VII, No. 2, have been corrected and ascertained from the photographic enlargements of the original diagrams.

The main strong shock was felt only within a small elliptical area of the diameters of 44 and 36 km., situated to the N.W. of the crater. The origin was probably at about 16 km. to the N.70°W. of the Asama-yama crater, or

$$\varphi = 36^{\circ} 26.8' \text{ N.}, \lambda = 138^{\circ} 21.5' \text{ E.}$$

64. Earthquake of Oct. 5th 1911, at 11.51.22 p.m. The earthquake was sensible and similar to that on the morning of the next day, the origin of these two disturbances being evidently close to one another. The max. 2a's in the radial and the transverse components were 0.55 and 0.40 mm. respectively. The preliminary tremor and the principal portion together lasted about 30 sec. The vibration at the earthquake commencement was as follows:—

$$\begin{cases} \text{1st displacement} = 0.028 \text{ mm., toward S.86}^{\circ}\text{E.} \\ \text{2nd „ „} = 0.17 \text{ „ „ N.73}^{\circ}\text{W.} \end{cases}$$

65. Earthquake of Oct. 6th, 1911, at 8. 50. 35 a.m. This was felt within a small elliptical area of the diameters of 52 and 38 km. respectively, situated to the N.W. of the crater, the origin being at about 24 km. to the N.75° W. of the Asama-yama crater, namely, at

$$\varphi = 36^{\circ} 30.3' \text{ N.}, \lambda = 138^{\circ} 17.8' \text{ E.}$$

The motion at Yuno-taira began with a sharp displacement of 0.041 mm. directed nearly toward the E. The max. 2a's were 0.8 mm. and 0.63 mm. in the radial and transverse components respectively. The preliminary tremor and the principal portion together lasted 40 sec.

66. Strong Earthquake of July 16th, 1912, at 7.45.35 a.m. The first slow displacement in the preliminary tremor was 0.77 mm. directed toward the N.24° E., while the quick movement

at the very commencement was 0.49 mm. directed toward the N.47° E. (See § 99.)

Observation at Maebashi Meteorological Observatory. The preliminary tremor, which lasted 6.5 sec., was composed of the vibrations of $T=1.3$ sec. (E.W. component) and $T=1.4$ sec. (N.S. component), the first two displacements being respectively 0.005 mm. toward the E. 6° N. and 0.001 mm. toward the W. 11° N., with the mean direction of E. 2° S. and W. 2° N. The duration of the principal portion was 15.2 sec. in the longitudinal and 12.4 sec. in the transverse component, the max. 2a in each direction being over 1.6 mm.

Observation at Nagano Meteorological Observatory. The preliminary tremor lasted 5.7 sec. The first displacement in the E.W. component was slow and 0.05 mm. directed toward the W.

At the Seismological Institute, Tokyo, the preliminary tremor lasted 18.3 sec., the initial movements being in the direction of S.56° $\frac{1}{2}$ E.—N.56° $\frac{1}{2}$ W. The epicentral distance of Nagano, Maebashi, and Tokyo, corresponding to the respective durations of the preliminary tremor, were 42, 48, and 136 km. The position of the earthquake centre determined from these distances combined with the directions of motion at the two latter places coincides very nearly with the mountain top. Further, according to the observation at Yuno-taira, the actual position of the origin seems* to have been a little to the west of the central cone, and was probably in the site of the old Kurofu-yama and Kiba-yama crater.

67. Strong Ueda earthquake of Aug. 17th 1912, at 11. 21. 25 a.m. The very 1st displacement of the earthquake motion was 0.018 mm., toward the S.89°W. As the initial displacement of the vertical component was 0.004 mm. downwards, the earthquake origin must have been situated in the direction of the 1st horizontal displacement. The duration of the preliminary tremor was about 3.3

sec., giving $24\frac{1}{2}$ km. for the radial distance. In the principal portion of the longitudinal component, which lasted 41.5 sec., the pendulum of the instrument was thrown into its own proper oscillations, of period = 3.8 sec. (max. motion = 0.76 mm.). In the next 42.6 sec., the motion was smaller: $2a = 0.057$ mm., $T = 1.8$ sec. approx. In the subsequent portion, the vibrations were regular and very small: $2a = 0.006$ mm., $T = 1.5$ sec. In the other component, the pointer indicated a motion larger than 0.9 mm., and went out of the recording drum 12 sec. after the commencement. Subsequently it again entered on the smoked paper, indicating extremely minute movements of $2a = 0.011$ mm., $T = 2.0$ sec. (See § 99.)

Observation at Nagano Meteorological Observatory. Time of occurrence = 11.21.38 p.m. According to the E.W. component 30-times magnification horizontal pendulum, the commencement was sharp, and the preliminary tremor (max. $2a = 0.12$ mm.) lasted about 3.4 sec., corresponding to the radial distance of $25\frac{1}{2}$ km. For the next 18.5 sec., the motion was most active and consisted of quick vibrations of max. $2a = 0.58$ mm. For the next 32.0 sec., the motion was made up of the following vibrations: $T = 1.8$ sec. (approx.), $2a = 0.25$ mm.; $T = 3.6$ sec., $2a = 0.22$ mm.; $T = 1.2$ sec., $2a = 0.18$ mm. Thereafter the motion gradually decreased, and became much smaller, being principally composed of the vibrations of $T = 3.2$ sec. (approx.), mixed with those of $T = 2.6$ sec. Total duration = $4\frac{1}{4}$ m.

68. Earthquake of Sept. 5th, 1915, at 10.50.25 p.m. The earthquake was sensible.

Duration of preliminary tremor = 0.7 sec.

{ 1st displacement = 0.072 mm., toward S.75°E.,
 { 2nd ,, = 0.42 mm., toward N.71°W.

The 4th and 5th displacements composed the maximum vibration:

Max. $2a = 0.73$ mm. (radial compt.); = 1.0 mm. (transv. compt.)

Duration of principal portion = 45 sec.

Total duration = $2\frac{2}{3}$ min.

69. Earthquakes of Sept. 19th, 1915, at 9. 25. 28; 9. 25. 52; 9. 26. 24 a.m. Three sensible earthquakes occurred in series, the successive intervals being 27.8 and 34.0 sec. (See fig. 9.) In each the radial component was much greater than the transverse, and the motion, which indicated no preliminary tremor, began at once with the maximum vibration, as follows:—

	(1st Eqke.)	(2nd Eqke.)	(3rd Eqke.)
1st displacement.	{ 0.14 mm., toward S. 72° W.	{ 0.082 mm., toward S. 70° W.	{ 0.073 mm., toward S. 71° W.
2nd or maximum displacement. (radial compt.)	0.19 mm.	0.11 mm.	0.12 mm.
Do. (transv. compt.)	0.11 mm.	0.065 mm.	0.062 mm.
Duration of princ. portion (radial and transv. compt.)	10.2 sec.	4.9 sec.	4.0 sec.

According to the observation at Wakasare, on the morning of the 19th the Asama-yama top was emitting fires from 4.0 to 4.24 a.m.

70. Earthquake of Oct. 10th, 1915, at 11.44.28 p.m. The earthquake was felt strongly at Yuno-taira, on the S.W. flank, and also at Wakasare at the E. base, of the Asama-yama. It was felt at Komoro for about 10 sec., being also sensible at Iwamrata. At the time of the earthquake, the Asama-yama was emitting fires and black smokes, which continued to 4 a.m. on the next morning.

The preliminary tremor lasted about 0.6 sec., the first displacement being 0.02 mm. toward the N. 35° E.

Duration of principal portion = 32 sec.

„ „ most active part = 15 sec.

Total duration = 130 sec.

Max. 2a = 0.30 mm. (radial compt.); 0.34 mm. (transv. compt.).

In Tokyo, the time of earthquake commencement was 11.44.52 p.m., and the duration of the preliminary tremor was 18 sec.

71. Earthquake of Oct. 18th, 1915, at 9.04.52 a.m. The preliminary tremor lasted 0.43 sec. and was composed of a single slow displacement=0.0035 mm. toward the N.88°E. Then occurred at the commencement of the principal portion a slow large displacement of 0.067 mm toward the S.34°W.

	(Radial Compt.)	(Transv. Compt.)
Duration of princ. portion :	2.5 sec.	2.7 sec.
Total duration :	26.0 „	20.0 „
Max. $2a$ { Near the commencement of principal portion :	0.067 mm.	0.086 mm.

The earthquake was small and not sensible at Yuno-taira.

72. Earthquake of Oct. 23rd, 1915, at 6.33.17 p.m. The earthquake was sensible.

Duration of preliminary tremor=0.74 sec.

1st displacement=0.0052 mm., toward the S.49°E.

	(Radial Compt.)	(Transv. Compt.)
Max. $2a$ = { At the comm't of princ. portion.	0.07 mm.	0.078 mm.
Duration of principal portion.	4.4 sec.	2.6 sec.
Total duration.	22.0 sec.	22.0 sec.

Toward the end the motion was composed of regular vibrations of $T=0.29$ sec.

73. Earthquake of July 4th, 1916, at 0.22. 19 p.m. The earthquake was sensible. The preliminary tremor lasted 1.6 sec., the first displacement being 0.009 mm. toward the N. 22° E.

	(Radial Compt.)	(Transv. Compt.)
Duration of princ. portion.	6.9 sec.	6.1 sec.
Total duration.	57.0 „	49.0 „
Max. $2a$ in prel. tremor.	0.035 mm.	0.024 mm.
Max. $2a$ in princ. portion.	0.058 „	0.087 „

74. Earthquake of July 4th, 1916, at 0.23.55 p.m. This earthquake was sensible and occurred 96 sec. after the preceding.

Duration of the preliminary tremor=0.81 sec.

1st displacement=0.020 mm., toward the N. 34° E.

	(Radial Compt.)	(Transv. Compt.)
Duration of the princ. portion.	10.9 sec.	10.9 sec.
Total duration.	—	over 73 sec.
Max. 2a.	0.115 mm.	0.087 mm.

75. Earthquake of July 26th, 1916, at 6.15.02 p.m. The earthquake was unfelt. The 1st displacement was 0.029 mm., toward the S. 75° W., and the counter motion had the max. 2a of 0.046 mm. nearly toward the E.N.E., the motion thence rapidly decreasing. In the radial component, no preliminary tremor was distinctly shown, the first vibration being composed of two greatest displacements. In the transverse component, the preliminary tremor lasted 0.51 sec. and was followed by the following three successive largest movements:—1st displ.=0.012 mm. toward S.; 2nd displ.=0.028 mm. toward N.; 3rd displ.=0.034 mm. toward S. The preliminary tremor and the principal portion lasted together 1.9 sec. and were made up of 6 vibrations. The total earthquake duration was 15 sec.

76. Earthquake of June 28th, 1917, at 1.38.01 p.m. The earthquake began with a sound like that caused by the falling of a heavy weight on the ground and then shook the building with a moderate intensity. It was not felt at the town of Komoro.

The preliminary tremor lasted 0.4 sec., and the first displacement was=0.039 mm. toward the S. 75° E., accompanied by a downward motion of 0.025 mm. The 2nd and 3rd horizontal displacements, which together made up a vibration of $T=0.84$ sec., were as follows:—

{ 2nd displacement=0.18 mm. toward N.78°W.
 { 3rd " =0.29 " S 68°E.

Thereafter the motion rapidly decreased, the durations being as follows:—

	(Radial Compt.)	(Transv. Compt.)	(Vert. Compt.)
Duration of princ. portion.	16.4 sec.	13.6 sec.	3.5 sec.
Total duration.	71.0 "	60.0 "	28.0 "

In the vertical component, the max. 2a was 0.15 mm., the period in the end portion being $T=0.87$ sec.

The position of the earthquake origin deduced from the Yunotaira observation is 1,550 m. to the S. of the crater centre.

77. Earthquake of July 26th, 1917, at 9.06.23 a.m. The earthquake was very small, but sensible. The two displacements of the 1st vibration, which made up the preliminary tremor and lasted together 0.43 sec., were as follows:—

{ 1st displacement=0.004 mm., toward the N.67°W.
 { 2nd " =0.0074 " S.67°E.

The next vibration, of $T=0.46$ sec., had the greatest range:

{ 1st displacement=0.078 mm, toward N.62°W.
 { 2nd " =0.150 " S.58°E.

Thereafter the motion rapidly decreased. Duration of princ. portion=5.4 sec. Total duration=20 sec. (radial compt.); 23 sec. (transv. compt,)

78. Earthquake of Aug. 8th, 1917, at 2.17.05 a.m. The earthquake which was only slightly sensible at Yunotaira, was felt moderately at Ashinotaira, where the accompanying sound was mistaken for a strong explosion of the volcano, causing the people to rush out of doors. Below Ashinotaira, the earthquake was not felt.

The preliminary tremor lasted 0.47 sec., the first displacement being 0.0116 mm. directed toward the N.7°E.

	(Radial Compt.)	(Transv. Compt.)
Duration of princ. portion.	5.6 sec.	6.1 sec.
Total duration.	61.0 „	61.0 „
Max. 2a.	0.23 mm.	0.28 mm.

The origin of disturbance was probably situated 2.8 km. to the S. 7° W. of the Yuno-taira observatory, or 4.6 km. to the S. 38° W. of the crater centre.

79. Earthquake of Sept. 15th, 1917, at 8.43.09 p.m. The earthquake was sensible. In the radial component the duration of the preliminary tremor was 1.0 sec. In the transverse component, the motion, which was small during the first 0.6 sec. and was made up of the single initial displacement, became larger (2a = 0.007 mm.) during the next 0.5 sec.; the total duration being 1.1 sec. The first displacement was as follows:—

0.0037 mm. toward the N.88°W.; 0.0023 mm. upwards.

The duration and the maximum range of motion were as follows:—

	(Radial Compt.)	(Transv. Compt.)	(Vert. Compt.)
Duration of princ. portion.	5.6 sec.	5.5 sec.	4.1 sec.
Total duration.	27.0 „	31.0 „	14.0 „
Max. 2a.	0.036 mm.	0.042 mm.	0.06 mm.

The approximate position of the earthquake origin was 6 km. to the E. of the observatory, namely, 3.8 km. to the S.73°E. of the crater centre.

80. Earthquake of Sept. 15th, 1917, at 10.23.07 p.m. The first displacement of this sensible earthquake was as follows:—

0.0055 mm. toward the N.54°W.; 0.004 mm. upwards

The range of motion and the duration were as follows:—

	(Radial Compt.)	(Transv. Compt.)	(Vert. Compt.)
Duration of prel. tremor.	1.1 sec.	1.1 sec.	1.2 sec.
„ „ princ. portion.	3.3 „	3.3 „	3.7 „
Total duration.	48.0 „	48.0 „	31.5 „
Max. 2a.	0.058 mm.	0.055 mm.	0.061 mm.

The approximate position of the earthquake origin was 6.9 km. to the S.54°E. of the Yuno-taira observatory, or 6.0 km. to the S.32°E. of the crater centre.

81. Earthquake of Oct. 23rd, 1917, at 3.33.57 p.m. The earthquake was sensible, the first displacement being the following :—

0.004 mm. toward the S.66°W.; 0.0034 mm. upwards.

The elements of motion were as follows :—

	(Radial Compt.)	(Transv. Compt.)	(Vert. Compt.)
Duration of prel. tremor.	0.3 sec.	0.84 sec.	0.47 sec.
„ „ princ. portion.	3.8 „	3.2 „	3.3 „
Total duration.	43.0 „	54.0 „	35.0 „
Max. 2a.	0.039 mm.	0.033 mm.	0.034 mm.

The origin of disturbance was situated probably $2\frac{1}{2}$ km. to the N.66°E. of the Yuno-taira observatory, coinciding almost exactly with the crater centre.

82. Strong earthquake of Aug. 8th, 1918, at 0.04.12 p.m. The earthquake was felt as a sharp shock preceded by a loud sound like that caused by the falling of a heavy weight on the ground. The building was shaken and the motion was sensible only for 5 or 6 sec. At the town of Komoro, the earthquake was felt very slightly only by some people.

The preliminary tremor lasted 1.6 sec., the initial motion being as follows :—

Yuno-taira Observation of the Sensible Asama-yama Earthquake
on July 16th, 1912, at 1.25.53 P.M.

[One of the After-shocks of the Strong Earthquake on the same day at 7.45.35 a.m.]

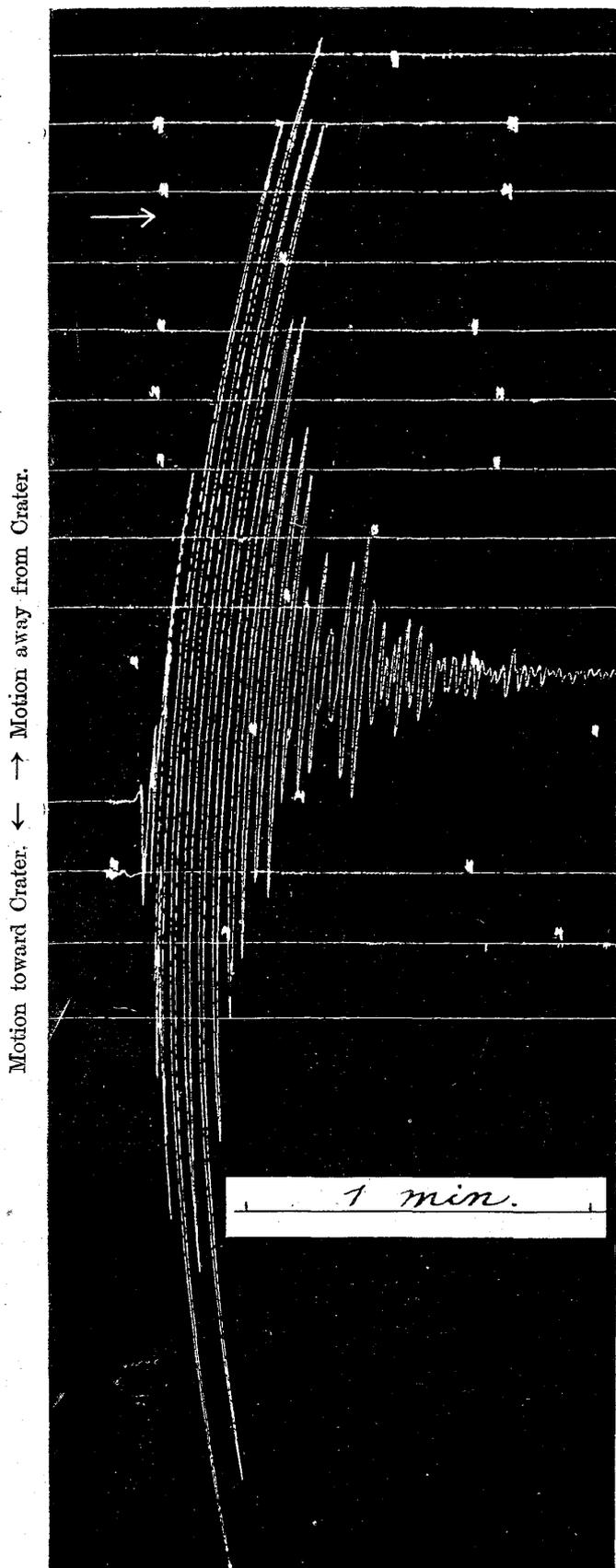
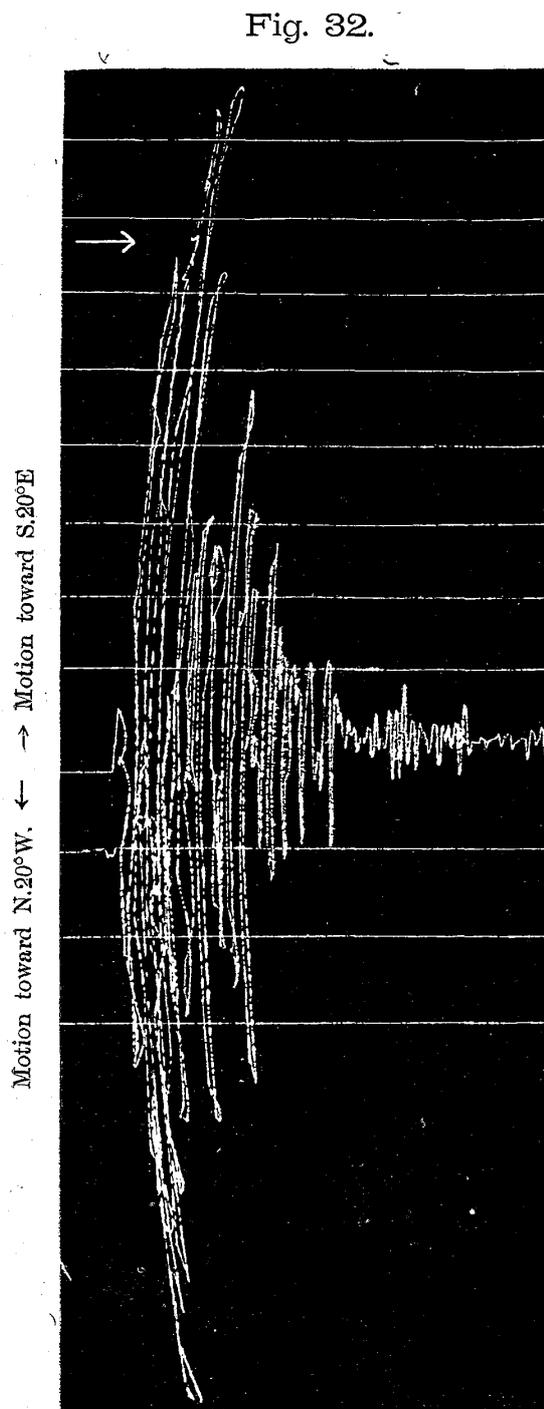


Fig. 31.



Horizontal Tremor-Recorder Diagram.
(Magnification = 200.)

Fig. 33. Asama-yama Earthquake of Oct. 12th, 1918, at 5.5.29 a.m.,
observed at Yuno-taira. Ordinary Seismograph Diagram.

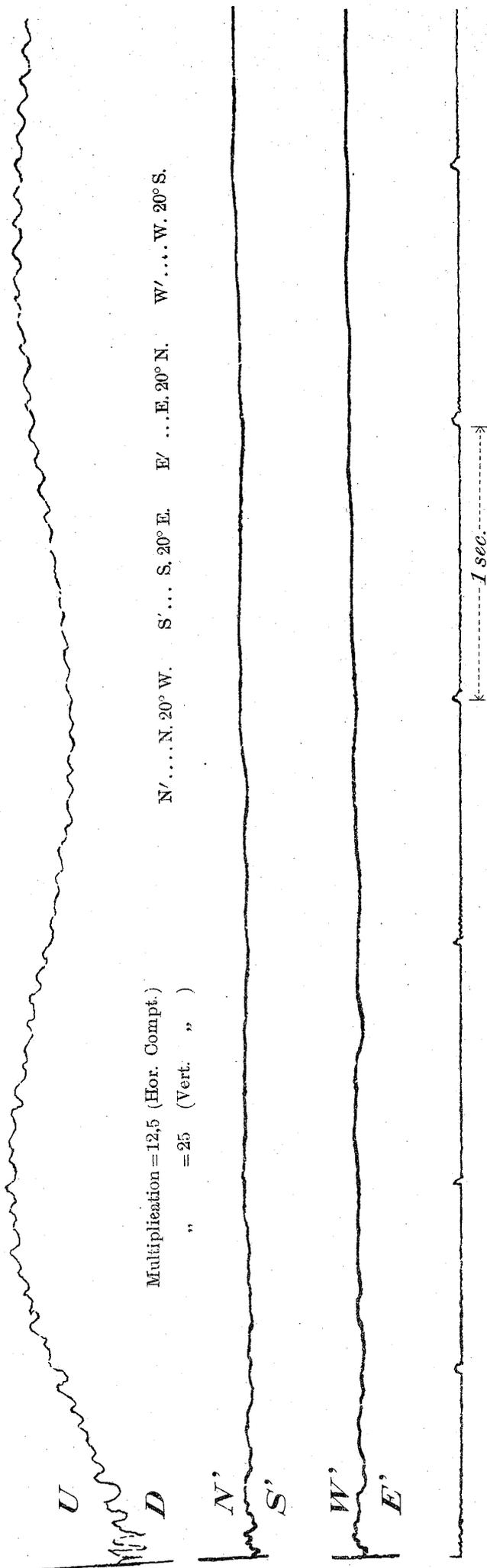


Fig. 34. Strong Central Shinano Earthquake of Jan. 22nd,
1899, observed in Tokyo. Multiplication = 20.
E. W. Component Hor. Pendulum Diagram.

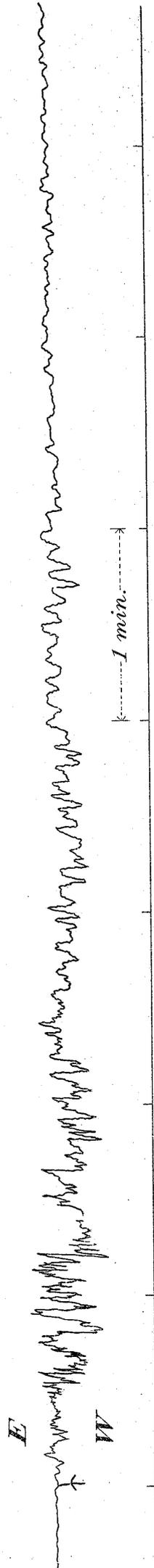


TABLE XXV. SUMMARY OF THE OBSERVATION OF THE NON-ERUPTIVE VOLCANIC EARTHQUAKES AT YUNO-TAIRA.

Date.	Preliminary Tremor.			Principal Portion.		Position of Eqke Origin.*
	Duration.	1st Displacement.	2nd Displacement.	Duration.	1st Displacement.	
VII 24, 1911. (5.56.44 p.m.)	—	0.6 → N.76°E.	0.9 → S.83°W.	34.0	.....	} 16; N.70°E.
VII 24, 1911. (9.11.49 a.m.)	—	0.46 → N.73°E.	1.3 → S.76°W.	51.0	.....
After-shock.	—	0.017 → S.67°E.	0.027 → N.53°W.			
X 5, 1911.	—	0.028 → S.86°E.	0.17 → N.73°W.	30.0	.....	} 24; N.75°W.
X 6, 1911.	—	0.041 → E.	.....	40.0	.....
VII 16, 1912.	—	Slow motion : 0.77 → N.24°E. Quick motion : 0.49 → N.47°E.	.....	—	.....	(W. base of the central cone.)
VIII 17, 1912.	3.3	0.018 → S.89°W.	.....	41.5	.....	26; W.
IX 5, 1915.	0.7	0.072 → S.75°E.	0.42 → N.71°W.	45.0		
IX 19, 1915.	0.0	0.14 → S.72°W.	.....	10.2		
„	0.0	0.082 → S.70°W.	.....	4.9		
„	0.0	0.073 → S.71°W.	.....	4.0		
X 10, 1915.	0.6	0.02 → N.35°E.	.....	32.0		
X 18, 1915.	0.43	0.0035 → N.88°E.	.....	2.5	mm 0.067 → S.34°W.	
X 23, 1915.	0.74	0.0052 → S.49°E.	.....	4.4		
VII 4, 1916. (0.22.19 p.m.)	1.6	0.009 → N.22°E.	.....	6.9		
VII 4, 1916. (0.23.55 p.m.)	0.81	0.020 → N.34°E.	.....	10.9		
VII 26, 1916.	0.5	0.029 → S.75°W.	.....	1.9	0.046 → E.N.E. 0.18 → N.78°W.	} 1.55; S.
VI 28, 1917.	0.4	0.039 → S.75°E. 0.025 → Down.	.....	16.4	Next motion : 0.29 → S.68°E.	
VII 26, 1917.	0.43	0.004 → N.67°W.	0.0074 → S.67°E.	5.4	0.078 → N.62°W. Next motion : 0.15 → S.58°E.	
VIII 8, 1917.	0.47	0.0116 → N.7°E.	.....	6.1	.....	46; S.33°W.
IX 15, 1917. (8.43.09 p.m.)	1.0	0.0037 → N.88°W. 0.0023 → Up.	.....	5.6	.....	3.8; S.73°E.
IX 15, 1917. (10.23.07 p.m.)	1.1	0.0055 → N.54°W. 0.001 → Up.	.....	3.3	.....	6.0; S.32°E.
X 23, 1917.	0.3	0.004 → S.66°W. 0.0034 → Up.	.....	3.8	.....	(Crater centre.)
VIII 8, 1918.	1.6	Quick motion : 0.014 → N.51°E. 0.016 → Down. Slow motion : 0.051 → N.51°5 E. 0.054 → Down.	.....	.....	.....	(N.E. base of the Asama-yama.)

* Referred to the centre of the Asama-yama crater.

$$\begin{aligned} \text{Quick displacement} &= \begin{cases} 0.016 \text{ mm., downwards.} \\ 0.014 \text{ ,, towards the N. } 51^\circ \text{ E.} \end{cases} \\ \text{Slow ,,} &= \begin{cases} 0.051 \text{ ,, ,, N. } 51\frac{1}{2}^\circ \text{ E.} \\ 0.054 \text{ ,, downwards.} \end{cases} \end{aligned}$$

The earthquake origin seems to have been situated 11 km. to the N. 51° E. of the Yuno-taira observatory, i.e., at the N.E. base of the mountain, about $\varphi=36^\circ 27'.4$ N., $\lambda=138^\circ 35'.4$ E.

83. Summary of results. The elements of motion of the different non-eruptive volcanic earthquakes described in the preceding §§ are collected in Table XXV. It will be noted that the volcanic earthquakes took place at varying radial distances from the Asama-yama crater. Amongst the others, the strong shock on July 16th, 1912, and five of the earthquakes in 1917 took place at the radial distances less than 6 km., mostly from the region lying to the S. of the present Asama-yama crater.

CHAPTER IX. NON-ERUPTIVE ASAMA-YAMA EARTHQUAKES OBSERVED IN TOKYO.

84. Observation in Tokyo. In §§ 85–90 I give notes on the tromometer observations* at the Seismological Institute (Tokyo) of the following five strongest recent Asama-yama volcanic earthquakes:—

- | | |
|------------------------|-----------------------------------|
| (1) May 26th, 1908. | (3) Jan. 22nd, 1910. |
| (2) July 16th, 1912. | (4) April 2nd, 1911. |
| (i) Jan. 22nd, 1899.** | (5) Aug. 17th, 1912. (Ueda Eqke.) |

(i) and (ii), which were the most violent Asama-yama earthquakes so far experienced, gave identical registers in Tokyo. The seismograms are reproduced in figs. 36 and 38–42.

* 2a denotes the double amplitude, and T the complete period of vibration.

** (i), which is not an earthquake of the Asama-yama origin, is given for the sake of comparison (See § 100)