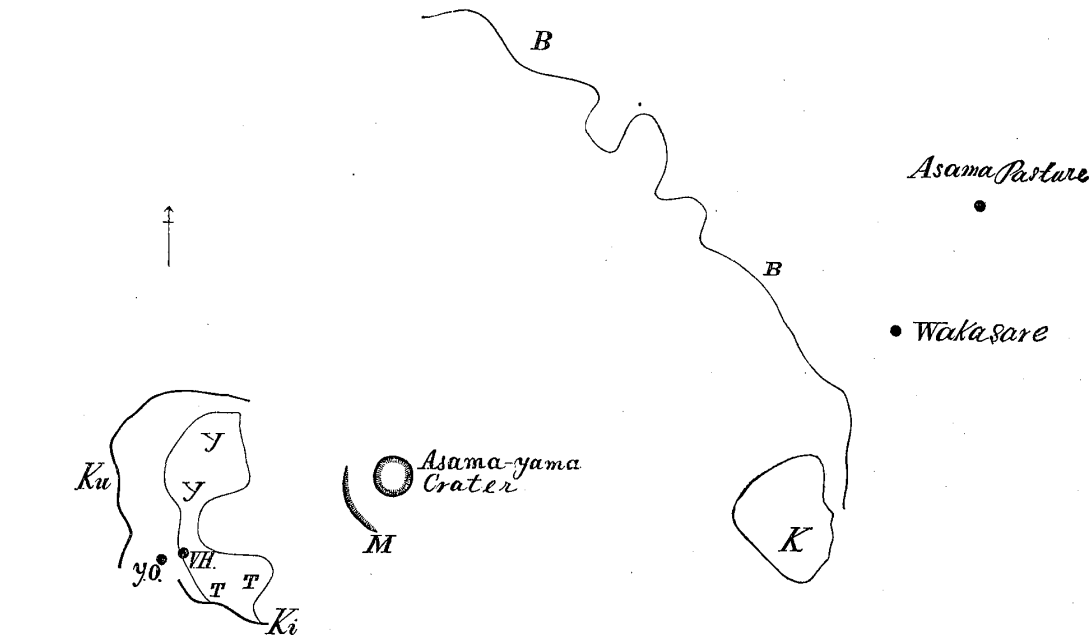


CHAPTER III. SEISMOGRAPHICAL OBSERVATIONS OF ASAMA-YAMA ERUPTIONS.

31. Seismographical observations. In Chapters IV to IX, I give the descriptions of the instrumental records of the strong Asama-yama eruptions in May 1913 to May 1914, and also those of a number of the small outbursts, of the volcanic micro-tremors, etc., in 1911-1913, observed at the three stations of Yuno-taira, Ashino-taira, and the Asama Pasture Ground, whose relative positions are indicated in the accompanying figure.

Fig. 45. Plan of the Upper part of the Asama-yama.



• *Askino-taira*

- | | | | |
|----------|--|---------------|-------------------------------|
| | | Y.O. | Yumo-taira Observatory. |
| | | V.H. | "Volcano House." |
| M. | Maikake-yama (Remnant of the 2nd Epoch Crater Ring). | | |
| Ku. | Kurofu-yama | } (" 1st ") | |
| Ki. | Kiba-yama | | |
| K. | Ko-Asama, a parasitic cone. | B B | NE Base of the Asama-yama. |
| Y Y | Flat Ground of Yuno-taira. | T T | Flat Ground of Tengu-no-roji. |

The Yuno-taira seismological observatory, whose front points toward S 20° E, is at a horizontal distance of 2,300 m to S 70° W from the crater centre; the top of the Asama-yama, being just screened from view on the Komoro, or south-western, side by the Maikake-yama. The temporal station of Ashino-taira was at a horizontal radial distance of 4,850 m to the S 55° W. These two places, both situated on the SW slope of the volcano, are at the height differences respectively of 580 and 1,130 m below the mouth level of the crater. The Asama Pasture Ground, which is at a horizontal distance of about 6,350 m to the N 65° E from the crater centre, is situated about 1,300 m below the level of the latter, on the Rokuriga-hara, the extensive plateau at the N base of the volcano. From the figure it will be seen that the Yuno-taira observatory and the Asama Pasture Ground are almost exactly on the mutually opposite sides of the crater, the ratio of their radial distances being roughly 1:3. Again, the position of Ashino-taira is not much out of the prolongation of the line joining the Asama Pasture Ground with Yuno-taira.

It is hereby to be noticed that Ashino-taira and Yuno-taira are separated from the present Asama-yama crater by the interposition of the Maikake-yama to the SW of the latter; while there is no sort of barrier on the E, NE, and N sides, so that the Asama Pasture Ground is situated directly at the base of the steep NE slope of the volcano.

The seismological instruments* used in 1912-1914 at the Yuno-taira observatory were: (1), a single component horizontal tromometer of 150 (or 200) times magnification and of the natural oscillation period of 15 to 17 sec., set up for the registration of the *apparent* longitudinal component, or the movements of the

* See p. 150 of the Bulletin, Vol. VI, No. 2.

ground parallel to the radial direction; (2), a portable two-components horizontal tremor-recorder of 100 times magnification, and of the natural oscillation period of about 4 sec. oriented for the registration of the *apparent* longitudinal and transverse movements, or those respectively parallel and normal to the radius; and (3), a vertical motion seismograph of 50 times magnification and of the natural oscillation period of 10 sec. At Ashino-taira and the Asama Pasture Ground the observation was made only with portable tremor-recorders, of magnifications respectively of 100 and 200, put up so as to register for each place the apparent longitudinal and transverse components of the earthquake motion with respect to the crater centre.* The times of occurrence at Yuno-taira of the eruptions in 1913 were carefully determined from the instrumental records, the error of the time keeper there having been frequently determined by comparisons with pocket chronometers brought from Tokyo, facilitated by the establishment of a telephonic communication between the observatory and the town of Komoro at the SW base of the mountain. The introduction since 1913 of an electrical arrangement, by which the small writing indices of the two component pointers of the tremor-recorders were simultaneously lifted for the interval of 0.5 sec. every full minute, enabled an accurate identification of a given time instant in the two rectangular directions. All the seismographical measurements given in the following pages relate to the horizontal motion alone,** as the vertical component was always very small.

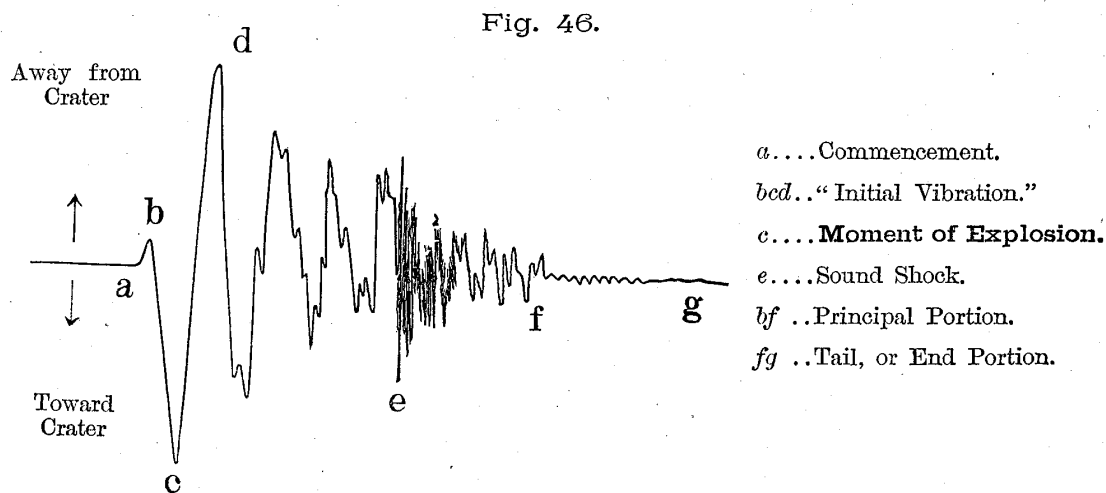
For the convenience of the examination, the seismographical diagrams of the different strong eruptions, as well as the more

* See also § 1.

** Only for the explosion of May 29th, 1913, the vertical component record is given (Fig. 52).

important of the small ones, volcanic micro-tremors, etc., have been photographically enlarged 3 to 20 times, resulting in the total magnification of up to about 4,000 times. (See Figs. 49 to 61.)

32. Seismograms. The longitudinal component seismogram of a strong Asama-yama *explosion* observed at Yuno-taira or the Asama Pasture Ground begins with a very small preliminary motion, *ab* (Fig. 46), directed outwards, corresponding to the preliminary tremor in ordinary cases. Then follows a slow well defined vibration, *bcd*, of period of 2 sec. or so, composed of the 1st displacement, *bc*, directed toward the crater, and the 2nd, or counter, displacement, *cd*, directed away from it. This may be



regarded as the first stage of the earthquake motion proper caused by the explosion, and may accordingly be termed the "initial vibration." As explained in Vol. VI, of the Bulletin, the effect of a strong internal explosive force, which leads to the breaking off of the surface lava layer in the crater bottom, is to push upwards the mountain top; the surrounding ground being, in consequence, first drawn toward the crater, to be moved back, or away from it, at the occurrence of the outburst. Hence, the point *c*, namely, the end of the 1st and the commencement of the 2nd displacement

of the "initial vibration" may be regarded as corresponding to the *actual moment of the explosion*, an assumption which is found to be satisfactory in the consideration of the sound velocity.

The preliminary portion is longer in duration in the transverse component, than in the longitudinal; while, in the cases of the non-explosive eruptions, it may sometimes reach a considerable length in both components.

The shakings of the ground caused by the strong explosions in 1913 *were not actually sensible* even at the Yuno-taira observatory, where the outbursts were in each case announced to the observer first by the loud detonation, or sound-shock, whose arrival there was several seconds after the preliminary portion and "initial vibration" had been registered by the tromometer. At the temporal station of the Asama Pasture Ground, the time difference in question was longer and the sound-shock was indicated often very clearly by the appearance on the diagram of a series of quick vibrations, as at *e* in the accompanying figure. The effect of the detonation on barographs is considered in a later Chapter.

What may be regarded as the end portion, or tail, of the earthquake motion caused by a strong explosive or non-explosive eruption is usually abruptly smaller than the *principal portion*, which latter is probably to be taken as corresponding to the course of the outburst itself.

In the descriptions of the seismographic records of the Asama-yama eruptions and earthquake shocks, 2a and T are used to designate respectively the double amplitude, or range of motion, and the complete period of the vibration.

33. List of Asama-yama disturbances. The different typical seismograms considered in Chapters IV to IX, are as follows.

**CHAPTER IV. STRONG EXPLOSIONS OBSERVED AT THE
ASAMA PASTURE GROUND. (1913.)**

- | | |
|--------------------------------|-------------------------------|
| (1) Sept. 21st; 1. 50. 59 p.m. | (4) Oct. 17th; 3. 27. 47 p.m. |
| (2) Oct. 7th; 11. 32. 32 a.m. | (5) „ 22nd; 3. 55. 42 a.m. |
| (3) „ 15th; 10. 43. 13 p.m. | (6) Nov. 14th; 11. 11. 55 „ |

CHAPTER V. STRONG EXPLOSIONS OBSERVED AT ASHINO-TAIRA. (1913.)

- | | |
|------------------------------|-----------------|
| (1) Sept. 21st.* | (4) Oct. 17th.* |
| (2) Oct. 9th; 1. 09. 10 a.m. | (5) „ 22nd.* |
| (3) „ 15th.* | |

CHAPTER VI. STRONG EXPLOSIONS OBSERVED AT YUNO-TAIRA.

- | | |
|------------------------------------|-------------------------------------|
| (1) May 16th, 1913; 4. 41. 00 p.m. | (11) July 7th, 1913; 7. 10. 32 a.m. |
| (2) „ 27th, „ 5. 22. 57 a.m. | (12) „ „ „ 9. 46. 53 p.m. |
| (3) „ 29th, „ 10. 44. 12 „ | (13) „ 8th, „ 5. 25. 25 a.m. |
| (4) June 13th, „ 11. 01. 16 p.m. | (14) „ 13th, „ 4. 01. 19 p.m. |
| (5) „ 17th, „ 10. 47. 41 „ | (15) „ 18th, „ 2. 08. 34 a.m. |
| (6) „ 18th, „ 6. 21. 03 a.m. | (16) „ 19th, „ 0. 54. 03 p.m. |
| (7) „ 20th, „ 4. 06. 47 „ | (17) Aug. 12th, „ 7. 45. 08 „ |
| (8) „ 24th. „ 11. 37. 34 „ | (18) „ „ „ 11. 20. 33 „ |
| (9) „ 26th, „ 8. 09. 40 „ | (19) May 5th, 1914; 0. 33. 02 a.m. |
| (10) „ „ „ 11. 41. 59 p.m. | |

**CHAPTER VII. LARGE NON-EXPLOSIVE ERUPTIONS OBSERVED AT
YUNO-TAIRA OR THE ASAMA PASTURE GROUND. (1913.)**

- | | |
|--------------------------------|-------------------------------|
| (1) June 24th; 11. 34. 17 p.m. | (5) Aug. 15th; 3. 58. 46 p.m. |
| (2) July 1st; 0. 17. 01 „ | (6) „ „ ; 5. 08. 54 „ |
| (3) Aug. 13th; 4. 01. 19 „ | (7) Nov. 20th; 3. 40. 35 „ |
| (4) „ 15th; 9. 59. 11 a.m. | |

**CHAPTER VIII. VOLCANIC MICRO-TREMORS AND SMALL NON-
EXPLOSIVE ERUPTIONS OBSERVED AT YUNO-TAIRA.**

- (i) Volcanic Micro-tremors and Eruptions on Oct. 2nd, 1912.
- (ii) *Small Eruptions in 1911* :—
- | | |
|-------------------------------|-------------------------------|
| (1) July 1st; 11. 32. 08 a.m. | (3) July 8th; 10. 16. 04 a.m. |
| (2) „ 2nd; 2. 18. 23 p.m. | (4) „ 14th; 4. 32. 26 „ |

- | | |
|--------------------------------|--------------------------------|
| (5) July 21st; 10. 47. 40 p.m. | (8) Aug. 29th; 8. 35. 53 p.m. |
| (6) Aug. 15th; 4. 42. 50 a.m. | (9) Sept. 9th; 11. 49. 21 a.m. |
| (7) „ 20th; 3. 38. 59 „ | and 11. 49. 59 a.m. |

(iii) *Small Eruptions in 1912*:—

- | | |
|------------------------------|------------------------------|
| (1) July 1st; 5. 33. 50 p.m. | (5) Aug. 7th; 8. 14. 48 a.m. |
| (2) „ 2nd; 5. 30. 07 a.m. | (6) „ „ ; 9. 43. 13 „ |
| (3) Aug. 3rd; 7. 20. 58 p.m. | (7) „ 22nd; 5. 25. 50 „ |
| (4) „ „ ; 7. 51. 03 „ | (8) „ 23rd; 3. 14. 01 p.m. |

The tromometer observations in Tokyo of the Asama-yama eruptions are considered in a later Chapter.

CHAPTER IV. ASAMA-YAMA EXPLOSIONS OBSERVED

AT ASAMA PASTURE GROUND.**

[TREMOR-RECORDER DIAGRAMS]

34. *Explosion of Sept. 21st, 1913, at 1. 50. 59 p.m.* According to the report of Mr. Kawazoe, who witnessed the eruption from Yunotaira, the detonation was like that of blast of a boisterous wind and lasted 3 or 4 sec. According to Mr. T. Kato, who saw the eruption from the foot of the Ko-Asama the detonation was very loud and like that of a gun discharge; the column of black smokes, which rose vertically high up, being gradually carried towards the NE. Several lava blocks fell to the E and N slopes of the Asama-yama, continuing to throw up vapours for some time. At the Wakasare Cottage there were precipitated platy lava fragments 2 cm in dimension, and at the Asama Pasture Ground those of the size of peas.

Total Duration=4 min. (Fig. 51.)

* Also registered at the Asama Pasture Ground.

** The times of occurrence of the explosions on Oct. 7th and Nov. 14th were registered by the tremor-recorder at the Asama Pasture Ground, while those of the 4 others considered in this chapter are the results determined by a similar instrument at Ashinotaira.