CHAPTER VII. NOTES ON THE ASAMA-YAMA ERUPTIONS IN 1914.

22. ***Eruptive activity in* 1914.** The year 1914 forms the closing stage of the recent activity period of the Asama-yama, the maximum eruptive intensity having been displayed in 1911 to 1913. After the explosion of Nov. 20th, 1913, the volcano remained for a time quiet, till it resumed activity simultaneously with the great outburst of Sakura-jima in Kyushu* and made several minor explosions on Jan. 11th, 12th, 13th, 23rd, 26th, 27th, and the 28th, culminating with the strong explosion on the 29th of the same month. In the following § § I give brief accounts of the 29 explosions in 1914 numbered 110 to 138, which were intense enough to be noticed at the mountain base or at places more or less distant from the volcano. In figs. 29 and 30 are reproduced the longitudinal, or radial, component seismograms observed at Yunotaira of the two strong explosions on May 16th and June 27th, 1913. Illustrations of several of the outbursts in the same year have already been given in the Bulletin, Vol. VII, No. 1.

23. (110) ***Jan. 11th, 6 h 16½ m a.m.*** [Province of Shinano.] At *Iwamrata* the detonation was weak, but was accompanied by rather strong shaking effects; the black smokes, which rose to a considerable height, were observed to be thence thrown towards the S.E. There was a slight ash-precipitation at Higashi and Nishi Nagakra village (Kita-Saku county). [Province of Kotsuke.] *Maebashi* meteorological observatory: two successive detonations, which were heard at 6^h 19^m a.m., caused slight shakings of doors

* The first smoke emission of Sakura-jima was on Jan. 12th, 1914, at 10 a.m. The premonitory earthquakes had began already on the early morning of the previous day.

and shojis; black smokes having previously, at $6^h\ 00^m$ a.m., been observed to issue from the top of the mountain, where thin red fires were displayed, The smokes were wafted towards the E.N.E., passed at $6^h\ 30^m$ a.m. over the northern part of the city, and were completely dispersed at 7 a.m. In the neighbourhood of the observatory there was no ash-precipitation. At *Sannokra* a strong detonation, heard from the west, shook doors and shojis; the precipitation of ashes continuing for 5 min. A weak detonation had also been heard from the west at 1 a.m. on the same morning.

The sound of the explosion was heard at *Oze-mura* (Naka county, Hitachi), at a radial distance of 160 km. followed 1 hour later by a slight ash-precipitation for 5 min.

24. (111) ***Jan. 12th, 2½ a.m.*** According to the report from *Iwamrata*, both the detonation and the shaking effects were inferior to those in the preceding case. The column of black smokes, which were rent by flashes of lightning, rose to a considerable height and was finally thrown southwards, causing some precipitation of ashes at Hi. and Ni. Nagakra and Goka-mura in Ki.-Saku county (Shinano). The crater rim was, in the bright moon light night, illuminated slightly red.

At *Naganohara*, the detonation was very loud, shaking briskly doors and shojis. Black smokes rose abundantly from the crater, which remained completely red for a time. Large fire masses (lava) rolling down the mountain slope furnished an exceedingly beautiful spectacle. There was no ash-precipitation.

The explosion was registered on the Tokyo tromometers.

(111′) ***Jan. 13th, 4¼ p.m.*** At *Naganohara*, sounds like distant thunders were heard for about ½ min., a column of black smokes being gradually thrown toward the N.E. There was no ash-drecipitation. Subsequently, at 5 p.m. similar detonations were

heard, not accompanied, however, by emmision of black smokes.

(111″) ***Jan. 23rd, 5¼ p.m.*** At *Naganohara*, detonations like distant thunders were heard, accompanied by the emission of black smokes, which did not cease till 9 a.m. on the next morning. There was no ash-precipitation.

An abundant issue from the Asama-yama at about 1 p.m. was visible from Nagano.

25. (112) ***Jan. 26th, 6¾ a.m.*** The smokes were visible from Nagano. *Karuizawa:* the detonation was accompanied by air shakings, the black smokes projected to a great height being gradually thrown toward the N.E. *Iwamrata:* the dark gray smoke column was observed to rise to a great vertical height; there was heard only a slight detonation difficult to be distinguished from rushing of winds. *Komoro*: the sound was not audible.

According to the report from the *Maebashi* meteor. observatory, a large smoke emission from the Asama-yama took place at 6^h 45^m a.m., unaccompanied by detonation, but followed by the precipitation of the sands between 7^h 24^m and 8^h 13^m a.m., whose amount was 11 grams per 1 yard square. *Sannokra:* the precipitation of ashes, which lasted 8 min., occurred twenty-five min. after the time of arrival of the detonation which was weak. *Naganohara:* The detonation was very loud and shook briskly doors and shojis; the emission of gray smokes continued unabated till noon, there being, however, no precipitation of ashes. At *Utsunomiya*, there was a slight falling of ashes at about 8^h 30^ma.m.

(112′) ***Jan. 26th, 4h 40m p.m.*** According to the report from *Maebashi*, smokes were thrown towards the E., followed by a very slight precipitation of ashes. No detonation was heard.

Jan. 27th. According to the report from *Maebashi*, the smokes were abundantly thrown out from about 6^h 30^m a.m. and at

7^h 13^m p.m. fires were for a short time interval seen at the mountain top. At *Sannokra*, weak sounds were heard toward the W. between 8^h 25^m and 9^h 00^m a.m.

26. (113) ***Jan. 27th, 7h 20m p.m.*** A weak detonation was heard at *Iwamrata*, some fires being observed at the crater mouth.

27. (114) ***Jan. 27th, 7h 50m p.m.*** A weak detonation was heard at *Iwamrata*.

28. (115) ***Jan. 28th, 11h 40m p.m.*** At *Naganohara* air shakings and sounds like distant thunders were perceived at 10^h 35^m p.m., which were, however, attended by no visible disturbance from the crater. At about $11\frac{2}{3}$ p.m. there took place a very loud detonation, apparently unaccompanied by emission of black smokes, which continued with alternations of maxima and minima of intensity for about 1 min., red-hot lava pieces being thrown out of the crater to some height like splendid fire-works. At *Sannokra*, weak sound were heard westwards from 10^h 40^m a.m., on the 28th, till 9 a.m., on the 29th. According to the report from *Maebashi*, the emission of the smokes towards the S.E. began from the morning of the 28th, an outburst at 1^h 50^m p.m. being specially powerful. Between 11^h 43^m and 11^h 50^m p.m. were heard 7 or 8 detonations like distant thunders, with occasional ascensions of red fires from the mountain top. The amount of smokes decreased from about 4 a.m., on the 29th. There was no ash-precipitation at Maebashi as well as at the two other above-mentioned places.

On the 29th the smokes were visible from Nagano.

29. (116) ***Jan. 29th, 11h 52m p.m.*** [Province of Shinano.] A strong detonation like the firing of a gun, with some after-shakings, was perceived at *Karuizawa*, *Komoro*, and *Iwamrata*. On account of the thick mists shrouding the mountain top, the condition of the latter could not be ascertained. [Province of Kotsuke.]

Naganohara: A very loud sound produced violent shakings of doors and shojis. The abundant black smokes, which were gradually thrown toward the N.E., caused no precipitation of ashes. Deeply red fires were seen for a time over the crater. According to the observation at *Maebashi*, the S.E.' ward smoke issue, which continued from the previous day, increased from about 3 p.m., and again gradually decreased from about 6 p.m. At $11^h\ 54^m$ p.m. two fairly loud consecutive detonations were perceived, which shook doors and shojis, their after-sounds continuing for further 6 or 7 seconds. At 12 p.m. black smokes were flowing towards the S.E. There was no ash-precipitation. *Sannokra* (Gumma)* : one loud and 5 small lengthened detonations were perceived. *Fujioka* (Tano) : a small detonation was followed 10 seconds after by a large one, each having a sort of after-sound and shaking doors and shojis as much as to almost overthrow them. At *Numata* (Tone) and *Ikao* (Gumma) there were heard respectively three and two strong detonations in close succession. *Hanageishi* (Seta) and *Yuhara* (Tone) : the detonation was strong and single. *Shibukawa* (Gumma) : detonation shook doors and shojis. In Kotsuke there was no ash-precipitation. [Province of Musashi.] *Kumagai* meteor. observatory : the detonation shook the glass doors at the N. and W. sides of the building as if struck by a sudden gust of wind, and lasted 6 sec., indicating two intensity maxima, the first of which was the greater. The detonation was moderately strong and like sound of a gun booming or thunder, at the following places: *Honjo; Wakaizumi; Nogami; Omiya; Ogawa; Habu; Sugito.* There was a slight precipitation of ashes at Kumagai, Honjo, and Habu. In Tokyo, the present author, who was at the time sitting quietly by a writing desk in his house at Sekiguchi-daimachi, (Koishikawa

* The name of the county to which a given village or town belongs is given within brackets.

District), perceived at $11^h 58^m 25^s$ p.m., the slight shakings due to the explosion, while the startled pheasants in the neighbouring ground shrieked out at $11^h 59^m 25^s$ p.m. The tromometers at the Seismological Institute registered the *earthquake* motion due to the explosion in question at $11^h 52^m 56^s$ p.m. [Province of Etchu.] At the *Fushiki* met. observatory, the detonation, which was heard at $0^h 02^m$ a.m., on the 30th, was markedly loud and had a lengthy after-sound, like the noise caused by an avalanche, shaking strongly the glass windows. The detonation was also heard at about $0^h 02^m$ a.m., as a sound like distant thunder, at the following places: *Kamiichi* (Naka Shinkawa); *Gohyakkok-machi* (五百石町, Naka Shinkawa); *Himi* (氷見町, Himi); *Jobata* (城端町, Hi.-Tonami); *Fukko* (福光町, Nishi-Tonami); *Shinminato* (Imizu); and *Yao* (Fubu). At Jobata the sound was loud. [Province of Echigo.] *Niigata* meteor. observatory: the detonation was perceived at about $0\frac{1}{4}$ a.m. on the 30th, as consecutive sounds coming from the S., which shook doors and shojis slightly and which were like distant thunders or booming of guns. The disturbance was generally noticed in the city. *Nofu* (能生町, Ni.-Kubiki): three sounds like distant thunders were heard towards the S.W. in the time interval of about 2 min. *Shibata* (Ki.-Kanbara): two sounds of similar nature shook briskly doors and shojis. *Ojiya* (Ki.-Uonuma): the sound, heard toward the S.E., was remarkably loud and like the noise caused by an avalanche. At *Horinouchi* (Ki.-Uonuma), Maki (巻町, Ni.-Kanbara), *Murakami* (Iwafune), *Tsugawa* (Hi.-Kanbara), *Kameda* (Na.-Kanbara), *Yoita* (Mishima), *Nagaoka*, *Kashiwazaki* (Kariha), *Muikamachi* (Mi.-Uonuma), *Chujo* (中條町, Ki.-Kanbara), *Shionomachi* (Iwafune), and *Mikawa* (三川村 Hi.-Kanbara), the detonation was like distant thunders, generally heard toward the S.W. or S.S.W., shaking doors and shojis at the first-named 4 places. No report was received

from *Tokamachi* (Koshi), *Niizu* (Na.-Kanbara), and *Muramatsu* (Ki.-Kanbara); while at *Naoetsu*, *Takata*, *Yasuzuka* (安塚, Hi.-Kubiki), and *Itoigawa*, the stormy weather prevailing at the time of the explosion prevented the perception of the detonation, if any. [Province of Sado.] At *Chuko* (中興, 金澤村,), slight shakings were felt, from the S. W., at about 0.40 a.m., on the 30th. There was no case of ash-precipitation in Echigo and Sado. [Province of Shimosa.] The detonation was heard at *Choshi*. [Province of Hitachi.] The detonation was heard at *Mito* met. observatory about the midnight of the 29th. At the *Tsukuba* met. observatory, the detonation was registered at $11^h58^m35^s$ p.m., as an earthquake of quick nature, with sounds, which shook doors and shojis. [Province of Shimotsuke.] *Utsunomiya* and *Nikko*: the detonation was like distant thunders and heard westwards. [Province of Rikzen.] *Aone* spa (青根, Shibata): the detonation was like distant thunders and repeated twice. *Okawara* (Shibata) and *Onoda* (Kami): the sound was heard toward the S.W. and like that of a gun firing or of the impact on the ground of a snow mass falling from a house roof. *Oginohama* (Ojika) and *Onikobe* (鬼首, Tamazukri): sounds like distant thunders were heard respectively toward the N.W. and the S. The sound waves arrived at the different places a little after the midnight. [Province of Iwaki and Iwashiro.] At the towns of *Miharu* and *Onahama* (Iwaki), and *Kitagata* (Iwashiro), there were heard two loud detonations which lasted together some 30 sec. and which, happening at a little past midnight, had a quite characteristic alarming effect, shaking the doors and shojis. At the met. observatory of *Fukushima*, the two detonations were heard at about $0^h04^m52^s$ a.m. on the 30th, toward the west. The detonation was very loud at the town of *Skagawa*. The sound and shaking phenomena were also perceived at the

town of *Nihonmatsu* and the village of *Takagawa* (Adachi). [Province of Uzen.] *Yonezawa:* at 12 p.m. sounds like distant thunders were heard, which shook doors and shojis.

Feb. 7th. At *Sannokra*, 60 or 70 weak booming sounds were heard between the noon on the 7th, and 2 p.m., on the 8th.

Feb. 11th. At about noon the ejection of large masses of the white smokes was visible from Nagano.

30. (117) ***Feb. 14th, 1h 26m p.m.*** [Province of Kotsuke.] *Maebashi* met. observatory: At $1^h 28^m$ p.m. a weak detonation was heard, followed by a stronger one, there being sounds like distant thunders for the next 30 or 40 sec. The clouds which then enveloped the mountain prevented the condition of the latter from being ascertained. At $1^h 40^m$ a.m., a smoke column which rose up through the clouds was observed to be flowing toward the E.S.E., reaching the zenith of the observatory at $1^h 47^m$. The intensity of the smoke emission was at its maximum at $5^h 20^m$ to $6^h 00^m$ a.m. There was no ash-precipitation. At *Sannokra* and *Hanageishi* (Seta), the sound was loud. [Province of Musashi.] *Kumagai* met. observatory: The detonation was heard at $1^h 30^m 00^s$ p.m. and lasted 3 sec., shaking the glass doors as if by an impact of wind blast or in an earthquake. The column of black smokes which accompanied the outburst moved slowly eastwards. *Honjo*: the sound was like distant thunders with two intensity maxima. *Omiya* (大宮, Chichibu): the detonation lasted 5 sec. At *Wakaizumi* (Kodama), shojis were shaken.

31. (118) ***Feb. 24th, 10h 16m p.m.*** At *Iwamrata* was heard a detonation like gun booming at about $10^h 20^m$ p.m., there being an upshot of fire on the mountain top which lasted for about 1 min. At *Maebashi*, a strong detonation shook doors and shojis at $10^h 18^m$ p.m. On account of the cloudy weather, the condition of the

mountain could not be ascertained. There was no ash-precipitation.

(118′) ***Feb. 26th.*** At *Naganohara* lengthy sounds like distant thunders, causing shakings of doors and shojis, were repeated more than 10 times between 2^h45^m and 7^h50^m p.m., there being no ash-precipitation. According to the report from *Iwamrata*, the emission of the white and black smokes was unusually abundant on the 25th and 26th.

32. (119) ***Feb. 27th, 5h 27m a.m.*** *Maebashi* met. observatory: Two consecutive weak detonations like distant thunders were heard at 5^h29^m a.m.; there being also slight and hardly audible sounds at 5^h36^m, 5^h47^m and 6^h04^m a.m. The smoke issue, which had already been abundant beforehand, indicated no special sign of outburst at the time of the detonations. There was no ash-precipitation. [Province of Musashi.] *Kumagai* meteor. observatory: slight ash-precipitation between about 5 and 7 a.m. *Honjo:* sound like distant thunders heard at about $1\frac{1}{2}$ a.m., there being a slight precipitation of ashes between the dawn and $6\frac{1}{2}$ a.m. *Matsuyama* (Hiki): slight ash-precipitation between $7\frac{1}{2}$ and 9 a.m.

(119′) ***Feb. 28th.*** *Maebashi* met. observatory: a detotation like a distant thunder was heard at 2 a.m.. when the smokes were flowing southwards. At 6 a.m., on March 1st, there was found a trace of a slight precipitation of ashes on the observation ground.

March 1st. *Komoro:* sound like distant thunders were heard between 10^h30^m and 12^h p.m., the mountain top being turned red from time to time.

March 3rd. *Maebashi* met. observatory: sounds like feeble distant thunders were heard at 1^h44^m and 1^h56^m a.m. On account of the rainy weather the condition of the mountain could not be ascertained. No ashes.

March 22nd. *Iwamrata:* between 0^h30^m and 1^h30^m a.m.,

were heard sounds like that of the running of a railway train; some fire was simultaneously observed over the mountain top, while during the day time the emission of the smokes was rather abundant.

33. (120) ***March 3rd, 9h 50m p.m.*** This eruption though sufficiently strong to knock down doors and shojis at *Karuizawa*, left no marks on the tromometer diagrams in Tokyo, indicating the slightness in amount of the seismic vibrations caused by a strongly explosive outburst.

[Province of Shinano.] *Karuizawa:* The detonation was very loud and shook the houses violently, overthrowing some doors and shojis. The sound like distant thunders continued to be heard for more than 20 min. On account of the thick mists the mountain top could not be observed. *Miyota* (Ki.-Saku): The mountain top became deeply red and the detonation was very strong, causing some damage to the doors and shojis in the village. At the municipal office one door was overthrown. *Iwamrata;* The detonation and the shaking effects were strong, being not much inferior to those in the case of the powerful explosion on June 17th, 1913. In spite of the presence of thick mists, the mountain top was rendered somewhat clear by the ejection of burning materials. Kita-Oi (北大井村, Ki.-Saku): A strong detonation shook violently doors and shojis, some outbursts of red-hot lava being also observed. The amount of the smokes and the red-hot lava ejected out was small in comparison to the detonation. *Konuma* (Ki.-Saku): A very strong detonation caused panic among the people; at the Shiono district, shojis were damaged in a dozen houses. For the three previous days the issue of the smokes had been abundant, fires having been seen over the crater during the night times. *Komoro*: The eruption was strong, and a very loud detonation was followed for about 30 min. by sound like distant thunders. Fires were

thrown out from the crater with a great force, the smokes flowing toward Karuizawa and the N.E. Minami-Mimaki (南御牧, Ki.-Saku): The strong detonation and shakings lasted about 3 sec. The amount of fires and smokes ejected was small in comparison to the intensity of the sound shocks. *Ueda:* the detonation was single and lasted about 2 sec., causing no shaking effects. *Suzaka* (須坂, Ka.-Takai): a loud sound was heard at about 10 p.m.

[Province of Kotsuke.] *Naganohara:* The detonation was excessively loud and shook violently doors and shojis. The crater mouth remained completely red for a time, and the fire masses were seen rolling down the mountain slope. The ejection of the black smokes was small in comparison to the violence of the detonation. No ash-precipitation. *Maebashi* met. observatory: The detonation, perceived at $9^h 53^m$ p.m., was moderately strong and shook doors and shojis. Fires displayed at the mountain top disappeared completely at $10^h 00^m$ p.m. The black smokes, which rose in the form of a vertical cylinder, were gradually carried toward the N.E. and passed at $10^h 25$ p.m. to the N. of the city, being completely dispersed at the midnight. At about $10^h 30^m$ p.m., there was a very slight precipitation of ashes. *Sannokra* and *Yuhara* (Tone): the detonation, which was single, was respectively strong and weak at these two places. [Province of Mino.] At the met. station of *Nagamine* (Motosu), an explosive sound was heard toward the N.E. at about $9^h 50^m$ p.m.

***March* 13*th*.** *Naganohara:* sounds like distant thunders were heard from $8^h 30^m$ a.m., becoming specially strong at $11^h 15^m$ a.m. The weather being cloudy, the mountain top could not be observed. No ashes. *Maebashi:* at $0^h 04^m$ p.m., sounds like distant thunders were heard westwards.

34. (121) ***March* 14*th*, 7*h* 56*m* *a.m*.** *Iwamrata:* The deto-

nation and the shakings were feeble. As it was raining and snowing at the time, the condition of the mountain could not be ascertained. *Nagano* met. observatory: a sound like distant thunders was heard at $7^h 58^m 22^s$ a.m. *Naganohara:* at about $9^h 35^m$ a.m., a sound like distant thunder was heard, followed by some dozen others. *Maebashi* met. observatory: at $7^h 58^m$ a.m., two feeble detonations like the booming of a gun were heard in succession.

35. (122) ***March 15th, 1 a.m.*** *Karuizawa:* the detonation was very loud. *Naganohara:* The detonation was excessively loud and shook strongly doors and shojis. Black smokes were projected vertically upwards and the mountain top was turned deeply red. *Maebashi* met. observatory: At about 1^h a.m. there were heard 4 times the sounds like that produced by the falling on the ground of a large stone block, which shook strongly the doors and shojis. The mass of the black smokes which accompanied the eruption, was thrown toward the N.E. *Sannokra:* at about $0^h 58^m$ a.m. a sudden strong detonation shook doors and shojis; subsequently were heard several times sounds like distant thunders, that at $4^h 20^m$ a.m. being the strongest. *Higashi-Ogawa* (片品村, Tone): a strong detonation, heard toward the S.W., shook violently doors and shojis.

Kumagai met. observatory: the detonation, felt at $1^h 03^m 20^s$ a.m., was like the booming of a gun and lasted $3\frac{1}{2}$ sec., the glass doors being shaken as if struck by a gust of wind.

36. (123) ***March 23rd, 7h 40m a.m.*** *Karuizawa:* the detonation was very loud. *Iwamrata:* sound and shakings were fairly strong. *Kumagai* met. observatory: at $7^h 40^m$ a.m., there was heard a feeble detonation like distant thunders, which lasted 3 sec. [Province of Kotsuke.] *Maebashi* met. observatory: a feeble detonation was heard at $7^h 48^m$ a.m. *Naganohara:* a loud detonation

which shook doors and shojis strongly, was followed by several feeble lengthy sounds. No ashes. *Sannokra:* the detonation was very loud, and was followed during the next 7 min. by 3 or 4 feeble sounds like distant thunders.

37. (124) ***March 25th, 2h 36m a.m.*** *Kumagai* met. observatory: the detonation, at $2^h 40^m$ a.m., lasted about 3 sec. and was like distant thunders. [Province of Kotsuke.] *Maebashi* met. observatory: At $2^h 38^m$ a.m., two feeble sounds like distant thunders were heard in close succession. On account of cloudy weather, the condition of the mountain top could not be observed. No ash-precipitation. *Naganohara:* The detonation was very loud and like the booming of gun, shaking strongly doors and shojis. Sound like distant thunders had been heard since the morning of the previous day. *Sannokra:* the detonation was strong and heard westwards.

March 25th. *Naganohara:* from $5^h 35^m$ p.m. were heard several times sounds like distant thunders, each of which was lengthy and was accompanied by the ejection of masses of white smokes.

March 29th. Abundant smoke issue during the day time was visible from Nagano.

38. (125) ***March 30th, 10h 10m a.m.*** *Naganohara:* at $10^h 12^m$ a.m. was heard a detonation like that caused by a distant gun firing, followed by a slight precipitation of ashes.

39. (126) ***April 6th, 7h 27m p.m.*** [Province of Shinano.] *Karuizawa:* The detonation was very strong. Although the mountain top was enveloped in thick mists, still could be observed some lava fragments which fell at the mid-slope of the mountain. *Komoro* and *Iwamrata:* The detonation was very strong and like the booming of gun. *Nagano* met. observatory: the detonation was

heard at $7^h 32^m$ p.m. *Ueda:* the detonation was loud and lasted 3 sec., without causing, however, marked shaking effects. [Province of Kotsuke.] *Naganohara:* The detonation was unusually strong and shook doors and shojis as if in an earthquake of a moderate intensity. No ash-precipitation. *Maebashi* met. observatory: At $7^h 29^m$ p.m. was heard a single detonation like a distant gun booming, the building having for the previous ½ min. been in a state of feeble shaking. The mountain was at the time enveloped in thick clouds. No ash-precipitation. *Higashi-Ogawa* (片品村, Tone): the detonation was single and strong. *Hanageishi* (Seta): the detonation was heard westwards and moderately strong. [Provinces of Musashi and Sagami]. *Kumagai* met. observatory: At $7^h 31^m 05^s$ p.m. were heard two unusually loud detonations in succession, which were like the sounds of gun discharges and lasted 3 sec., the doors and shojis, especially those on the W. and N. sides, being strongly shaken. The Richard's barograph indicated no distinct trace. *Yokohama* met. observatory: At about 7½ p.m., the shojis on the N. side of the building began to be shaken slightly for about 2 sec., then for the next 5 or 6 sec. the movements became stronger as if in the case of a moderate earthquake; the doors and shojis on the S. side remaining unmoved throughout. The air shocks, which altogether lasted about 10 sec., were accompanied by no audible sound.

REPORTS FROM DIFFERENT PLACES IN THE KANAGAWA PREFECTURE.

Locality.		Intensity of Sound.	Remark.
Hakone	箱根町	Feeble, like distant thunders.	——
Toriya	津久井郡鳥屋村	Feeble.	Doors and shojis shaken for some time interval.
Nakano	„ 中野村	„	*Do.*
Ogino	愛甲郡荻野村	Feeble, like distant thunders.	Doors and shojis slightly shaken.
Kamimizo	高座郡上溝村	Strong.	The shock was like that caused by the falling of a heavy body on the ground.
Ayase	„ 綾瀬村	„	Heard toward the N.W.
Fujisawa	藤澤町	——	The sound was not heard distinctly, but doors and shojis were shaken slightly for a few seconds.
Kawawa	都筑郡川和村	Strong.	The sound was like that caused by the fall of a heavy timber and heard toward the N.W.; the doors and shojis shaken.
Totsuka	戸塚町	Feeble.	——
Mizonokuchi	橘樹郡溝ノ口村	——	Doors and shojis shaken.
Ikuta	„ 生田村	Feeble.	*Do.*
Kawasaki	川崎町	Moderately strong.	——
Sasashita	久良岐郡笹下村	Strong.	——
Kanazawa	金澤村	Feeble.	——
Yokosuka	橫須賀町	Feeble, like distant gun booming.	——
Misaki	三崎町	Feeble.	——

40. (127) ***April 9th, 8h 51m a.m.*** [Province of Shinano.] *Karuizawa*, *Iwamrata*, *Komoro*, *Usuta* (Mi.-Saku), and *Konuma* (小沼村, Ki.-Saku): The detonation was very loud and like the sound of a gun discharge. On account of the thick clouds, the condition of the mountain could not be observed. [Province of Kotsuke.] *Maebashi* met. observatory: at 8^h53^m a.m., a detonation shook slightly doors and shojis, followed 20 sec. later by a sound like that of distant thunders. *Naganohara:* the detonation, which was like

the sound of a gun firing, shook strongly doors and shojis. No ash-precipitation.

May 4th. An abundant smoke issue was visible from Nagano.

41. (128) ***May 5th, 0h 34m a.m.*** [Province of Shinano.] *Nagano* met. observatory: the tromometer registered the tremor due to this explosion at $0^h 32^m 51^s$ a.m. *Iwamrata:* The detonation was rather weak, but the shaking effects were moderately strong. The black smokes, rent by lightnings, ascended to a considerable height and were then thrown gradually toward the E. The red-hot lava pieces, which fell around the crater, were visible for a few minutes. The intensity of the eruption was nearly the same as that on March 23rd, at $7^h 40^m$ a.m. *Komoro* and *Usuta:* The detonation was moderately strong. The mountain top was for a time enveloped in fires. [Province of Kotsuke.] *Maebashi* met. observatory: Two moderately strong detonations in succession, at $0^h 36^m$ a.m., shook the doors and shojis, followed about 20 sec. after by sounds from the west like distant thunders. The column of the black smokes, which ascended vertically through the clouds shrouding the mountain, were gradually thrown toward the E., reaching the zenith at about 1 a.m. The Richard's barograph registered an atmospheric disturbance of about 0.7 mm sudden rise. *Sannokra:* the detonation was strong and heard westwards. *Shibukawa* (Gumma): moderately strong detonation shook shojis.

42. (129) ***May 9th, 4h 7m p.m.*** [Province of Kotsuke.] *Maebashi* met. observatory: at $4^h 09^m$ p.m. sounds like distant thunders were heard for about 10 sec.; no ash-precipitation. *Naganohara:* The sounds were like that of distant thunders and lasted about 20 sec. On account of the thick enveloping clouds, the mountain top could not be observed. *Sannokra:* a strong sound was heard westwards.

43. (130) ***May 19th.*** *Naganohara:* at 6 p.m. was heard a sound like distant thunder, followed by 2 or 3 others.

44. (131) ***June 24th.*** The smoke column which issued at $2^h 05^m$ p.m. was well observed from Nagano.

45. (132) ***Nov. 12th, 8h 50m a.m.*** *Iwamrata:* there was heard a moderately loud detonation accompanied by marked shaking effects, and the black smokes which rose vertically to a considerable height were seen to be gradually thrown eastwards, the outbursts lasting nearly an hour. *Komoro:* a loud detonation was heard, and the smokes, whose emission continued for about 50 minutes, were seen to be thrown toward the east. *Usuta:* the mountain top was observed to turn red, the houses being slightly shaken for about 3 sec. *Karuizawa:* the black smokes were observed rising high up, but no detonative sound was heard. *Nagano* meteor. observatory reports as follows: On the 11th, the smoke emission from the Asama was slight, though there was a temporary increase at about 11.30 a.m.; on the 12th, after a momentary increase in the amount of the smokes at 6.10 a.m., there began at 8.50. 30 a.m. a long-continued copious outthrow of black smokes which ascended vertically and was thence gradually thrown northwards, attaining at 8.55 a.m. the maximum visible altitude of 11°20′. In the province of Kotsuke, there was a slight ash-precipitation at the town of *Shibukawa* at about 8.52 a.m. At the *Maebashi* met. observatory, where no detonation was heard, the black smoke column was observed to be gradually thrown toward the N.E., the outburst continuing from 8.50 to 9.25 a.m.

46. (133) ***Nov. 12th, 8h 35m p.m.*** *Maebashi:* a rushing noise was heard at 8.37 p.m., shaking doors and windows slightly. At *Shibukawa*, a single detonation was heard, while at *Hanageishi* the sounds were repeated twice in succession.

47. (134) ***Nov. 15th, 11h 24m a.m.*** *Karuizawa*, *Komoro*, and *Usuta:* a loud detonation was heard, causing some shakings of the buildings. *Nagano* met. observatory: sounds like a landslip or avalanche were heard for about 10 sec. *Maebashi* met. observatory: sounds like distant thunders were heard twice in close succession, lasting about 1 min. and causing slight shakings of doors and windows. The sound and shaking effects were perceived also at *Yuhara*, *Higashi-Ogawa*, *Kusatsu*, *Sannokra*, *Hanageishi* and *Isezaki*. *Naganohara:* the detonation was very loud. *Shibukawa:* the sounds were repeated in succession. *Kumagai* met. observatory: a loud detonation like the booming of a gun was heard at 11.27.20 a.m., lasting 3 sec. In the province of Echigo, the slight shaking effects or the sounds were noticed at *Ashigasaki* (蘆ヶ崎村) and *Mikuni*.

The tromometers in Tokyo registered the vibrations due to the explosion at 11.24.38 a.m.

48. (135) ***Nov. 16th, 7h 27m p.m.*** At *Karuizawa* an explosive sound was perceived, but at *Komoro* and *Iwamrata* nothing was noticed. At the *Maebashi* met. observatory, a single feeble sound was heard at 7.29 p.m., causing slight shakings of doors and shojis. A slight ash-precipitation took place some time previous to 5 p.m., on Nov. 20th.

49. (136) ***Dec. 14th, 3h 33m p.m.*** Between 2 p.m. on the 13th and 2 a.m. on the 14th there was a slight ash-precipitation at *Kumagai* and *Wakaizumi*, in Musashi. At the town of *Honjo*, in the same province, ashes fell between 10 a.m., 13th, and 4.30 a.m., 14th, to the amount of 23 grams per sq. metre. According to the report from the *Maebashi* met. observatory, there was an abundant emission of black smokes between $8\frac{1}{2}$ and $10\frac{1}{2}$ a.m., 14th, and also from 0.30 p.m. throughout the rest of the day;

there being a feeble eruptive sound at 3.35 p.m., 14th.

50. (137) ***Dec. 15th, 0h 50m a.m.*** At the town of *Maizuru*, in the S.W. part of the province of Kazusa, 190 km. to the S.E. of the Asama-yama a loud detonation was heard at about 0.50 a.m. toward the N.W., followed by the shakings of doors and shojis. On the other hand, the sound was perceived toward the S.W. at about 0.50 a.m. at the following places in the province of Mino, situated 185 to 210 km. to the W.S.W. of the volcano: *Gifu* met. observatory, *Nagamine*, *Iwamra*, *Itadori* and *Ōgaki*.

51. (138) ***Dec. 16th, 7h a.m.*** The explosion effect was perceived at several places in the province of Mino, as follows: at *Iwamra*, two continuous sounds like gun boomings heard toward the N.E.; at *Tokitsu*, *Hachiman*, and *Kera* (氣良), sound was loud and like a gun booming; at *Itadori*, like distant thunders; at *Ogaki*, like a distant gun discharge; and at *Mino* (美濃), *Shimo-Asō*, *Mitake* (御嵜), *Kano*, *Mushiroda* (席田), and *Kamimra* the sound was feeble.

52. ***Sound area.*** Of the different outbursts in 1914, the following had each a more or less extensive sound area (figs. 24 to 28):—

No. 134.	Nov. 15th, 1914.	No. 126*	April 6th 1914.
No. 120.*	March 3rd, „	No. 116*	Jan. 29th, „
No. 137.	Dec. 15th, „		

53. ***Weather.*** The positions of the centres of the low and high barometric pressures at or about the times of the five above-mentioned explosions are shown in the following table.

* Strong explosion.

No. of Explosion.	Date. (1914)	Low Pressure Centre.	High Pressure Area.
		mm	mm
134	Nov. 15; 6 a.m.	752, in Japan Sea.	768, over N. China and Manchuria.
	„ ; 2 p.m.	750, between Hokkaido and Karafto.	768, over N. China.
120	March 3; 10 p.m.	750, in Karafto Strait. 752, to the E. of Tsugaru Strait.	766–764, over China and Yellow Sea.
137	Dec. 14; 10 p.m.	750, in the vicinity of Wladivostock.	768, over S. China.
126	April 6; 2 p.m.	760–762, over Japan.	766-764, over S. and Central China.
	„ ; 10 p.m.	762, generally over Japan.	764, over S. China.
116	Jan. 29; 10 p.m.	752, off the E coast of Hokkaido.	772, over N. China.

54. (134) ***Explosion of Nov. 15th, 1914.*** (Fig. 27.) The sound area, whose maximum radial distance was 93 km., extended toward the E.S.E., E.N.E., and N., being limited to 20 to 35 km. on the W. and the S. The ash precipitation was reported only from Ksatsu, situated about 25 km. to the N. slightly E. of the volcano.

55. (120) ***Explosion of March 3rd, 1914.*** (Fig. 25.) The sound area extended principally toward the E.N.E. and the S., the greatest radial distances in these two directions being 85 and 61 km. respectively. The extension toward the W. was only 34 km. The sound was generally strong within the area in question, which was comparatively very small, being specially loud to the radial distance of about 20 km. toward the S. and the N. At the time of the explosion there prevailed, in and about the sound area, W., N.N.W. or W.N.W. winds, with velocity of 7 to 11 m/sec., (Table XXIV); the ash-precipitation being reported only from Maebashi 50 km. to the E. of the volcano. In conformity with this latter fact, the sound was perceived at Nagamine, in the

Sound Areas of the Asama-yama Explosions in 1914.

Small red dot indicates a place where the sound was loud.

„ „ circle „ „ „ „ „ feeble.

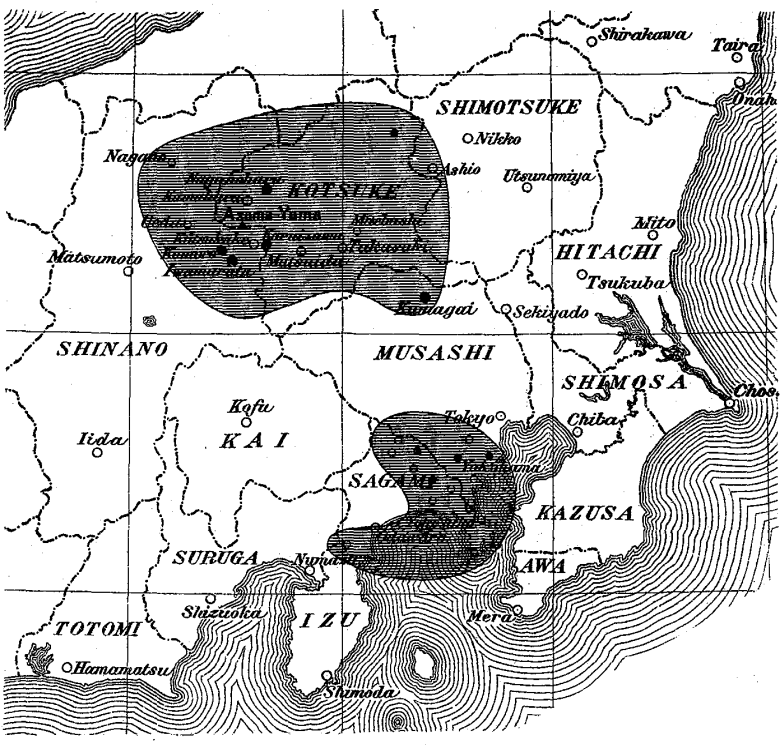


Fig. 24.
Explosion on
April 6th, 1914.

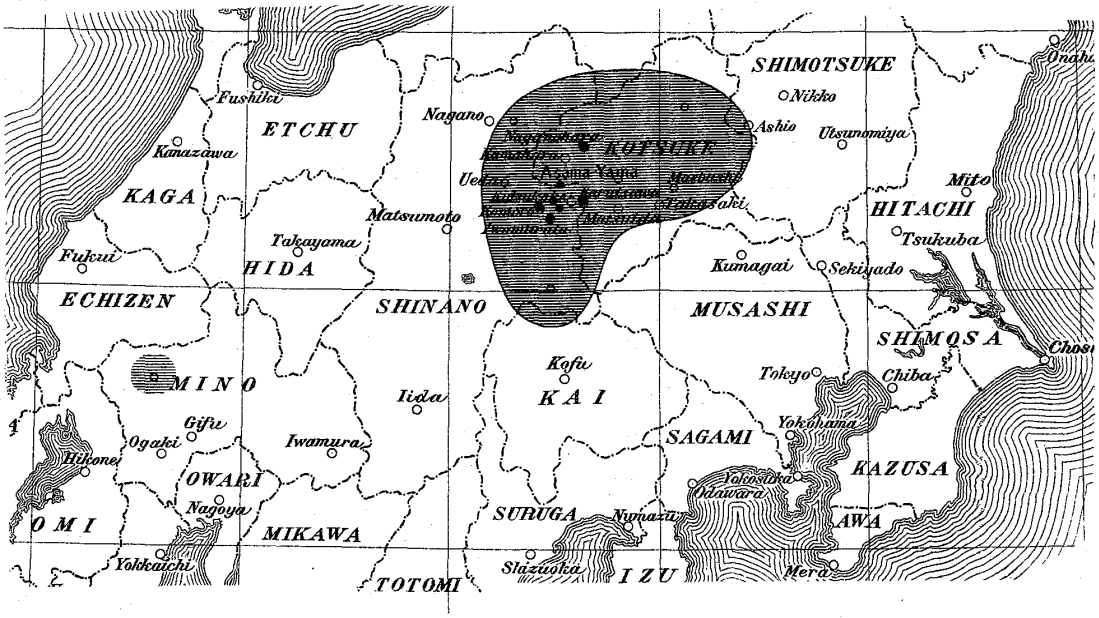


Fig. 25.
Explosion on
March 3rd, 1914.

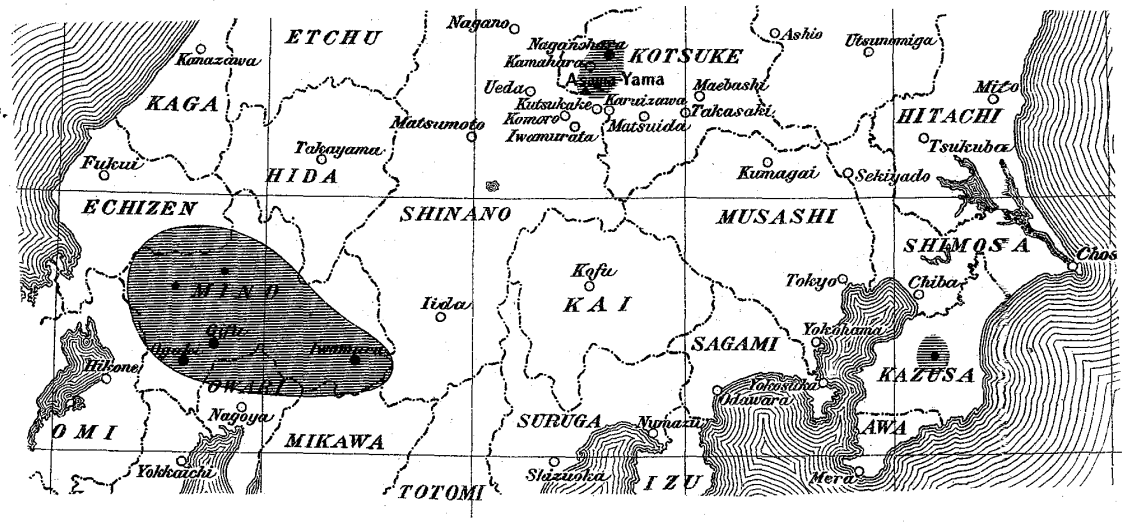


Fig. 26.
Explosion on
Dec. 15th, 1914.

Sound Areas of the Asama-yama Explosions in 1914.

Small red dot indicates a place where the sound was loud.

„ „ circle „ „ „ „ „ feeble.

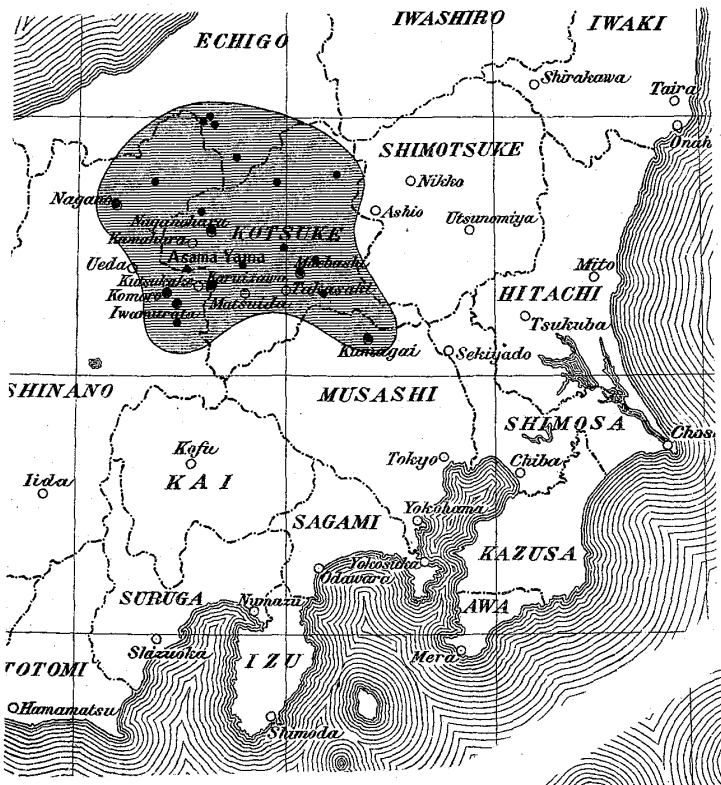


Fig. 27.
Explosion on
Nov. 15th, 1914.

Fig. 28.
Explosion on
Jan. 29th, 1914.

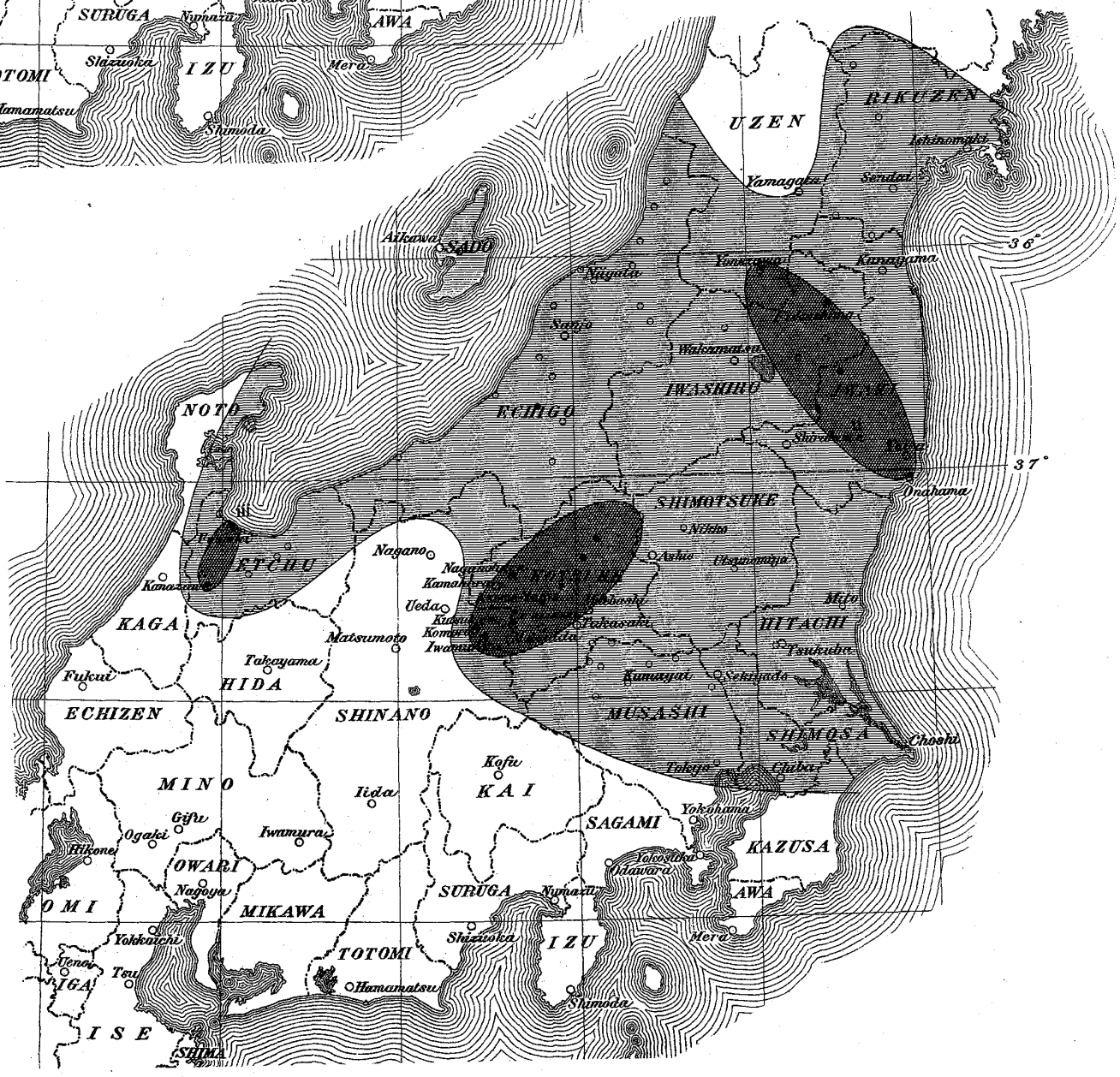


Fig. 29. The Asama-yama Explosion on May 16, 1913, observed at Yuno-taira.

Radial Component Tromometer Diagram.

Multiplication = 953.

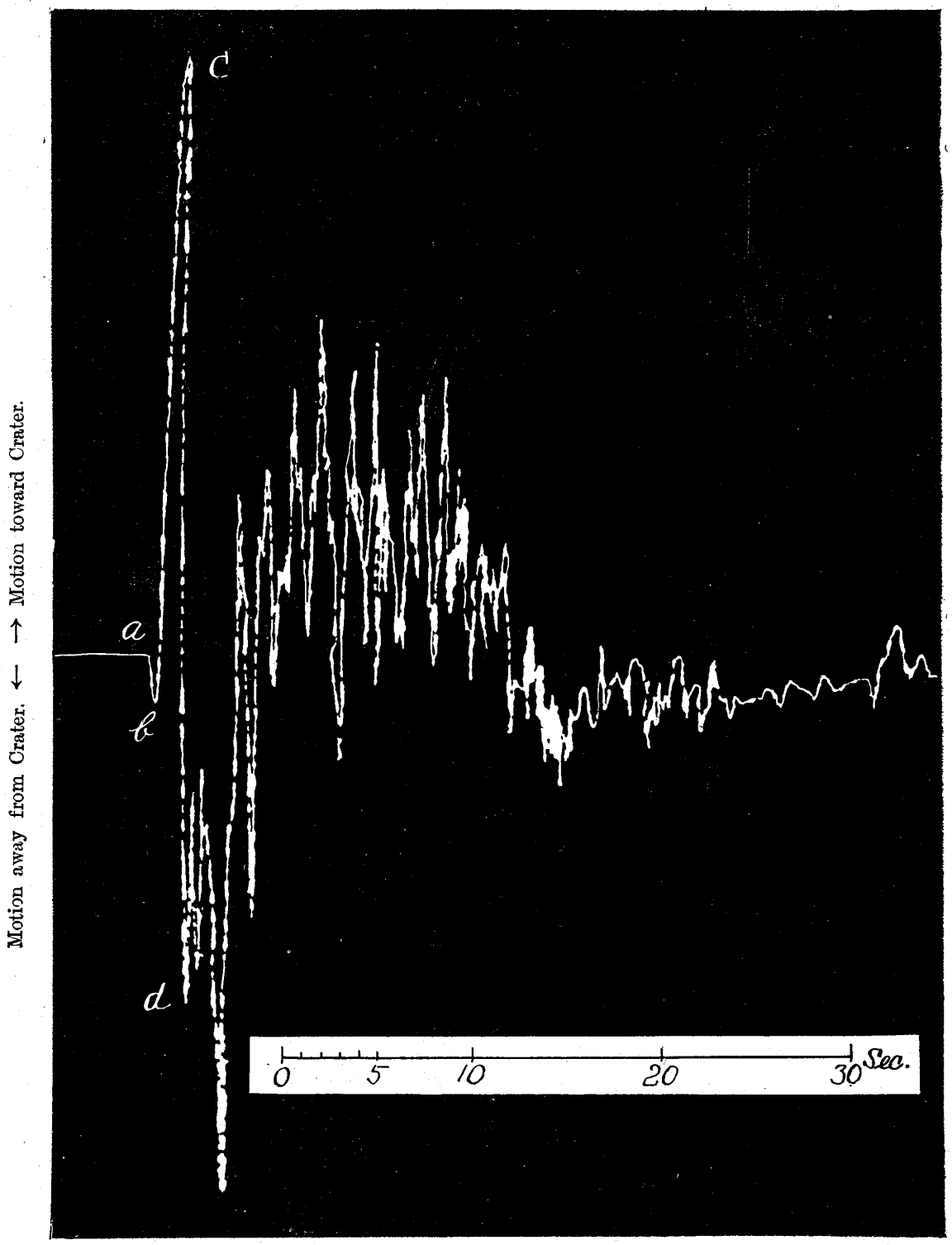
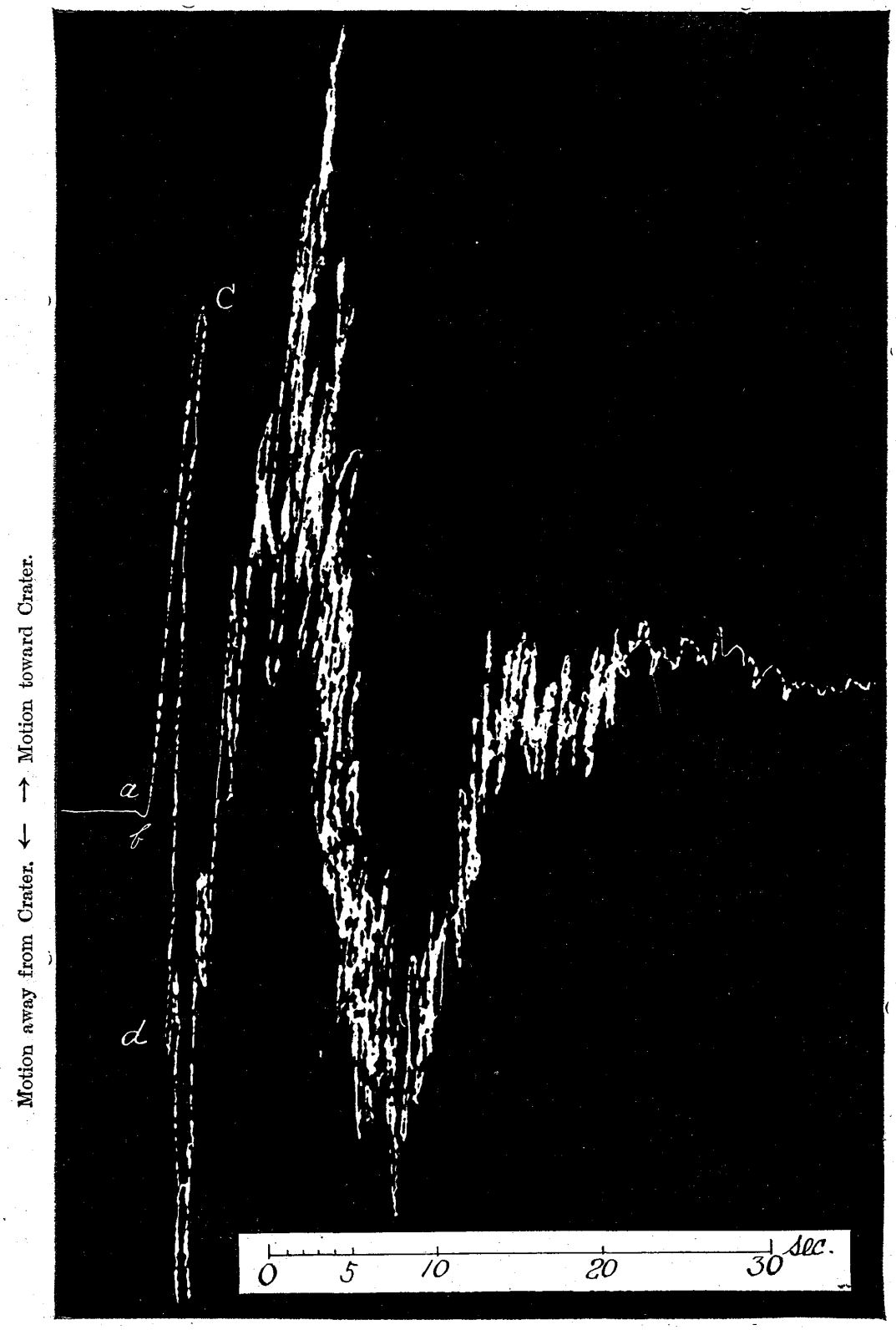


Fig. 30. The Asama-yama Explosion on June 27, 1913. observed at Yuno-taira.

Radial Component Tromometer, Diagram.

Multiplication = 810.



N.W. part of the province of Mino, situated nearly on the opposite side at the radial distance of 196 km. (See page 60 of this volume.)

56. (137.) ***Explosion of Dec. 15th*, 1914.** (Fig. 26.) In the vicinity of the volcano the sound was not heard except at Wakasare and Naganohara, within the radial distance of some 20 km. to the N.E. On the S.W., however, the sound was heard in the province of Mino within a comparatively large area, of the major diameter of 120 km., whose centre was about 177 km. distant from the Asama-yama. The sound was also noticed at the town of Maizuru in the province of Kazusa about 190 km. to the S.E.

57. (126) ***Explosion of April 6th*, 1914.** (Fig. 24.) The eruption sound was heard within two detached areas. One of these, (A), including the volcano itself, had the maximum radial extention of 90 km. toward the E., the area being about 130 km. in length and 80 km. in width. The other, (B), was smaller in extension and comprised the S. extremity of the province of Musashi and the greater portion of Sagami, its centre being 148 km. distant from the Asama-yama to the S.E. Although the sound was perceived with an unusual intensity at several places within the two areas, still the outburst left no well-defined trace on the Tokyo tromometer diagrams, so that the eruptive energy seems to have been spent chiefly in the explosive action. This is the only instance among the numerous recent explosions of the Asama-yama in which a distinct detached sound area was formed to the S.E. of the volcano.

At the time of the outburst the wind direction was N. or N.N.W. at Nagano and Maebashi within the (A) area, and S.E., E.S.E. or S.S.E. at Tokyo, Yokohama, and Yokosuka in or about the (B) area, the wind velocity being nowhere over 7 m./sec. (Table XXIV).

TABLE XXIV. CLOUD AMOUNT AND WIND DIRECTION AND VELOCITY ON MARCH 3RD AND APRIL 6TH, 1914.

Place.	March, 3rd.			April, 6th.								
	10 p.m.			6 p.m.			7 p.m.			10 p.m.		
	Cloud Amount.	Wind Direction.	Wind Velocity.	Cloud Amount.	Wind Direction	Wind Velocity.	Cloud Amount.	Wind Direction.	Wind Velocity.	Cloud Amount.	Wind Direction.	Wind Velocity.
Gifu.	8	N	3.0	2	NW	3.5				10	NNE	2.4
Nagoya.	0	WNW	8.7	8	W	6.7	5	W	4.7	10	ENE	2.9
Fukui.	10	SSW	1.3	4	NW	4.5				10	S	1.9
Kanazawa.	8	SSE	4.1	7	N	1.9				9	E	2.8
Fushiki.	9	SW	2.2	10	NW	4.4				9	SW	3.6
Takayama.	10	SW	1.0	10	NNW	5.4				10	ESE	0.7
Hamamatsu.	2	W	9.2	10	W	3.2				10	W	2.6
Numazu.	1	NE	2.8	7	WNW	4.2				10	ENE	2.5
Kofu.	1	SE	1.0	10	SSW	4.8				10	NW	1.8
Iida.	2	N	2.0	0	N	2.6				10	—	0.0
Matsumoto.	10	N	2.6	7	N	6.7				10	NW	1.8
Nagano.	8	E	0.8	8	N	2.1				9	SW	1.1
Niigata.	0	W	7.2	4	SW	3.7				9	SW	2.4
Maebashi.	0	NNW	11.0	9	N	6.8	10	NNW	4.5	10	ESE	7.2
Yokohama.	0	WNW	3.0	10	ESE	2.4				10	E	8.8
Tokyo.	4	NW	6.3	10	SE	3.9	9	ESE	4.8	10	E	3.5
Yokosuka.	0	NE	2.2	5	SSE	2.5				10	ESE	3.3
Choshi.	2	ESE	1.6	2	ENE	3.8	10	ENE	2.8	10	ENE	3.4
Mito.	0	WSW	1.2	8	NE	5.3	10	NE	2.7	10	NNE	2.0
Utsunomiya.	3	S	0.5	10	SE	4.2				10	NW	0.7
Kumagai	0	NW	8.1	10	SE	4.0				10	E	1.9

58. (116.) ***Explosion of Jan. 29th, 1914.*** (Fig 26.) The sound area, which was unusually large, stretched mainly to the

N.E. from the Asama-yama, with the maximum radial distance of about 350 km, and extended from the coasts of Hitachi, Iwaki, and Rikzen on the Pacific side, to those of Echigo and Etchu on the Japan Sea side. To the S.W, of the volcano, the sound was heard only at the vicinity of Komoro, Karuizawa, and Iwamrata, the minimum radial distance being 20 km. The land area of sound propagation of this explosion was 71,200 sq. km., and much greater than those of the three strongest outbursts on Dec. 7th, 1909, Dec. 2nd, 1910, and of May 5th, 1911, respectively equal to 58,700 ; 40,100 ; and 41,900 sq. km.

Within the sound area there were three small elliptical regions (i), (ii), and (iii), wherein the detonation was perceived strongly, as follows :—

(i), an area about the Asama-yama, extending toward the N.E., and having the major and minor diameters of 105 and 45 km. respectively.

(ii), an area stretching from the S.E. corner of the province of Iwaki to the S.E. corner of Uzen. with the major and minor diameters of some 130 and 45 km. respectively.

(iii), a small area at the W. portion of the province of Etchu.

The central points of the (ii) and (iii) areas of strong sound were respectively 205 and 145 km. distant from the Asama-yama, and may be taken as representing the position of the detached sound areas beyond the "zone of silence" in the usual typical case.

59. *Extension of sound area and ash-precipitation.* The land areas of sound propagation in the different cases described in the preceding § § were as follows :—

No.	Date (1914).	Land Area of Sound Propagation, in sq. km.		
		(A), Area about the Asama-yama.	(B), Detached Area.	Total.
134	Nov. 15th.	9,900	——	9,900
120*	March 3rd.	8,200	(Perceived only at one place in N.W. Mino.)	8,200
137	Dec. 15th.	(Perceived only at the N.E. vicinity of the volcano.)	5,700	5,700
126*	April 6th.	10,000	3,800	13,800
116*	Jan. 29th.	71,200	——	71,200

* Strong explosion.

Thus the sound area was small except in the case of the explosion on Jan. 29th, 1914, whose magnitude was inferior to none of the strongest outbursts in the previous years. On the occasion of the eruption in question, however, there was only a slight ash-precipitation in the vicinity of Kumagai, Honjo, and Habu, in the N. part of Musashi. In the strong eruption on March 3rd ashes fell to a very slight amount only at Maebashi, while the three remaining outbursts in 1914 considered above was accompanied by no ash-precipitation. These facts seem to indicate that in 1914, when the recent eruptive activity was quickly approaching the end, the strong explosions were only *detonatively strong*, but caused no great ejection of lava fragments and ashes, becoming essentially of the nature of a surface disturbance. In the following table are collected the cases wherein the explosion was accompanied by the ash-precipitation more or less.

PRECIPITATION OF THE ASAMA-YAMA ASHES IN 1914.

No.	Date (1914).	Place where the ash-precipitation took place.
110	Jan. 11.	Higashi and Nishi Nagakra (Kita-Saku, Shinano). Sannokra (Kotsuke).
111	„ 12.	Higashi and Nishi Nagakra and Goka (K.-Saku, Shinano).
112	„ 26.	Maebashi and Sannokra (Kotsuke). Utsunomiya.
116	„ 29.	Kumagai, Honjo, and Habu (N. part of Musashi).
119	Feb. 27.	Honjo and Matsuyama (Musashi).
119′	„ 28.	Maebashi.
120	March 3.	„
125	„ 30.	Naganohara (some 18 km. to the N.E. of Asama-yama).
132	Nov. 12.	Shibukawa (Kotsuke).
—	„ 20.	Maebashi.
—	Dec. 13-14.	Kumagai and Honjo (Musashi).

On Jan. 26th there was some precipitation of the sand at Maebashi, and on Dec. 13th–14th, the ashes fell at Honjo to an appreciable amount. But in all the other cases, the precipitation of ashes was extremely slight.

60. ***Radial distance of the detached sound area.*** The results stated in §§ 54–58 concerning the position of the "detached sound area," or the sound area beyond the zone of silence, are collected in the following table:—

DISTANCE AND DIRECTION OF THE "DETACHED SOUND AREA" FROM THE ASAMA-YAMA CRATER.

No.	Date. (1914)	Distance and Direction of the central point of "Detached Sound Area" from Asama-yama.	Remark.
120	March 3rd.	196 km toward S. 64° W.	Perceived at single place.
137	Dec. 15th.	177 km „ S. 56° W. 190 km „ S. 53° E.	Perceived at single place.
126	April 6th.	148 km „ S. 38° E.	
111	Jan. 29th.	205 km „ N. 57° E. 145 km „ N. 78° W.	

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 Yuno-taira 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