These results, which are only gross approximations, indicate that the velocity of the detonations generated by the explosions of the Asama-yama varied from 314 to 343 m/s, for the radial distances between some 40 and 260 km, and for the mean *surface* temperatures of 5°.0 to 20°.7 *C.*

The velocity of the earthquake motion was 3.31 km/s for the radial distances of 40 to 137 km between Nagano and Tokyo, and 3.8 km/s for the radial distances of 137 to 330 km between Tokyo and Osaka, tending to indicate that the propagation rate of volcanic earthquakes is generally low.

CHAPTER VII. ERUPTIONS OF THE YAKE-DAKE.

41. ***Recent Activity of Yake-dake (Iwo-san).*** The Yake-dake, whose proper name is Iwo-san (Sulphur Mountain) is 2053 metres in height, and is situated at a distance of 85 km to the SW from the Asama-yama, on the boundary of the provinces of Shinano and Hida, and between the two much higher mountains of the Norikura-dake (3166 m) and Yariga-take (3092 m). This volcano, whose present activity began in Dec. 1907, had, according to Dr. Tetsunosuke Kato, been quiet for many centuries after its eruption in 1585, such that the crater became densely covered with trees. Since about 20 years ago, however, the volcanic energy gradually revived, till the old crater bottom was partly destroyed by the recent convulsions. On the occasions of these latter, the precipitation of ashes took place very often at Matsumoto, which is 32 km to the due E. of the volcano, and the different towns and villages situated on the plateau stretching N-S to the west of that city. The ashes reached, on several occasions, as far as Nagano, 70 km to the NE; Ueda, 65 km to the ENE; and

Komoro, Iwamurata, and Usuta, about 80 km to the E. In no case, however, the explosion was large enough to send the ashes beyond the eastern boundary of Shinano, in which province all the above-mentioned places are situated.* On a few occasions, the ashes were carried westwards into the province of Hida, and reached the towns of Takayama (in Ono county) and Funatsu (in Yoshiki county), which are at a distance of about 35 km, in the valleys running from the Yake-dake and the adjacent mountains respectively toward the west and toward the WNW.

42. *List of eruptions of Yake-dake.* The following list of the Yake-dake eruptions numbered 1 to 33, which occurred between 1907 and 1911, has been compiled mostly from the reports sent in from the meteorological stations of Matsumoto and Nagano (in Shinano), and of Takayama (in Hida), and from the different district and village offices in the Yoshiki, N. and S. Atsumi, E. and W. Chikuma, Suwa, Sarashina, Kami-Takai, Chiisagata N. and S. Saku counties, of which the first belongs to the province of Hida and the rest to that of Shinano.

(1) Dec. 8th, 1907; 2 pm. At Funatsu ashes fell to a thickness of 3 mm, and at Takayama snow mixed with ashes amounted to 10 mm.

(2) Dec. 11th, 1907; 9 am. Between 9 and 11 am, a slight precipitation of ashes in the E. Chikuma and S. Atsumi counties.

(3) Dec. 23rd, 1907; 3 pm. A smoke explosion which threw out ashes, forming in the W. Chikuma county a thin gray covering on the snow layer.

(4) March 8th, 1908; 3 pm. At Takayama: during the afternoon there prevailed a strong snow storm, while in the even-

* During the night of July 12th, 1911, there was a slight fall of ashes at Kumagai, in the province of Musashi, due possibly to the explosion, No. 29, of the Yake-dake.

ing the snow-fall continued heavy, although the wind became weaker; when examined at 6 pm, there was an accumulation of ashes about 10 mm in thickness, the ash-precipitation having commenced between 2 and 6 pm. At Funatsu, ashes fell from about 3 pm, to a thickness of 3 mm.

(5) July 28th, 1908. Occasional ejections of ashes.

(6) Jan. 20th, 1909; 7 pm. In the province of Shinano, ashes fell, between 2 pm and the early hours of the next day, at the town of Suzaka and the villages of Shichiki and Rikugo (N. Atsumi); Higashi Hotaka (S. Atsumi); Yamanouchi and Yamase (Takai); Watauchi, Hoshina, and Inouye (Kami Takai); and Sakakita (E. Chikuma). In the Yoshiki county, province of Hida, a very loud detonation was heard at about 7 pm at Tagoroya, 6 km to the NW of Hirayu, while it caused at Nakao marked oscillations of lamps.

(7) March 13th, 1909; 11 pm. In the S. Atsumi county there were, during the night, shakings of the doors and windows as in an earthquake, a small quantity of ashes being left on the snow. At the city of Matsumoto, loud detonations were heard from 11 pm, and some clocks were stopped by the earthquakes (?); ashes fell at Okaya and Kami-Suwa in the neighbourhood of the lake of Suwa.

(8) March 23rd, 1909; 1.30 pm. The ashes fell for about 20 min., from 1.30 pm, to a thickness of 3 mm, at Nishi Hotaka, Ariake and Kitaho (S. Atsumi), and Sakakita (E. Chikuma), such that for about 10 min. it became so dark as to necessitate the use of lamps; the smoke cloud progressing from the S. to the N. At Minami Odani (N. Atsumi), there was a slight fall of ashes from 2.25 to 5.10 pm, the wind being S. Ashes fell also as far as Ikeda (N. Atsumi), Omi (E. Chikuma), Inariyama (Sarashina), and the city of Nagano.

(9) March 29th, 1909; 7 am. A slight fall of ashes at Toyoshina (S. Atsumi) and Higashi Kawate (E. Chikuma).

(10) April 16th, 1909; noon. Ashes fell slightly from noon to 1 pm, at Asahi (E. Chikuma), and at about 11 am at Shima-jima and Azusa (S. Atsumi); detonation was heard at the last-named place and at Ono-gawa (S. Atsumi).

(11) May 7th, 1909. Ashes fell in the neighbourhood of the Choga-dake.

(12) May 13th, 1909; 11 pm. At Funatsu, three detonations were heard at about 11 pm, ashes falling for 1 hour from about the midnight. The amount of ashes was 3 mm at Kami-muro and Tagoroya (in Yoshiki county). At Kamihara, 36 km to the W. of the latter, the tree leaves became covered with ashes.

(13) May 15th, 1909; 9 pm. At Omachi (N. Atsumi), loud detonations were heard from 9 pm, ashes falling between 10 and 11 pm.

(14) May 28th, 1909; 6 am. Ashes fell, in the S. and N. Atsumi counties and the city of Nagano.

(14′) June 1st, 1909; 6.15 pm*. Loud detonations for about 15 min.

(15) Nov. 11th, 1910; 5 am. Detonation and explosion; ashes fell in the city of Matsumoto and the vicinity.

(16) Nov. 29th, 1910; 8 pm. At Hirayu (Yoshiki county, Hida), about 7 km to the west of the volcano, detonations were heard at 6.10 am, for 3 min., the black smokes being observed to drift with the westerly winds toward Shinano. In the latter province, at the Atsumi village, ashes fell slightly at 10 pm, on the 29th; the sky was covered by smoke clouds running

* This was a small disturbance whose detonation was heard only in the immediate neighbourhood of the mountain.

toward the SE, at 6 am, on the 30th, and the ashes continued to fall till 2 pm; the Azusa-gawa was rendered for a time turbid. The ashes fell at about 7 am in the entire S. Atsumi county; and at about 8 am at the town of Inariyama. In the Kami Ina and Suwa counties, where no detonation was heard, there were, during the night of the 29th, between 8 pm and 3 am, a slight frost-like precipitation of gray ashes at Konan, Kanazawa, Toyoda, Kami-Suwa, Hirano, Nagaji, Minato, Inatomi, Naka-Minowa, and Kawashima. At Kawagishi (Suwa), the sky which, on the 29th was clear till 8 pm, became thereafter cloudy on account of the ashes, whose accumulation amounted to 0.5 mm.

(17) May 6th, 1911. Strong detonations and explosions, much ashes falling in the neighbourhood of Atsumi-mura, where the new grean leaves of plants were turned gray. The mountain had, after a long period of rest, began its activity since a few days before.

(18) May 11th, 1911; 7½ am. Strong explosion, ashes being carried by winds as far as the city of Nagano.

(19) June 13th, 1911; 8.10 pm. According to Dr. T. Kato, who witnessed this eruption, from Kami-Koji, at a distance of 4 km to the NE of the volcano, the outburst consisted in the emission of black smokes mixed with bright flames like those seen about the gun muzzle at the moment of the discharge, accompanied by loud sounds which lasted 5 min. and among which 4 detonations could be distinguished. At 8.30 pm, the sky was covered with dense black smokes, and from 8.40 pm, ashes began to fall, for 30 min., to a thickness of 3 mm. The stone fragments which fell at a locality called Kurotani, on the W. corner of the crater wall reached the maximum size of 2 feet diameter.

The ashes, which were blown by winds towards the east, and carried as far as Nagano and Ueda, fell heavily in the S. Atsumi county, especially at the villages of Mita, Ogura, Toyoshina, Takaya, Nukumi, and Meisei, where the accumulation on a news paper sheet spread out amounted to about 0.2 litre in 7 minutes. The ashes, which continued to fall till past 9 pm, covered at the different places the leaves of the mulberry trees; the quantity of precipitation being the greatest ever experienced at the city of Matsumoto and the vicinity. At Ueda, the leaves of mulberry trees and vegetables were covered by the grayish ashes, which fell from 9½ pm for about 1 hour, and whose precipitation over a space of 1 sq. metre amounted in the course of 20 minutes to about 6 grams. The ashes fell nearly to an equal amount at Bessho, Aoki, and Sakaki.

(20) June 14th, 1911 ; 9 am. A strong explosion, unattended by detonation. Ashes fell in the neighbourhood of the Kami-Koji spa, for about 30 min., to an amount of 1 mm.

(21) June 16th, 1911 ; 0.30 am. A strong explosion, attended by detonation. At Kami-Koji spa ashes fell to an amount of 2 mm.

(22) June 16th, 1911 ; 2.25 pm. An explosion attended by sound, the black smokes being carried by the SW winds toward Kami-Koji, where a precipitation of ashes took place.

(23) June 17, 1911 ; 1.40 pm. Detonation and explosion ; the ashes, driven by the NW winds, fell at Atsumi-mura and in the districts about Matsumoto and the lake of Suwa.

(24) June 22nd, 1911 ; 7.10 pm. Strong explosion, the ashes falling towards the S. At Hirayu was observed the smoke emission, attended by sounds like those of distant thunders, the ashes continuing to fall from 8½ pm to 2 am on the next morning.

This was the first instance of ashes falling at Hirayu since the explosion of the 13th.

(25) June 24th, 1911 ; 4.40 am. Explosion of black smokes, which were gradually carried toward the S. ; the ashes falling at Kaida, Mitake, and Otaki in the N. Chikuma county.

(26) July 7th, 1911 ; 1.40 pm. Smoke explosion accompanied by flames, lasting for about 20 minutes.

(27) July 8th, 1911 ; 8.30 pm. Ashes fell at the village of Omi, which is situated at the NE part of the E. Chikuma county.

(28) July 10th, 1911 ; 11 am. Detonation at 10 am, followed by explosion at 11 am. Ashes fell at Mita, Ogura, Meisei, and Takaya in the E. part of the S. Atsumi county ; at Ikeda, Aisome, Shichiki, etc., in the SE part of the N. Atsumi county, between 1 and 4 pm ; at Shiozaki and Nakatsu in the Sarashina county, between 2 and 3 pm ; and in the neighbourhood of the city of Matsumoto, and the towns of Matsushiro, Ueda, and Yashiro. Greatest amount of ashes fell, from 11.40 am, at Motoki and Sakakita in the E. Chikuma county. At Takayama (Hida), a loud detonation was heard at about 10 am, the smoke explosion being seen in the maximum intensity at about 11 am.

(29) July 12th, 1911 ; 6½ pm. At 10 am there was some smoke emission, followed at 6½ pm by a strong explosion, accompanied by the loud detonation heard at Toyoshina in the E. part of the S. Atsumi county ; the ashes fell most thickly at Okada and Kami-Kawate, situated to the N. of Matsumoto. In the latter city, the precipitation, which lasted till 11 pm, amounted, as accurately measured at the Sericultural Institute, to 338 grams per sq. *tsubo* (1 *tsubo*=4 sq. metres). The ashes fell towards the E. as far as the towns of Usuta and Komoro in the Saku counties. The slight falling of ashes at Kumagai, 160 km to the E.

a little S. from the Yake-dake, during the night was possibly due to this explosion.

(30) July 16th, 1911; 5.32 pm. Detonation and explosion.

(31) July 17th, 1911; 2.40 am. Loud detonation, emitting smokes and flames.

(32) July 17th, 1911; 6 pm. Explosion, ashes falling at Matsumoto and Atsumi-mura. At 11.20 pm, also detonations for 5 minutes.

(33) Aug. 18th, 1911; 4 am. Loud detonation and explosion; the ashes fell, for about 4 hours, at Nukumi, Azusa, Yamato, Meisei, and other places in the S. Atsumi county, and also at the city of Matsumoto; there was a slight ash-precipitation at Iwamurata (N. Saku county).

There was no further eruption till the end of the year 1911.

43. *Areas of ash-precipitation of Yake-dake eruptions.* The direction and extreme distance of the area of precipitation of ashes in each of the above mentioned explosions are indicated in the following table.

TABLE XXVI. THE ERUPTIONS OF THE YAKE-DAKE: DIRECTION AND LENGTH OF THE AREA OF PRECIPITATION OF ASHES.

No.	Date.	Distance and Direction from the Yake-dake of the area of precipitation of ashes.	Sound Area.
1	Dec. 8, 1907.	35 km, W, till Takayama and Funatsu in Hida.	—
2	,, 11, ,,	30 km, ESE.	—
3	,, 23, ,,	20 km, E.	—
4	Mar. 8, 1908.	Same as (1).	—
6	Jan. 20, 1909.	80 km, NE, till the vicinity of Suzaka.	At Tagoroya, about 12 km to the WNW, strong detonation shook the houses.
7	Mar. 13, ,,	55 km, ESE. till the vicinity of Suwa.	—

No.	Date.	Distance and Direction from the Yake-dake of the area of precipitation of ashes.	Sound Area.
8	Mar. 23, 1909	80 km, NE.	—
9	„ 29, „	35 km, ENE.	—
10	April 16, „	15 km, ESE.	—
11	May 7, „	NE, some 4 km toward the Mount Choga-take.	—
12	„ 13, „	35 km, W, till Funatsu in Hida.	—
13	„ 15, „	33 km, NE, till Omachi.	—
14	„ 28, „	70 km, NE, till Nagano.	—
15	Nov. 11, 1910.	30 km, E, toward Matsumoto.	—
16	„ 29, „	60 km, ESE, till the SE part of Lake Suwa.	Sound heard till Hirayu (Hida).
17	May 6, 1911	15 km, ESE, toward the Atsumi village.	—
18	„ 11, „	70 km, NE, till Nagano.	—
19	June 13, „	70 km, ENE, toward Ueda and Nagano.	—
20	„ 14, „	4 km, NE, toward Kami-Koji spa.	—
21	„ 16, „	Do.	—
22	„ „, „	Do.	—
23	„ 17, „	55 km, ESE, toward Matsumoto and Lake Suwa.	—
24	„ 22, „	10 km, W, toward Hirayu.	Sounds heard at Hirayu.
25	„ 24, „	50 km, S.	—
27	July 8, „	50 km, NE.	—
28	„ 10, „	65 km, NE, toward Matsushiro and Ueda.	Detonation heard at Takayama.
29	„ 12, „	77 km, E, till Komoro and Usuta. (At Kumagai, 160 km to the E slightly S from the Yake-dake, there was slight falling of ashes during the night.)	—
32	„ 17, „	35 km, E, till Matsumoto.	—
33	Aug. 18, „	80 km, E, till Iwamurata.	—

According to the above table the directions toward which the ashes were blown from the Yake-dake were as follows:—

Toward NE ..... 7 cases.

Toward	ENE	2	cases.
„	E	5	„
„	ESE	6	„
„	S	1	„
„	W	4	„

Thus, out of the 25 principal explosions, in four were the ashes blown toward the W. and in one toward the S., while in all the remaining twenty the direction was eastwards, namely, toward the NE, ENE, E, or ESE, the greatest distances of 50 to 80 km being also reached in these latter cases. Thus the eruptions of the Yake-dake seem to indicate, as those of the Asama-yama, the general prevailence of the westerly winds.

44. ***Effect of Yake-dake eruptions on sericulture.*** The consequence of the direction distribution above stated, which is illustrated in Fig. 41, is that such great centres of silk industry in Shinano as Matsumoto, Suwa, and Ueda, suffered great inconvenience from the deposition of the volcanic ashes on the mulberry leaves, with which they had to feed the silkworms. According to the experiments carried on at the Sericultural Institute of Ueda, the silkworms fed with the ash-soiled mulberry leaves indicated a marked inferiority of development, while the cocoons were much smaller, such that the average number in 1 *sho** was 507 against 320 to 400 of the normal ones, and the number of the eggs laid down by a moss so obtained was only from 168 to 367, with the mean of 249, against the ordinary figure of 320 to 560, with the mean of 480. The hatching from these eggs, however, goes on in the usual way, and the new silkworms, at first small and slow in development, gradually attain the condition of those produced under the usual conditions.

* 1 *sho* = 1.8 litre.

45. *Relation between eruptions of Asama-yama and those of Yake-dake.* To find out the time relations, which may exist between the activity of the Asama-yama and that of the Yake-dake, I give in Table XXVII a comparative view of the dates of the 33 explosions of the latter volcano, which happened between Dec. 1907 and Dec. 1911 (§ 42), and of the 62 explosions of the former recorded during the same time interval (Table V), divided conveniently into 9 groups, (i) to (ix).

TABLE XXVII. COMPARISON OF THE ERUPTIONS OF THE ASAMA-YAMA AND THE YAKE-DAKE VOLCANOES.

(*)....Strong Eruption.

Group.	Yake-dake.	Asama-yama.
i	(1) XII, 8th, 1907; 2 pm. (2) „ , 11th, „ ; 9 am. (3) „ , 23rd, „ ; 3 pm.	
ii	(4) III, 8th, 1908; 3 pm.	II, 13th, 1908; evening. „ , 19th, „ ; 11 pm.
iii	(5) VII, 28th, 1908.	VIII, 5th, 1908; 3 am. „ , 16th, „ ; 8 pm. IX, 22nd, „ .
iv, *A*	(6) I, 20th, 1909; 7 pm.*	
iv, *B*		I, 29th, 1909; 5 pm.* II, 2nd, „ ; 2-3 pm.

Group.	Yake-dake.	Asama-yama.
v, *A*	(7) III, 13th, 1909; 11 pm. (8) „, 23rd, „ ; 1.30 pm.* (9) „, 29th, „ ; 7 am. (10) IV, 16th, „ ; noon. (11) V, 7th, „ . (12) „ 13th, „ ; 11 pm. (13) „ 15th, „ ; 9 pm. (14) „ 28th, „ ; 6 am.	IV, 2nd, 1909; 7 am.
v, *B*		V, 31st, 1909; 11.25 pm.* VII, 6th, „ . VIII, 21st, „ ; 6 pm. XII, 7th, „ ; 7.45.07 pm.* II, 12th, 1910; 2 am. V, 2nd, „ ; 9 am. VII, 5th, „ ; 10.50 am. „ 11th, „ ; 11.00 pm. X, 21st, „ ; 3.30 pm. XI, 7th, „ ; —.
vi, *A*	(15) XI, 11th, 1910; 5 am. (16) „, 29th, „ ; 8 pm.*	
vi, *B*		XII, 2nd, 1910; 8.20.53 pm.* „, 15th, „ ; 5.01 pm. „, 16th, „ ; 8.05 am. „, 25th, „ ; 8.45.30 pm. I, 3rd, 1911; 2.— pm. „ 6th, „ ; 1.07 am. „ 16th, „ ; 8.— am. „ 17th, „ ; 2.04.25 am. „ „, „ ; 1.— pm.

Group.	Yake-dake.	Asama-yama.
vi, *B* (*Cont.*)		I, 17th, 1911; night. „ 18th, „ ; 1.08.17 pm. „ „ , „ ; 5.20.58 pm. „ „ , „ ; 9.27.49 pm. „ 19th, „ ; 1.15.18 am. „ „ , „ ; 9.47 — am. „ „ , „ ; 2.17.45 pm. „ 20th, „ ; 0.47.— pm. „ 21st, „ ; 6.— — am. „ „ , „ ; 0.16.35 pm. „ 22nd, „ ; 4.— — pm. „ 23rd, „ ; 4.16.— pm. „ „ , „ ; 9.27.14 pm. II, 4th, „ ; (whole day). „ 6th, „ ; 8.30.— pm. „ 10th, „ ; 5.30.— am. „ 13th, „ ; 10.25.— pm. III, 21st, „ ; 2.46.— am. „ „ , „ ; 9.10.30 am. „ 22nd, „ ; (afternoon). „ 24th, „ ; 11.55.— pm. „ 25th, „ ; 11.03.30 pm. IV, 2nd, „ ; 9.50.— pm. „ „ , „ ; 10.20.— pm. „ 3rd, „ ; 1.52.30 pm. „ 4th, „ ; 8.42.— am. „ 7th, „ ; 3.40.— am. „ 8th, „ ; 1.— — pm. „ 9th, „ ; 10.— — am. „ 11th, „ ; 8.12.— am.

Group.	Yake-dake.	Asama-yama.
vi, *B* (*Cont.*)		IV, 13th, 1911; 2.—— am. „ 16th, „ ; 4.40,— pm.
vii, *A-B.*	(17) V, 6th, 1911; (18) „ 11th, „ ; 7.30 am.	V, 8th, 1911; 3.27.58 pm.*
viii	(19) VI, 13th, 1911; 8.10 pm.* (20) „ 14th, „ ; 9 am. (21) „ 16th, „ ; 0.30 am. (22) „ „ , „ ; 2.25 pm. (23) „ 17th, „ ; 1.40 pm. (24) „ 22nd, „ ; 7.10 pm. (25) „ 24th, „ ; 4.40 am. (26) VII, 7th, „ ; 1.40 pm. (27) „ 8th, „ ; 8.30 pm. (28) „ 10th, „ ; 11 am.* (29) „ 12th, „ ; 6.30 pm.* (30) „ 16th, „ ; 5.32 pm. (31) „ 17th, „ ; 2.40 am. (32) „ „ , „ ; 6 pm. (33) VIII, 18th, „ ; 4 am.	
ix		X, 22nd, 1911; 3.46.04 am.* XII, 3rd, „ ; 3.16 am.

From the above comparative table we may infer the following two-fold relations between the explosions of the Asama-yama and the Yake-dake.

(I) *Activity epochs of the Asama-yama alternate with those of the Yake-dake.* The alternations in the occurrences of the explo-

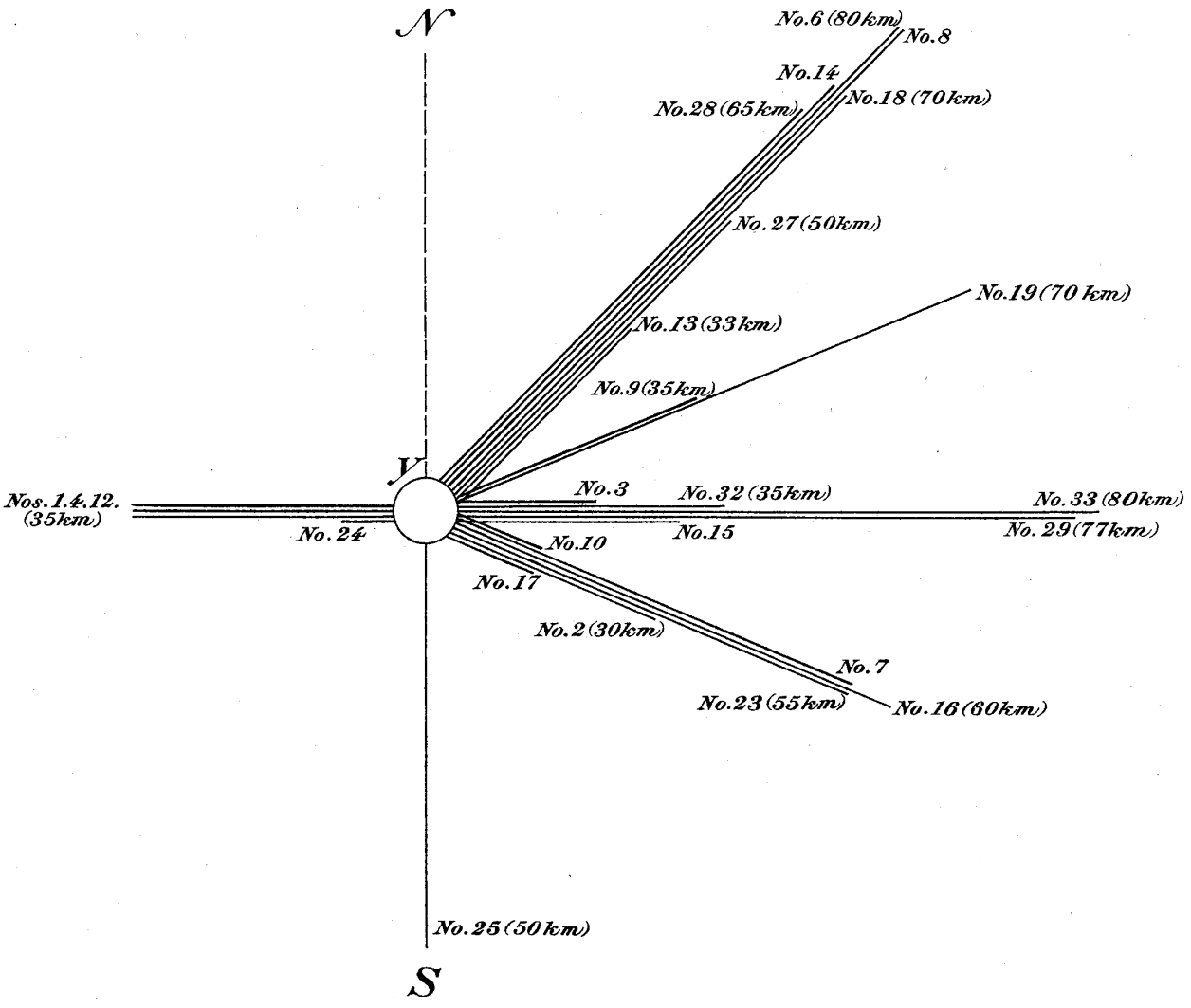
sions of the Asama-yama and the Yake-dake are very clearly indicated by the groups (i), (iv), (v), (vi), (viii), and (ix), in which either of the two volcanoes was excessively active, while the other remained perfectly, or almost entirely, quiet. Thus, in the groups (v, *B*) and (vi, *B*), there were in the intervals of May 31st, 1909—Nov. 7th, 1910, and of Dec. 2nd, 1910—April 16th, 1911, respectively 10 and 40 explosions of the Asama-yama, while the Yake-dake made simultaneously no eruption at all; the groups (iv, *B*) and (ix), each of which comprises 2 explosions of the former, being likewise unattended by disturbances of the latter. On the other hand, in the groups (v, *A*) and (viii), there were between March 13th and May 28th, 1909, and between June 13th and Aug. 18th, 1911, respectively 8 and 15 explosions of the Yake-dake, while the Asama-yama remained during the same intervals quiet, excepting a slight disturbance on April 2nd, 1909; the groups (i) and (vi, *A*), which comprise respectively 3 and 2 explosions of the former, being also accompanied by none of the latter.

(II) *Strong outburst of the Asama-yama follows an explocion of the Yake-dake.** After the disturbances (Group iii) of the Yake-dake and the Asama-yama respectively on July 28th and Aug. 18th of 1908, the two volcanoes were quiet for about 6 months, when the Yake-dake made an explosion on Jan. 20th, 1909, (group iv, *A*); this being followed 9 days after by a strong outburst of the Asama-yama (Group iv, *B*). Again, the Yake-dake, which remained quiet for about 1 year 6 months after the explosion of May 28th, 1909 (end of Group v, *A*), made an explosion on Nov. 11th, 1910, and a strong one on the 29th of the same month

* This view was published in the Jour. of the Met. Soc. of Japan in March 1911, previous to the occurrence of the strong Asama-yama explosion of May 8th in the same year.

Fig. 41. Diagram showing the Direction and Extension of the Ash-precipitation Zone in the different Eruptions of the Yake-dake.

Y.....Yake-dake.
The Nos. put at the end of the different radii are the Numbers of the Eruptions of the Yake-dake.



(Group vi, *A*); this being followed only 3 days after by a powerful outburst of the Asama-yama, which marked the commencement of a long series of the explosions of the latter (Group vi, *B*). Finally, the Yake-dake remained quiet for more than 5 months after the explosion of Nov. 29th, 1910 (Group vi, *A*), but made an explosion on May 6th, 1911 (Group vii, *A*); and this was followed only 2 days after by a strong outburst of the Asama-yama on May 8th, 1911 (Group vii, *B*). Further, the 1st Asama-yama explosion of Group v, *B*, on May 31st, 1909, followed, after an interval of 3 days, the last Yake-dake explosion of Group v, *A*, on May 28th, of the same year. These facts seem to indicate that the eruptions of the two volcanoes are corelated, probably in such a way that, when the stress in the earth's crust is sufficiently increased in the volcanic regions in question, an eruption takes place first from the Yake-dake, serving as a precursor to that from the Asama-yama.

The monthly distributions of the explosions of the two volcanoes within the time limits under consideration are as follows :—

TABLE XXVIII. MONTHLY DISTRIBUTION OF EXPLOSIONS OF ASAMA-YAMA AND OF YAKE-DAKE. DEC. 1907—DEC. 1911.

Month.	Number of Eruptions.	
	Asama-yama.	Yake-dake.
January.	19	1
February.	8	0
March.	5	4
April.	11	1
May.	3	6
June.	0	7

Month.	Number of Eruptions.	
	Asama-yama.	Yake-dake.
July.	3	8
August.	3	1
September.	1	0
October.	2	0
November.	1	2
December.	6	3
Sum.	62	33

As is illustrated in Fig. 14, the maximum numbers of the Asama-yama explosions occurred in January and April, while those of the Yake-dake occurred in May, June, and July; the time distributions for the two volcanoes between December and August being symmetrically opposite to each other.

CHAPTER VIII. THE GREAT ERUPTION OF THE ASAMA-YAMA IN THE 3RD YEAR OF TEMMEI, 1783.

46. *Date of occurrence.* The series of the explosions of the Asama-yama in the 3rd year of the Temmei period, 1783, culminated in a tremendous catastrophe on Aug. 5th. It is a memorable circumstance that in the same year (on Feb. 5th) the great Calabrian earthquake also took place.

As shown in § 9 the frequency of the eruptions of the Asama-yama is subject to an annual variation, which indicates two maxima occurring respectively in April and in August.* The Temmei eruption of the Asama-yama belonged to the latter epoch.

* See also F. Omori: *Notes on the recent volcanic eruptions in Japan.* The Bulletin, Vol. II.