

CHAPTER V. ACCUMULATION AND TRANSPORTATION OF ASHES THROWN OUT DURING THE SAKURA- JIMA ERUPTIONS OF 1914.

34. Emission of ashes from two craterlets groups. The eruptive, especially the explosive, energy of the eastern, or Nabe-yama, side craterlets group was much more powerful than that of the western, or Yokoyama, side one. Thus, for instance, on the latter side only one of the explosive vents is large, while there are on the former four large explosive craterlets, beside a large *eruption crack* formed across the shoulder of Nabe-yama. The volume of lava outflow from the eastern craterlets was also more than double that from the western ones. From these facts it may be concluded that the pumice and ash, which are carried by the winds mainly eastwards, originated at least twice as much from the former than from the latter craterlets group.

35. Distribution of ash and pumice in Sakura-jima. The greatest precipitation of ash and pumice was in the vicinity of Nabe-yama, the thickness of the accumulation being about 4 metres in the valley between the latter and Gongen-yama (a 340-metre hill), and from 1.8 to 2.2 m in the low districts about the village of Krokami. To the S.E., on the top of the 325-metre Sakkabira (Hayasaki) promontory at the opposite side of the former Seto strait, the precipitation was reduced to 69 cm. To the N.E., on the slope of Kita-dake, above Komen at 400 m height, the thickness of the pumice layer was 90 cm, being not less than 1 m on the peak summit itself. On the other hand, the top of Minami-dake was thinly covered by pumice, at least at the S.E. part of the crater rim, where black earth remained exposed at some places.

The Kamano trigonometrical point on the 374 m hill above the villages of Take, Fujino, and Saido, was covered by ash and pumice to a thickness of 1.35 m.

The pumice pieces precipitated during the active epoch of the eruption were larger than those at succeeding times, and the surface ashes which cover the pumice layers were due to the subsequent weaker outbursts. The following supplementary list of the ash and pumice accumulations at different places in Sakura-jima is taken from the report of the Forest Office of Kagoshima respecting the effects of the eruption on forestry.

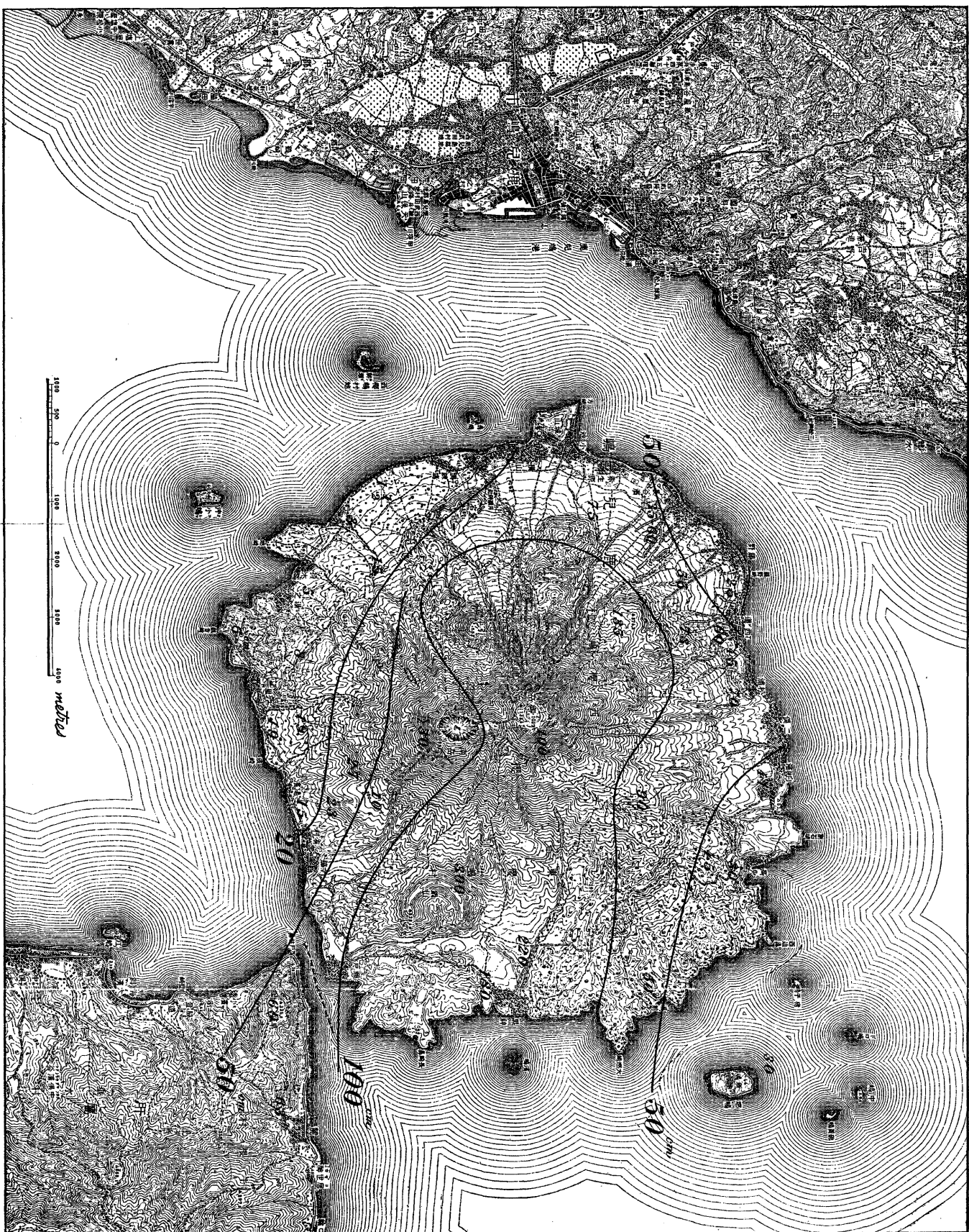
TABLE XX. ACCUMULATION OF ASH AND PUMICE
IN SAKURA-JIMA.

(1 *sun* = 1.2 inch = 30.3 mm.)

Locality.	Surface Ash-layer.	Pumice Layer.		
		Upper portion. (Fine pumice.)	Lower portion. (Coarse pumice.)	Total Thickness.
	<i>sun</i>	<i>sun</i>	<i>sun</i>	<i>sun</i>
Yunohama (湯之濱), at 150 m height.	2.5	1.9	3.1	5.0
Between Yunohama and Furusato, at 150 m height.	2.5	—	—	3.7
Above Yunohama, at 250 m. height.	3.0	—	—	6.0
Cultivated field at the east of Furusato.	2.5	—	—	3.7
Above Furusato, at 140 m height.	2.5	—	—	2.5
Yunohama beach.	3.7	—	—	0.0
Above Kwannon-zaki.	2.5	—	—	0.0
At Kwannon-zaki.	1.9	—	—	0.0
Between Furusato and Yuno (湯之).	1.9	—	—	0.0
At Yuno and Mochiki (持木).	1.7	—	—	0.0
Krokami (黒神).	2.0—3.0	—	—	40.0—70.0
Vicinity of Gongen-yama, near Krokami.	—	—	—	>35.0
At Uranomae (浦ノ前).	6.0	5.0	5.0	10.0
Near Komen, at 150 m height.	1.3	—	—	13.0
Cultivated field at Shirahama (白濱).	0.6	—	—	13.0
„ „ above Matsuura (松浦).	0.5	—	—	18.0
Saido (西道).	1.2	—	—	18.8
Cultivated field above Saido.	(Slight)	—	—	24.0
„ „ at Fujino.	„	—	—	18.0
Near Take (武), at 100 m height.	„	—	—	18.0

Fig. 31. Map showing the Accumulation of Pumice and Ash at different places in Sakura-jima.

(The figures give the thickness of the pumice and ash accumulation.)
The curves, drawn by interpolation, are the lines of 100, 50, and 20 cm accumulation respectively.



As will be seen from the map (fig. 31), the precipitation of volcanic matter in the S.W. portion of the island, from Yunohama to the neighbourhood of Hakamagoshi, was very slight, namely, under 20 cm, and consisted of ashes only. This, together with a few limited localities in the N.W. coast of the island is the only district in the island, where vegetation was not seriously affected by the eruption. The northward extension of the curves of equal accumulation is due to the southerly wind which set in at Kagoshima from about the noon on the 13th (Jan. 1914).

36. Ash-precipitation in the vicinity of Sakura-jima. The map (fig. 33), which indicates the approximate distribution of amount of the ashes in the vicinity of Sakura-jima, namely, the S.E. portion of Kyushu, has been compiled from a great number of reports sent in by the village offices and tobacco plantation stations respectively to the

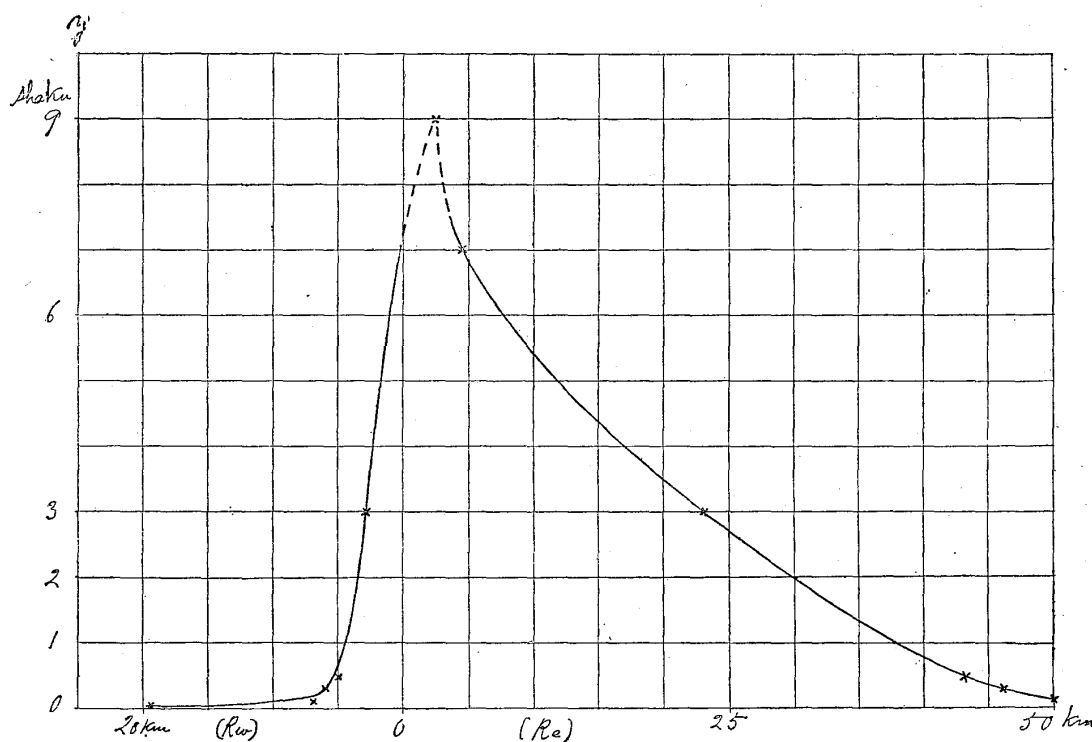


Fig. 32. Diagrammatic Representation of the Ash and Pumice Accumulation along an E.S.E.-W.N.W. line through the centre of Sakura-jima.
(1 shaku=30.3 cm=1 foot very nearly.)

Kagoshima meteorological observatory and Kagoshima Monopoly Bureau, supplemented with a few personal observations. The area of ash-precipitation of over 30 *sun* ($=3$ *shaku* $=3$ feet very nearly) was an ellipse stretching from the centre of Sakura-jima towards the E. slightly S. for a length of about 26 km, with the maximum width of $8\frac{1}{2}$ km. The greatest length of the areas of the precipitation of over 5 *sun* ($=6$ inches), 3 *sun* ($=3\frac{1}{2}$ inches), and 1 *sun* ($=0.1$ foot) were respectively 47, 52, and 70 km. The land area of slight precipitation, or of ash-accumulation of 1 *sun* to about 1 mm, had a radial distance of 120 km in the N.E. direction, but one of only about 20 km toward the W.

The radial distances of the points of intersection of the different curves of equal precipitation amount with a line parallel to E10°S–W10°N, which is the direction of the major axis of the 30-*sun* area, are as follows:—

Westwards from Centre of Sakura-jima.		Eastwards from Centre of Sakura-jima.
—		(East coast of Sakura-j. = 5 km)
—		(Coast of Ushine, Ōsumi = 11 „)
3 km	30- <i>sun</i> Line.....	23 km
5 „	5 „ „	43 „
6 „	3 „ „	46 „
7 „	1 „ „	50 „
22 „	1 mm line (Stretches far out over the ocean.)	

The profile of the cone, or accumulation, of pumice, sand, and ash, based on the above given figures and the observations at Krokami and on the Minami-dake and Kita-dake peaks, is given in Fig. 32, from which it will be seen that the eastern slope is, on an exaggerated scale, perfectly similar to the gradual logarithmic slope of Fuji-san type volcanoes, while the western slope is incomparably much steeper. From this fact, it can perhaps be

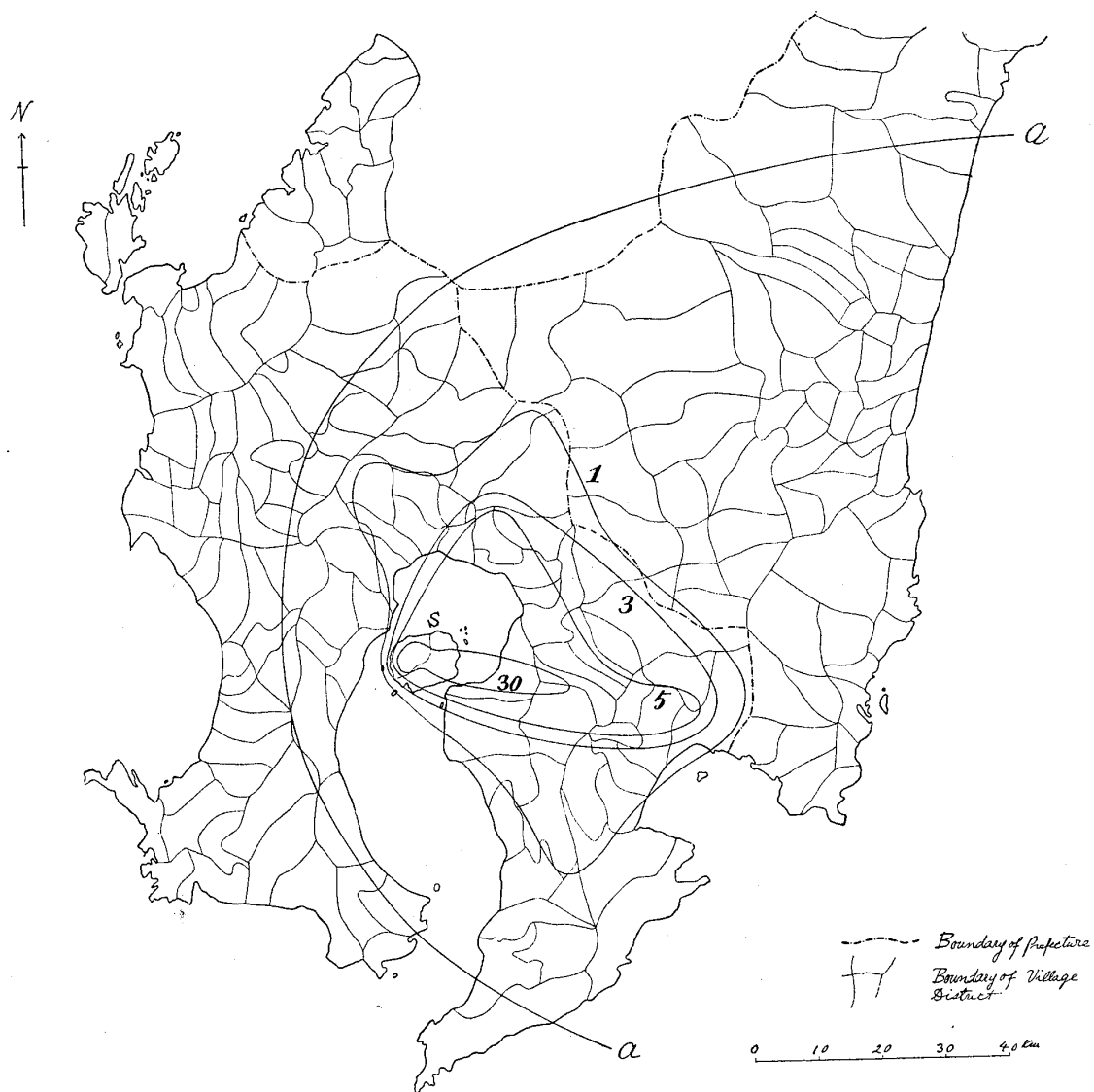
Sakura-jima Eruption of 1914.

Fig. 33. Map showing the approximate Ash-distribution in the S. Portion of Kyushu.

The four inner curves are lines respectively of 30; 5; 3; and 1 *sun* accumulation.

(1 *sun* = 0.1 foot very nearly). The outermost curve (a) marks the boundary of the area of a slight ash-precipitation, about 0.1 *sun* or so.

S. . . . Sakura-jima.



inferred that the form of a cinder and ash cone of large magnitude, resulting from a powerful outburst, must necessarily be unsymmetrical on account of the influence of the strong westerly current in the higher atmospheric region. The high regularity of the conical or logarithmic form of Fuji-san, Kaimon-dake, etc., must essentially depend on the lavas which flowed from the respective central craters. The outline of the volcano of Sakura-jima is also, on the whole, symmetrical with respect to the N.S. direction.

37. Ash-precipitation area. (See Table XXIV, A.) The ashes carried to furthest distances were those due to the strong outbursts during the first two days of the eruption, namely, Jan. 12th and 13th, 1914, the precipitation at different places having taken place on the 12th to 14th. As will be seen from fig. 34, the area in question included Main Island (Honshu), except its N.E. portion, its S.E. corner, and a narrow tract along the Japan Sea coast at the extreme W. end; the whole of Shikoku; and Kyushu, except very small portions at its S.W. and N.W. ends.

The ash-precipitation area was highly eccentric with respect to Sakura-jima, indicating a marked eastward extension, as is usual with great eruptions in Japan where the upper atmospheric current is westerly. So far as is shown in the map (fig. 34), the furthest transportation of the ashes was in the N.E. direction, to Ishinomaki and vicinity, the extreme radial distance* being 1231 km. It is, however, likely that a very small quantity of the ashes was transported also to some places situated outside the general precipitation area, in the N.E. directions. Thus, according to the report of the agricultural station of Hanatate (Senpoku county, province of Ugo), whose radial distance is 1245 km, the water obtained by liquifying the snow precipitated there during the 24

* Distances measured from the centre of Sakura-jima.

hours between 10 a.m., 15th, and 10 a.m., 16th, (Jan. 1914), was markedly turbid and ashy in colour, and gave a large quantity of deposits; the amount of the ashy material* contained in 1 litre of the water in question being 108.3 grams, against the average amount of 3.7 grams for the interval between Dec. 1st. 1913, and Jan. 4th, 1914. This difference represents probably the volcanic ash due to the eruption of Sakura-jima. Ash-precipitation was also reported from a few places near Niigata, in the province of Echigo.

To the north from Sakura-jima, the ash-precipitation was not noticed at the W. coast of Hizen (in Kyushu) and in the islands of Iki (radial distance=267 km) and Tsushima (radial distance=319 km). A thin ashy cloud seems, however, to have spread some distance beyond these limits to the S.E. part of Chosen. Thus, at Fusan (radial distance=419 km), on the 13th (Jan. 1914), when the weather was fine and quiet, there appeared light mists in the early morning due probably to the dusts from Sakura-jima, which thickened at 9 a.m. to an unusual degree, such that the chimneys and other objects at a distance of some 800 m could only be dimly seen, and which were finally dissipated on the commencement of rain at 9.50 a.m.

To the S.W. of Sakura-jima, there was on the 12th and 13th (Jan. 1914) no precipitation of the volcanic dusts in the S.W. part of Satsuma and the S. part of Ōsumi, the shortest distance of transportation of the ashes in the direction under consideration being only 15 km from the centre of the island. Here, again, the fine misty smokes spread some distance further beyond the limit of the area of the actual ash-precipitation. Thus, at Nakano-shima, situated about 200 km to the S.S.W. of Sakura-jima, the

* Solid material obtained by combusting the deposits.

eastern sky was, from about 5 a.m. on the 13th (Jan. 1914), peculiarly orange in colour, while the air was misty, rendering it dark at noon as in the evening.

38. Observations at meteorological stations. In Tables XXII and XXIII I summarize the observations at the different meteorological stations relating to the precipitation of the volcanic dusts of Sakura-jima.

Mists. It will be seen that in Kyushu, Shikoku, and in the western and Kinai districts of Main Island (Honshu), the ash-precipitation was preceded, at an interval of some 9 or more hours, by the development of a peculiar misty condition which rendered the atmosphere considerably opaque. These "mists" were undoubtedly caused by the floating of the extremely minute volcanic dusts given out during the earlier stage of the eruption, say, before 6 p.m. on the 12th (Jan. 1914), when the explosive force was not yet powerful to project to a sufficient elevation the coarser constituents of the ejecta to be precipitated as ash at great radial distances. Owing to the gradual appearance of the "mists," it would naturally be difficult to observe the exact time of their commencement. The earliest arrivals were reported from Kumamoto, Matsuyama, and Kobe, the times observed being 10 p.m. (12th), 6 a.m. (13th), and 7 a.m. (13th), corresponding to the radial distances (r) of 137, 317, and 544 km respectively. Assuming the moment of the beginning of the definite *radial* progress of the smokes first shot up from Sakura-jima to be 11 a.m. (12th, Jan.), we obtain the following rough values of the north-eastward translation velocity of the "misty ash":—

To Kumamoto ($r=137$ km)	Velocity=12.5 km/hour=3.5 m/s.
„ Matsuyama ($r=317$ „)	„ =16.7 „ =4.6
„ Kobe ($r=544$ „)	„ =27.2 „ =7.6

Ashes. The accumulation of the ashes was slight except in

the S.E. portion of Kyūshū. In the N.E. direction from the volcano the precipitation was reduced to 1 mm already at the radial distance of some 150 to 200 km, the decrease in the northern direction being still more rapid. Owing to the smallness of the amount of ash at distant places, the time of commencement of the precipitation, happening in night in many cases, was observed but approximately at the different meteorological stations, probably with the exception of that of Miyazaki, where the accumulation was not insignificant. According to Table XXII, the earliest time of ash-precipitation, reported from the last mentioned place, was $1\frac{3}{4}$ a.m., 13th. Then come Ōita, Kōchi, and Matsuyama, respectively at $8\frac{1}{2}$, 6, and 10 a.m., 13th. At Ōsaka, Kyoto, Iida, and Tsukuba, the precipitation began during the night of the 13th, while at other places in the central and northern parts of Main Island, it was noticed first generally at the early hours of the 14th. Assuming the ashes precipitated at places of great radial distance to be due to the smokes thrown out from Sakura-jima with reinforced violence after 6 p.m., 12th, we get the values of their transit velocity indicated in the 4th column of Table XXI, in which (I) includes the places lying to the N.E., and (II) those lying to the N. or N.N.E., from Sakura-jima.

Again, referring the times of commencement of precipitation of ash at the different distant places to that at Miyazaki, and calculating by the difference method, we get the values of the transit velocity of the volcanic dusts indicated in the last column of Table XXI.

The ash-precipitation became thicker at Miyazaki from 1 p.m., at Kōchi and Tokushima from 8 to $8\frac{1}{2}$ p.m., on the 13th, and at Ōsaka, Yagi, and Wakayama from 2 to 10 a.m., on the 14th; namely, $11\frac{1}{4}$, $9\frac{1}{2}$, 14, 2, 8, and 11 hours after the time of the commencement of the ash-precipitation respectively, giving, with

the exception of Ōsaka, an average value of about $10\frac{3}{4}$ hours. The increase in the precipitation, possibly influenced by the change in the distribution of the barometric pressure over Japan on the 13th and 14th (Jan.), may also denote a stage in the eruption when the ashes began to be thrown out more copiously.

TABLE XXI. APPROXIMATE TRANSIT VELOCITIES OF THE ASHES.

Group.	Place.	Radial Distance.	Average Transit Velocity of Ashes.	
			Direct Calculation.	Calculation by "Difference Method." (Referred to the time of Commencement at Miyazaki.)
I	Miyazaki.	83km.	10.7km/hour.	— km/hour.
	Ōita.	206	14.2	18.2
	Kōchi.	347	29.0*	62.1*
	Matsuyama.	317	19.8	28.4
	Besshi.	355	19.2	25.3
	Ōsaka.	560	18.7	21.4
	Yagi.	579	18.1	20.5
	Kyoto.	606	23.3	28.7
	Wakayama.	512	24.4	32.4
	Tsu.	647	19.5	21.1
	Hamamatsu.	743	21.9	25.2
	Iida.	796	28.4	35.2
	Mito.	1048	27.6	31.9
	Ishinomaki.	1231	29.3	33.5
II	Kumamoto.	137	7.4	5.0
	Shimonoseki.	266	12.7	13.8
	Sakai.	501	23.8	31.6
	Hiroshima.	353	18.6	24.1

* The high values of the velocity for Kōchi is only apparent, the time of commencement of the ash-precipitation at Kōchi (6 a.m., 13th) corresponding probably to the arrival of the "Mists" at the other places.

39. Observation in Ogasawara-jima (Bonin Islands).* According to the report of Mr. Y. Yoshida, director of the meteorological observatory of Chichi-jima, in the Bonin islands group, the circumstances of the ash-precipitation at Futami Harbour were as follows:— On the 12th (Jan. 1914), the sky was cloudy, but the air was dry under the high barometric pressure of 766 mm, with slight N.E. wind. On the morning of the 13th, at about 5. 30 a.m., the arrival of the dense cloudy matter, which was like the sudden visitation of a squall, rendered the air dark, and was at first mistook for development of thick mists by the people, who were, however, soon undeceived, as the fine gray ashes began to fall down. The precipitation was most marked for about $1\frac{1}{2}$ hours, from $6\frac{1}{4}$ to $7\frac{3}{4}$ a.m., and thinly covered the ground and leaves of plants, while the sun looked like a dull white disc amid the dusky sky. The coast of Ōgi-ura on the opposite side of Futami Bay at a distance of 2 miles could but be dimly discerned. From about 9 a.m. the sun began to recover slightly its brightness, but it was only at about 5 p.m. that the weather almost regained its usual aspect. There still remained, however, some mistiness in the air, and in the night the moon and stars shone lazily. A slight fall of rain at a little past 9 p.m. made no change, and the same condition of a milky haziness of the atmosphere continued throughout the 14th and 15th, when high cirrus clouds came floating from the west. On the 16th (Jan. 1914), there developed from the early morning a misty condition which was thicker than on the 13th, fine ashy particles being suspended in the air. After 1 p.m., the sun shone out, but the weather did not regain its ordinary condition, it becoming again dark before the evening. During the

* For the positions of Ogasawara-jima (Bonins) and Kita, Naka, and Minami Iwo-jima (Volcano Islands), see fig. 1 (Pl. VIII).

night the apparent mist became thin. At Haha-jima, in the same Bonin group, the precipitation of ashes is said to have been most marked between 8 and 9 a.m. on the 13th.*

If we assume the ashes precipitated at 5.30 a.m. on the 13th in Chichi-jima, at a radial distance of 1222 km to the S. 68°E. of Sakura-jima, to be due to the transportation of the smoke masses powerfully projected at the commencement of the eruption of the latter, which reached the height of over 3000 m at about 11½ a.m., the average velocity of the S.E. progress of the fine ashes in question comes out to be

$$\frac{1222 \text{ km.}}{18 \text{ hours}} = 67.9 \text{ km/hour} = 18.8 \text{ m/sec.}$$

At Naka-Iwo-jima (Volcano Islands group), lying at a radial distance of 1290 km to the S. 57°E. of Sakura-jima, there was some ash-precipitation on the 15th or 16th of Jan., 1914, turning tree leaves slightly gray in colour.

40. Remarks on transportation of ashes. Comparing together what was said in §§ 36, 37, and 38, it seems that the ashes of the Sakura-jima eruption were carried eastwards, that is to say, toward the directions of N.E. to S.E., the extreme radial distances being over 1200–1300 km. As, however, there was no precipitation of the volcanic dust at Hachijō-jima, situated at the distance of 877 km to the N. 76°E. of Sakura-jima, the ashes transported N.E.'wards over Shikoku and Main Island and those transported S.E.'wards to the Bonins and Volcano Islands might have belonged to the different stages of the eruption. The following seems,

* It is true that the eruption of Sakura-jima was closely followed by the submarine outburst from a point situated 3 miles to the east of Minami Iwo-jima, in the Volcano Islands group, whose smokes were first observed on the 23rd of January (1914), at 4.50 p.m., from Naka Iwo-jima, situated at a distance of only 60 miles from the scene of disturbance. The ashes which fell in the Ogasawara-jima on the 13th seem to be due to the eruption of Sakura-jima on the 12th.

however, to be a more probable explanation of the ash-distribution in question:—As the height attained by the explosive smokes of Sakura-jima was considerable, while the craterlets themselves were at low levels of under 500 m, it is to be expected that the transportation of the ashes to places of different distances depended both on the high and the surface air currents. Thus the ash-precipitation at Ogasawara-jima (Bonins) and Volcano Islands was probably due to the swift upper winds, while that in Main Island, Shikoku, and Kyushu, was effected by the S.W.'ly surface winds, connected with the appearance in the night of the 13th and in the early morning of the 14th, Jan. 1915, of a deep low pressure centre (744 mm) on Japan Sea.

For the N.E.'ly ash-transportation, the different places in Kyushu, Shikoku, and Main Island, considered in § 38, may be grouped according to the radial distance ($=r$), as in the following table, in which a mean value is indicated by gothic numerals, a figure enclosed in brackets being the number of cases from which it has been deduced.

Method of Calculation.	$r < 300$ km	$300 < r < 600$ km*	$600 < r < 1231$ km
Direct Method.	$\frac{\text{km/h}}{7.4-14.2}$	$\frac{\text{km/h}}{20.4(7)}$	$\frac{\text{km/h}}{25.0(6)}$
Difference Method: referred to Miyazaki.	5.0—13.8	26.3(7)	29.3
“Misty Ashes.”	12.5	16.7—27.2	

The mean ash-transportation velocity calculated by the “difference method” is $v_1=26.3$ km/h for the radial distances between 300 and 600 km, and increased to $v_2=29.3$ km/h for those between 600 and 1231 km; the corresponding values calculated by the “direct method” being a little smaller, namely, 20.4 and 25.0 km/h

* Kōchi omitted.

respectively. The velocity for the radial distances less than 300 km was much smaller, the maximum value being about 14 km/h. The transportation velocity of the "misty ashes" was probably not different from that of the ordinary volcanic dusts.

The "difference method" values of the velocity v_1 and v_2 are equivalent respectively to 7.3 and 8.1 m/sec., with the mean value of 7.7 m/sec. Now, on account of the cyclonic weather from the evening of the 13th to the morning of the 15th (Jan. 1914), there prevailed S.W.'ly winds over the central and western Japan, whose mean daily velocity at the different places within the ash-precipitation area varied on the 13th from 0.82 to 3.5 m/sec., and on the 14th from 3.7 to 13.5 m/sec., with the average values of 2.1 and 7.7 m/s. for these two days respectively. The latter average is accidentally identical with the general mean velocity of the ash-transportation above mentioned, which might have depended mainly on the surface winds or those at low altitude.

The high velocity of 67.9 km/hour or 18.8 m/sec., with which the ashes of the Sakura-jima eruption reached Ogasawara-jima (Bonin Islands) is not much different from the values obtained in the case of the Asama-yama eruptions,* for the radial distances under 145 km, as follows:—

Asama Eruption of Dec. 7th, 1909.....	22 m/sec.
„ „ „ Jan. 3rd, 1911.....	17
„ „ „ „ 6th, „	35
<hr/>	
Mean.....	24 m/s=86.4 km/h

41. Ash-precipitation on and after Jan. 15th, 1914. In Table XXIV, B is given a list of places where ash-precipitation took place, which was due to the after-outbursts of Sakura-jima.

* See the Bulletin, Vol. VI, p. 69.

Only on the two days, Jan. 18th and 20th, (1914), ash-precipitation was reported from places outside of Kyushu, namely, from Kyoto and Ōsaka (radial distance=606 and 560 km) and from Katahara and Toyohama, in the provinces of Owari and Mikawa (radial distance=700 km), respectively. At Kumamoto (radial distance=137 km) and Mitai in the N.W. corner of Hyuga (radial distance=140 km), however, the ash-precipitation took place on several occasions; that at the former place dating as late as the 1st and 19th of April, 1914. It thus seems that the after-outbursts were unable to send ashes, except on only a few cases, to distances much above 150 km from the volcano, in the N. or N.E. direction. Again, on the 15th, 16th, 17th, and 19th of Jan. 1914, the ash-precipitation was reported from about one to two dozen places, within area over 200 km in extension; while on the subsequent dates it was limited to only a few places or a single district. This indicates, in conjunction with the falling of ashes in Mikawa and Owari above noticed, that the eruptive energy was reduced in a marked and almost abrupt manner after the 19th and 20th of Jan. (1914): a conclusion which is in perfect accordance with the results of the tromometer observations.

In fig. 29 is shown the area of ash-precipitation on Jan. 17th, 1914, which extended in the N.S. direction for a distance of nearly 300 km, and included the whole of Satsuma, the three islands of Koshiki-jima, Iwo-jima, and Yaku-shima, the S. extremity of Ōsumi, the S.W. portion of Higo, the Shimabara peninsula of Hizen, and the N.W. corner of Hyuga. The ash-precipitation areas on Jan. 15th, 16th, and 19th were somewhat smaller in extension than, but very much similar to, that on the 17th. Now, as will be seen from Chapter III, the barometric distribution over Japan on the 17th of January was nearly identical to that on the 12th

to 13th of the same month; there being in each case an area of high barometric pressure of 770 to 772 mm covering the S.W. part of Japan. Yet the ashes were carried on the occasion of the first outbursts principally eastwards, while on the 15th to 17th, and on the 19th, the precipitation took place principally toward the S.W. and the N., but not toward the E. It is probable that in very strong explosions of Jan. 12th-13th, when the smoke columns were projected vertically upwards to a considerable elevation, the ashes were carried toward the east by the swift westerly current in the higher atmospheric region. In cases of the small outbursts, however, the precipitation of ash depended entirely on the surface winds or on those at a slight elevation, which, on the 17th of January and other dates under consideration, were governed by the existence of a high barometric area in the western and central Japan.

TABLE XXII. ASH-PRECIPITATION AT DIFFERENT PLACES.

[Observations at Meteorological Observatories.]

Place.	Time of Ash-precipitation.	Amount of Ash-precipitation.
Kumamoto.	{ Misty from 10 p.m., 12th. Precipitation of ash from 0½ to 11 p.m., 13th.	{ The ground had the appearance of being covered with white sand.
Miyazaki.	{ Ash-precipitation from 1½ a.m., 13th, became thick from 1 and continued till 7½ p.m., the same day.	{ Thickness = 1.1 mm (measured on the 13th).
Fukuoka.	8 a.m. till night, 13th.	Tree leaves became slightly white.
Ōita.	{ Misty from morning; ash-precipitn. which began at 8.30 a.m., becoming strongest at 6 p.m., and ending at 11.45 p.m., 13th.	{ Ground surface was white as in a frost.
Saga.	{ Apparently enveloped in thick mist in the forenoon, with ash-precipitn. on the afternoon, 13th.	
Nagasaki.	{ Apparently enveloped in thick mist from early morning, 13th.	Tree leaves became white.
Kōchi.	{ Ash-precipitation from 6 a.m., being thickest at 8 p.m., 13th.	Waters of ponds became turbid.
Matsuyama.	{ Misty from 6 a.m., precipitation of ash becoming visible from 10 a.m., 13th.	Ashes adhered to tree leaves.

TABLE XXII. (Cont.)

Place.	Time of Ash-precipitation.	Amount of Ash-precipitation.
Tadotsu.	{ Misty from 9 a.m.; ashes fell in the evening, 13th.	{ Black boards were thinly covered with ashes.
Besshi.	{ Misty from 10 a.m.; ashes fell at 0.30 p.m., 13th.	It was like a very thick mist.
Tokushima.	{ Ash-precipitation from 8½ to 11 p.m., 13th.	It was like a severe frost.
Shimonoseki.	{ Misty from morning, intensified at 3 p.m., 13th. Actual precipitation of ash was not observed.	{ The ground was thinly covered with ash.
Sakai.	{ Misty from 1 p.m.; ashes fell at 3-4 p.m., 13th.	{ Verandahs were thinly covered with ashes. During night, street electric lights were dim.
Hamada.	Misty from morning, 13th.	No ash-precipitation.
Hiroshima.	Ash-precipitation from 1 p.m., 13th.	House roofs became white.
Kôbe.	Misty from 7 a.m., 13th.	{ House roofs were very slightly covered with ash.
Ôsaka.	{ Ash-precipitation from midnight, 13th, thickest from 2-3 till 7 a.m., 14th.	{ The ground looked as if covered by frost. 5 grams of ash were collected on a sheet of paper 4 ft square.
Yagi (Nara).	{ Misty from afternoon, 13th, with ash-precipitation from 2-4 a.m., and thickest at 10 a.m., 14th.	{ Traces of ash were found on earth-thermometers.
Hikone.	—	{ Slight ash-precipitation, not directly observed.
Kyoto.	Ash-precipitation at 8-9 p.m., 13th.	Slight.
Tsu.	{ Ash-precipitation between 4½ and 6 a.m., 14th.	{ Very slight traces left on black boards.
Wakayama.	{ Misty from morning, thickened at 3 p.m., 13th, with ash-precipitation at 1-2 a.m., 14th.	{ Floors were slightly covered with ashes.
Ushio-misaki.	—	Slight.
Fukui.	—	Only a trace.
Hamamatsu.	Ash-precipitation at 4 a.m., 14th.	
Numazu.	„ before 6 a.m., 14th.	{ Green tree leaves became slightly white.
Matsumoto.	„ at the dawn, 14th.	
Iida.	„ before 10 p.m., 13th.	{ Traces of ash found on black boards.
Yokohama.	{ Ash-precipitation from early morning, 14th.	
Kumagai.	{ Ash-precipitation from early morning, 14th.	

(●)....Place where ash-precipitation took place.
 (○).... " " " "
 (◇).... " " " "

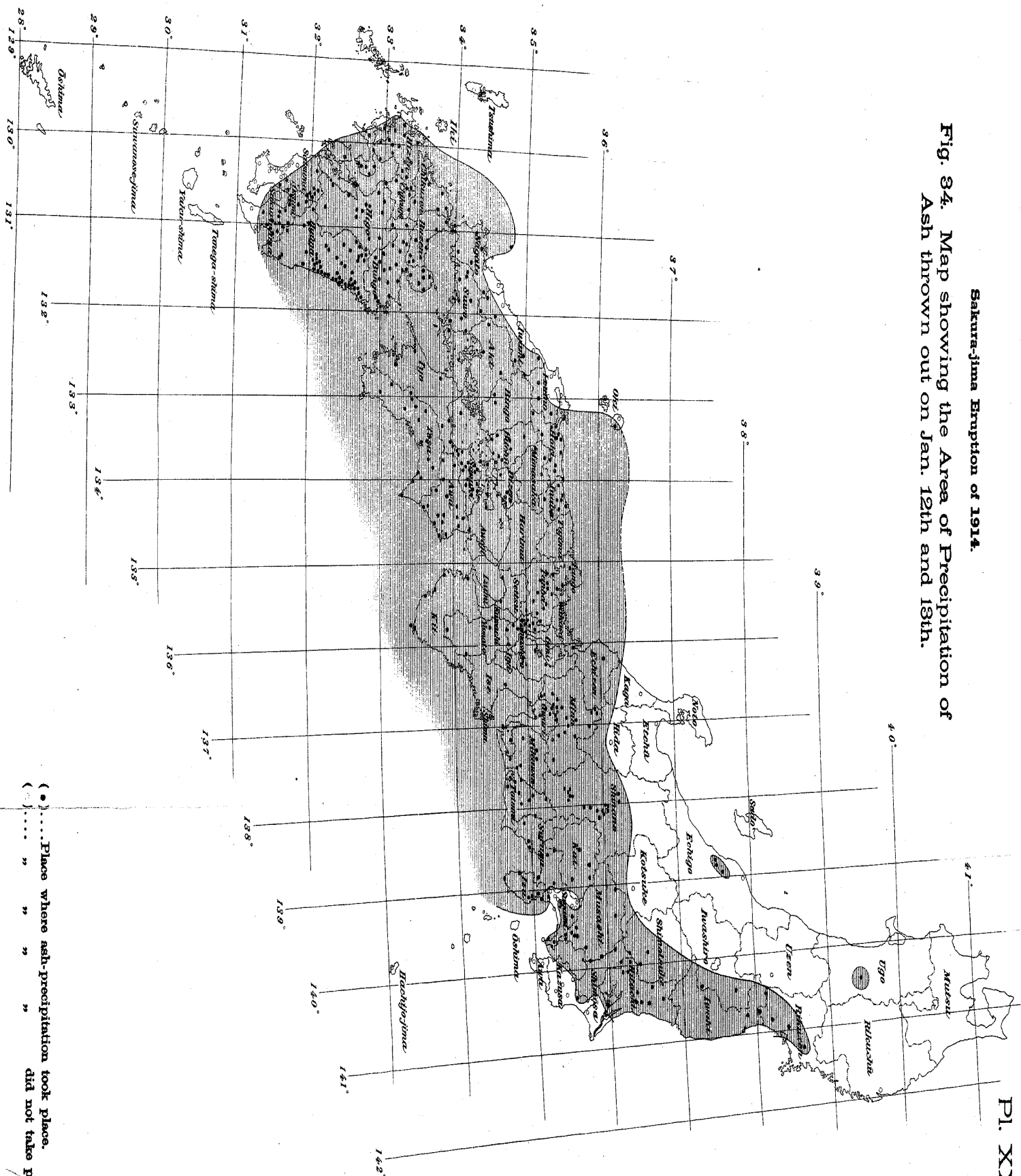


TABLE XXII. (Cont.)

Place.	Time of Ash-precipitation.	Amount of Ash-precipitation.
Nagatsuro.	{ Ash-precipitation from early morning, 14th.	{ Trace of ash like dust was found on floors.
Tsukuba.	{ Ash-precipitation between evening, 13th, and morning, 14th.	
Utsunomiya.	{ Ash-precipitation at 11½ a.m.?, 14th.	
Mito.	Ash-precipitation at 8-8½ a.m. 14th.	
Fukushima.	„ „ 3 p.m.?, 14th.	
Hanadate.	{ „ „ from 10 a.m., 15th. till 10 a.m., 16th.	
Ishinomaki.	Ash-precipitation at 0-2 p.m., 14th.	

TABLE XXIII. LIST OF RADIAL DISTANCE OF, AND APPROXIMATE TIME OF ASH-PRECIPIATION AT, DIFFERENT METEOROLOGICAL OBSERVATORIES.

(Jan. 1914.)

Place.	Radial Distance.	Air became misty at	Ash-precipitation	
			began at	became thicker
		[Kyushu.]		
Kumamoto.	137 ^{km}	12th, 10 p.m.	13th, 0½ p.m.	—
Miyazaki.	83	—	„ 1¾ a.m.	13th, 1 p.m.
Ōita.	206	13th, morning.	„ 8½ „	„ 6 „
		[Shikoku.]		
Kōchi.	347	—	13th, 6 a.m.	13th, 8 p.m.
Matsuyama.	317	13th, 6 a.m.	„ 10 „	—
Besshi.	355	„ 10 „	„ 0½ p.m.	—
Tadotsu.	417	„ 9 „	—	—
Tokushima.	457	—	—	13th, 8½ p.m.
		[Honshu: W. Part.]		
Shimonoseki.	266	13th, morning.	13th, 3 p.m.*	—

TABLE XXIII. (Cont.)

Place.	Radial Distance.	Air became misty at	Ash-precipitation.	
			began at	became thicker
Sakai.	501 ^{km}	13th, 1 p.m.	13th, 3-4 p.m.	—
Hiroshima.	353	—	„ 1 „	—
[Honshu: Kinai and Vicinity.]				
Kobe.	544	13th, 7 a.m.	—	—
Ōsaka.	560	—	13th, 12 p.m.	14th, 2-3 a.m.
Yagi.	579	13th, afternoon.	14th, 2-4 a.m.	14th, 10 a.m.
Kyoto.	606	—	13th, 8-9 p.m.	—
Wakayama.	512	13th, morning.	13th, 3 p.m.*	14th, 2 a.m.
Tsu.	647	—	14th, 4½ a.m.	—
[Honshu: Central and Northern Parts.]				
Hamamatsu.	743	—	14th, 4 a.m.	—
Iida.	796	—	13th, before 10 p.m.	—
Tsukuba.	1004	—	13th, during the night.	—
Mito.	1048	—	14th, 8 a.m.	—
Ishinomaki.	1231	—	„ 0-2 p.m.	—

TABLE XXIV, A. LIST OF PLACES WHERE ASH-PRECIPIATION TOOK PLACE ON 12TH, 13TH, AND 14TH, JAN. 1914.

Places where ash-precipitation took place on the 12th:—

Kagoshima Pref. (Satsuma and Ōsumi). 鹿兒島, Kagoshima. 東南方, Higashi-Minakata. 岩川, Iwakawa. 恒吉, Tsuneyoshi. 市成, Ichinari. 財部, Takarabe. 末吉, Sueyoshi. 松山, Matsuyama. 志布志, Shibushi. 月野, Tsukino. 野方, Nogata. 大崎, Osaki. 加治木, Kajiki. 西國分, Nishi-Kokbu. 牧園, Makizono. 東國分, Higashi-Kokbu. 福山, Fukuyama. 栗野, Kurino. 重富, Shigetomi. 山野, Yamano. 羽月, Hazuki. 西太良, Nishi-Taira. *Miyazaki Pref.* (Hyuga). 福島, (南那珂郡), Fukushima. 油津, Aburatsu. 都城, Miyakonojō. 加久藤, Kakto. 飫肥, Ōbi. *Kumamoto Pref.* (Higo). 高森, Takamori. 宮地, Miyaji. *Fukuoka Pref.* (Chikugo). 柳川, Yanagawa.

* Time when the misty condition of air increased, being here assumed to correspond to the commencement of ash-precipitation.

Nagasaki Pref. (Hizen). 神代, Kōjiro. 南有馬, Minami-Arima.

Saga Pref. (Hizen). 伊萬里, Imari. 古湯, Furuyu.

Places where ash-precipitation took place on the 13th:—

Kagoshima Pref. (Satsuma and Ōsumi). 鹿兒島, Kagoshima. 上出水, Kami-Izumi. 郡山, Kōriyama. 岩川, Iwakawa. 恒吉, Tsuneyoshi. 市成, Ichinari. 財部, Takarabe. 末吉, Suyeyoshi. 松山, Matsuyama. 志布志, Shibushi. 月野, Tsukino. 野方, Nogata. 大崎, Ōsaki. 加治木, Kajiki. 西國分, Nishi-Kokbu. 溝邊, Mizobe. 牧園, Makizono. 東襲山, Higashi-Soyama. 東國分, Higashi-Kokbu. 福山, Fukuyama. 栗野, Kurino. 清水, Shimizu. 横川, Yokogawa. 帖佐, Chōsa. 國分, Kokbu. 西襲山, Nishi-Soyama. 蒲生, Gamo. 吉松, Yoshimatsu. 山野, Yamano. 羽月, Hazuki. 西太良, Nishi-Daira. 大口, Ōguchi. 惠太良, Yetara. 菱刈, Hishikari.

Miyazaki Pref. (Hyuga). 宮崎, Miyazaki. 高原 (西諸縣郡), Takahara. 延岡, Nobeoka. 南郷 (東臼杵郡), Minamigo. 椎葉 (西臼杵郡), Shiiba. 高鍋, Takanabe. 都城, Miyakonojō. 小林, Kobayashi. 飢肥, Obi.

Kumamoto Pref. (Higo). 熊本, Kumamoto. 人吉, Hitoyoshi. 佐敷 (葦北郡), Sashiki. 本渡 (天草郡), Hondo. 八代, Yatsushiro. 三角, Misumi. 砥用 (下益城郡), Tomochi. 松橋 (下益城郡), Matsubashi. 御船 (上益城郡), Mifune. 春日 (飽託郡), Kasuga. 高森 (阿蘇郡), Takamori. 宮地 (阿蘇郡), Miyaji. 高瀬, Takase. 隈府, Waifu. 山鹿, Yamaga.

Fukuoka Pref. (Chikuzen, Chikugo, and Buzen). 福岡, Fukuoka. 柳川, Yanagawa. 大牟田, Ōmuta. 福島, Fukushima. 久留米, Kurume. 北野, Kitano. 吉井, Yoshii. 甘木, Amaki. 西新町, Nishi-Shinmachi. 箱崎, Hakozaki. 東郷, Togo. 折尾, Orio. 直方, Nōgata. 行橋, Yukuhashi. 門司, Mozi.

Nagasaki Pref. (Hizen). 南有馬, Minami-Arima. 神代, Kōjiro. 溫泉, Uzen. 口加, Kōka.

Saga Pref. (Hizen). 佐賀, Saga. 鳥栖 (三養基郡), Tosu. 藤津, Fujitsu. 神崎郡 (農學校), Kanzaki. 小城, Ogi. 武雄, Tokeo.

Ash-precipitation took place on the 13th also at different places throughout the prefectures of Ōita (Bungo), Tokushima (Awa, in Shikoku), Kōchi (Tosa), Kagawa (Sanuki), Yamaguchi (Nagato and Suwō), Hiroshima (Aki and Bingo), Okayama (Bizen, Bitchu, and Mimasaka), Shimane (Izumo, Iwami, and Ōki), Tottori (Inaba and Hōki), Ōsaka (Settsu, Izumi, and Kawachi), Nara (Yamato), and Wakayama (Kii); and on Mount Tsukuba, and in parts of the prefectures of Kyoto (Yamashiro, Tanba, and Tango) and Aichi (Owari and Mikawa).

Places where ash-precipitation took place on the 14th:—

Kagoshima Pref. (Satsuma and Ōsumi). 硫黃島, 甌島, 下屋久, Islands of Iwo-jima, Koshiki-jima, and Yaku-shima. 佐多, Sata. 東南方, (川邊郡), Higashi-Minakata. 中伊集院, Naka-Ijuin. 郡山, Kōriyama. 花岡, Hanaoka. 牧園, Makizono. 福山, Fukuyama. 山田, Yamada. 蒲生, Gamo.

Miyazaki Pref. (Hyuga). 都城, Miyakonojō. 飢肥, Obi. 高千穂 (西臼杵), Takachiho. 延岡, Nobeoka.

Kumamoto Pref. (Higo). 人吉, Hitoyoshi. 砥用 (下益城郡), Tomochi. 御船 (上益城郡), Mifune. 春日 (飽託郡), Kasuga.

Fukuoka Pref. (Chikzen, Chikugo, and Buzen). 福島, Fukushima. 箱崎, Hakozaki. 行橋, Yukuhashi. 小倉, Kokura. 門司, Moji.

Yamaguchi Pref. (Suwō and Nagato). 防府, Bofu. 徳山, Tokuyama. 徳佐 (阿武郡), Tokusa. 田耕, Tasuki.

Ookayama Pref. (Mimasaku). 奥津 (苦田郡), Okutsu.

Saga Pref. (Hizen). 嬉野, Ureshino.

Tokushima Pref. (Awa). 石井町 (名西郡), Ishii-machi. 椿 (那賀郡), Tsubaki. 富岡 (那賀郡), Tomioka. 鳴門 (板野郡), Naruto.

Kōchi Pref. (Tosa). 中村 (幡多郡), Nakamura. *Ehime Pref.* (Iyo). 新居濱, Niihama.

Ibaraki Pref. (Hitachi). 水戸, Mito. 筑波, Tsukuba. *Miyagi Pref.* (Rikzen). 石巻, Ishinomaki.

On the 14th, the ash-precipitation took place also at Kōbe, Ōsaka, Tsu, and Tokyo; and at several places in the prefectures of Shimane (Iwami, Izumo), Wakayama (Kii), Nara (Yamato), Kyoto (Yamashiro, Tanba, Tango), Aichi (Owari, Mikawa), Gifu (Mino, Hida), Fukui (Echizen, Wakasa), Shizuoka (Totomi, Suruga, Izu), Kanagawa (Musashi, Sagami), etc.

TABLE XXIV, B. LIST OF PLACES WHERE ASH-PRECIPIATION TOOK PLACE ON AND AFTER THE 15TH OF JAN. 1914.

All the places, unless otherwise marked, belong to Kagoshima prefecture. Those marked 1, 2, 3, 4, 5, and 6, belong respectively to the provinces of Hyuga, Buzen, Higo, Hizen, Owari, and Mikawa. On Jan. 18th, 1914, there was a slight ash-precipitation in Kyoto and Ōsaka.

Jan. 15th.	硫黄島 Iwo-jima.	郡山 Koriyama.	飯肥 Obi.
	甕島 Koshiki-jima.	花岡 Hanaoka.	三田井 Mitai.
	下屋久 Yaku-shima.	内之浦 Uchinoura.	行橋 Ikuhashi.
	隈之城 Kumanoki.	蒲生 Gamo.	
Jan. 16th.	硫黄島 Iwo-jima.	今和泉 Imaizumi.	小根占 Konejime.
	下屋久 Yaku-shima.	指宿 Ibusuki.	大根占 Onejime.
	東市來 Higashi-Ichiku.	山川 Yamagawa.	田代 Tashiro.
	吉永 Yoshinaga.	颯娃 Yei.	三田井 Mitai. (1)
	喜入 Kiire.	鹿屋 Kanoya.	
Jan. 17th.	鹿兒島 Kagoshima.	中伊集院 Naka-Ijuin.	今和泉 Imaizumi.
	硫黄島 Iwo-jima.	上伊集院 Kami-Ijuin.	指宿 Ibusuki.
	甕島 Koshiki-jima.	郡山 Koriyama.	山川 Yamagawa.
	下屋久 Yaku-shima.	日置 Hioki.	颯娃 Yei.
	佐多 Sata.	吉利 Yoshitoshi.	三田井 Mitai. (1)
	上出水 Kami-izumi.	田布施 Tabuse.	佐敷 Sashiki. (3)
	隈之城 Kumanoki.	阿多 Ada.	本渡 Hondo. (3)

TABLE XXIV, B. (Cont.)

Jan. 17th.	西市來 Nishi-Ichiku. 下伊集院 Shimo-Ijuin.	加世田 Kaseda. 喜入 Kiire.	溫泉 Unzen. (4)
Jan. 18th.	硫黃島 Iwo-jima. 甕島 Koshiki-jima. 三田井 Mitai. (1)	下屋久 Yaku-shima. 喜入 Kiire.	大阪 Ōsaka. 京都 Kyoto.
Jan. 19th.	鹿兒嶋 Kagoshima. 中之島 Nakano-shima. 硫黃島 Iwo-jima. 下屋久 Yaku-shima. 佐多 Sata. 上出水 Kami-Izumi.	中伊集院 Naka-Ijuin. 上伊集院 Kami-Ijuin. 日置 Hioki. 阿多 Ada. 加世田 Kaseda. 喜入 Kiire.	指宿 Ibusuki. 山川 Yamagawa. 宮崎 Miyazaki. (1) 三田井 Mitai. (1) 熊本 Kumamoto. (3) 佐敷 Sashiki. (3)
Jan. 20th.	高鍋 Takanabe. (1)	形原 Katahara. (6)	豐濱 Toyohama. (5)
Jan. 21st.	高鍋 Takanabe. (1)		
Jan. 22nd.	鹿兒島 Kagoshima. 郡山 Koriyama. 阿多 Ada.	加世田 Kaseda. 喜入 Kiire.	指宿 Ibusuki. 山川 Yamagawa.
Jan. 23rd.	鹿兒嶋 Kagoshima.		
Jan. 24th.	鹿兒嶋 Kagoshima.	隈之城 Kumanoki.	佐敷 Sashiki. (3)
Jan. 26th.	今和泉 Imaizumi.	Jan. 29th.	熊本 Kumamoto. (3)
Feb. 2nd.	今和泉 Imaizumi.	Feb. 4th.	阿多 Ada.
Feb. 5th.	加世田 Kaseda.		
Feb. 7th.	上出水 Kami-Izumi. 郡山 Koriyama. 日置 Hioki.	阿多 Ada. 喜入 Kiire.	熊本 Kumamoto. (3) 佐敷 Sashiki. (3)
Feb. 15th.	中伊集院 Naka-Ijuin.	佐多 Sata.	
Feb. 17th.	熊本 Kumamoto. (3)	佐敷 Sashiki. (3)	
Feb. 19th.	上伊集院 Kami-Ijuin.	March 5th.	佐敷 Sashiki. (3)
March 6th.	熊本 Kumamoto. (3)	March 15th.	佐多 Sata.
March 17th.	佐多 Sata.	March 20th.	熊本 Kumamoto. (3)
March 27th.	佐多 Sata.	March 31st.	佐多 Sata.
April 1st.	熊本 Kumamoto. (3)	April 6th.	佐多 Sata.
April 17th.	佐多 Sata.	April 19th.	熊本 Kumamoto. (3)