50. *The Explosive Activities of Volcano Asama in 1935. (Part 1.)*

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(Read May 21, 1935.—Received June 20, 1935.)

1. Introduction.

The remarkable activity of volcano Asama that began in April 20, 1935, continued until the later part of May the same year.

For some years since the explosions in the autumn of 1932, Asama had been very inactive, with neither eruption of any violence nor earthquakes originating in the volcano. But as reported by the writer

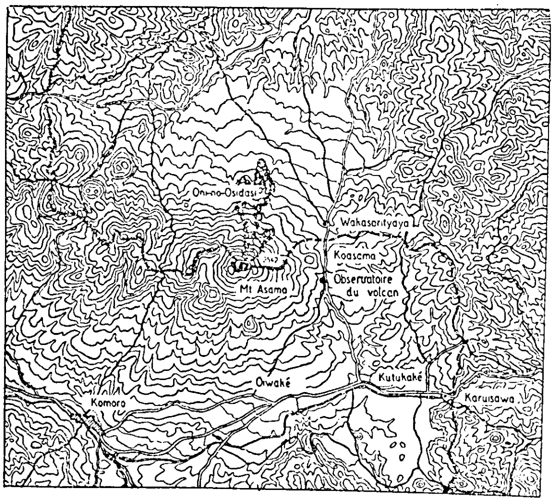


Fig. 1. Topographic map of volcano Asama and its vicinity.

in his previous paper, the crater floor, which has been rising since October 1934 as well as the considerable tilting of the earth's surface that had begun in October 1934, was observed at our Observatory, which is situated 5 km away from the crater (Fig. 1). It was in view of these phenomena and the conditions of the vapours emitted from the crater, that the writer concluded in the previous paper that the volcano was showing signs of coming activity as early as October 1935. This paper is mainly a description of the sound phenomena and the distribution of volcanic bombs and ashes in the explosion of April 20, 1935. Full details of the explosions that took place after that date, together with the observations made by various means, will be given in following papers.

2. List of Eruptions in April and May 1935.

For convenience of description, the explosions have been divided into the following four stages according to the nature of the outburst.

A; Violent explosion with strong detonation, with projection of numerous volcanic bombs, small fragmental lavas, and ashes; earth-shaking and air vibrations sensible 100 km distant from the volcano.

B; Explosion with strong detonation, with projection of volcanic bombs and ashes, but in less amount than A; earth-shaking and air vibration felt about 50 km distant.

C; Explosion with or without small detonation, with projection of small volcanic bombs, fragmental materials and ashes; earth-shaking sensible to seismographs, but not the air vibration.

D; Small non-detonating eruption with projection of only volcanic gravels and ashes, with or without volcanic tremors.

Table I.

No.	Class	Date	Time of occurrence	Remarks
			h. m. s.	
1	A	April 20, 1935	4.21.02. p.m.	Sound heard in Tôkyô and Nagoya. Ashes fell in Tiba and Tôkyô.
2	D	〃 21, 〃	0.15. 〃	
3	C	〃 〃, 〃	10.25. 〃	
4	D	〃 22, 〃	5.30. 〃	
5	〃	〃 〃, 〃	4.33. 〃	
6	〃	〃 23, 〃	11.37. a.m.	
7	〃	〃 〃, 〃	3.37. p.m.	
8	〃	〃 24, 〃	3.30. a.m.	
9	〃	May 4, 〃	11.15. 〃	
10	B	〃 5, 〃	8.47.05. 〃	Sound heard in Tôkyô.
11	C	〃 〃, 〃	11.18. 〃	
12	D	〃 6, 〃	8.32. 〃	
13	C	〃 〃, 〃	7.50. p.m.	

(to be continued.)

Table I. (*continued.*)

No.	Class	Date	Time of occurrence	Remarks
			h. m. s.	
14	C	May 11, 1935	2.22.15. a.m.	Sound heard in Tôkyô and ashes fell in Tôkyô.
15	B	〃 〃, 〃	4.06.54. 〃	Sound heard in Tôkyô where ashes also fell.
16	〃	〃 〃, 〃	6.26.12. 〃	〃
17	D	〃 〃, 〃	8.00. 〃	
18	〃	〃 〃, 〃	2.37.38. p.m.	
19	〃	〃 〃, 〃	4.15. 〃	
20	C	〃 14, 〃	8.26. a.m.	
21	A	〃 16, 〃	9.15.50. p.m.	Sound heard in Tôkyô.
22	D	〃 19, 〃	8.30. a.m.	
23	B	〃 20, 〃	4.02.08. 〃	
24	D	〃 〃, 〃	8.30. 〃	
25	〃	〃 〃, 〃	10.30. 〃	
26	〃	〃 21, 〃	4.13. p.m.	
27	B	〃 22, 〃	11.23.21. a.m.	Sound heard in Tôkyô.
28	D	〃 〃, 〃	6.25. p.m.	
29	〃	〃 23, 〃	4.25. a.m.	
30	〃	〃 〃, 〃	11.45. 〃	
31	〃	〃 〃, 〃	12.00. 〃	
32	C	〃 〃, 〃	7.11. 〃	
33	D	〃 24, 〃	10.23. 〃	
34	〃	〃 〃, 〃	3.05. p.m.	
35	〃	〃 〃, 〃	5.21. 〃	
36	〃	〃 〃, 〃	8.01. 〃	
37	〃	〃 25, 〃	1. 〃	
38	〃	〃 〃, 〃	2.25. a.m.	
39	〃	〃 26, 〃	3.20. 〃	
40	C	〃 〃, 〃	2.30. p.m.	
41	B	〃 28, 〃	6.14.49. 〃	Sound heard in Tôkyô. A large quantity of ashes fell in the neighbourhood of our Observatory.

3. The violent Explosion of April 20 1935.*

(a) *Deformation of the crater floor caused by this explosion.*

During the period from July to October, 1934, the writer surveyed the crater floor in order to ascertain the rise or fall of the lava in the crater, with the result that although the floor continued to sink from July to September, after the latter part of September it began

* See Fig. 14.

to rise with a mean daily rate of 20 cm. This elevation of crater floor had amounted to about 50 m just before the explosion. The explosion threw out the massive lava that lay on the crater floor, and which measured 150 m × 150 m × 100 m, in the form of volcanic bombs, volcanic gravels, and volcanic ashes. The lava thus poured out consisted principally of the andesite and pumice-stone that had covered the surface of the crater floor to a thickness of about 1 m, with the result that the total mass of the lava ejected in this explosion, calculated on a mean lava density of 2·0, amounts to

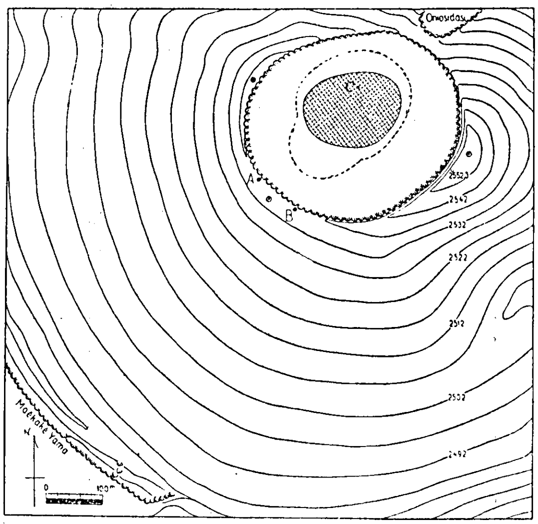


Fig. 2. ; Crater-bottom scooped out by the explosion.

$$4{\cdot}5 \times 10^9\ \text{kg} = 4{\cdot}5 \times 10^6\ \text{tons}.$$

Fig. 2 is a plan of the lava projected from the crater floor. Fig. 3 shows the rise and fall of point C on the crater floor shown in Fig. 2. Fig. 15 is a photograph of the crater floor taken from the south side on the crater wall in October, 1934. Figs. 16 and 17 are these of the crater floor taken from the same place and in the same direction on six days after the explosions. A mere glance at these photographs is enough to give one an idea of the immense change that occurred in the crater floor. Fig. 17 shows the south slope of the crater floor hollowed out and a part of the floor which was not hollowed out.

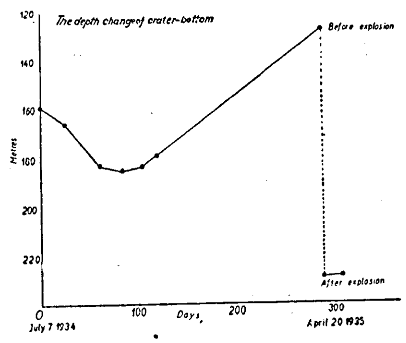


Fig. 3.

(b) *Volcanic bombs, volcanic gravels, and ashes.*

Since as already mentioned, the rocks ejected consisted of andesite and pumiceous rocks that had formed the surface of the crater floor, in the explosions that followed the one forming the subject of this paper, practically no more pumiceous rocks were to be seen. Fragments of that big lava mass of about $4{\cdot}5 \times 10^6$ tons were scattered in all directions in the form of volcanic bombs. These bombs were larger in size and greater in numbers the nearer they were to the crater; the whole surface of the central cone, which is less than 600 m distant from the crater, was covered with new volcanic bombs, of which the largest, 18 m in circumference, fell on the central cone at a distance of about 100 m S. W. of the crater. Assuming the density of this

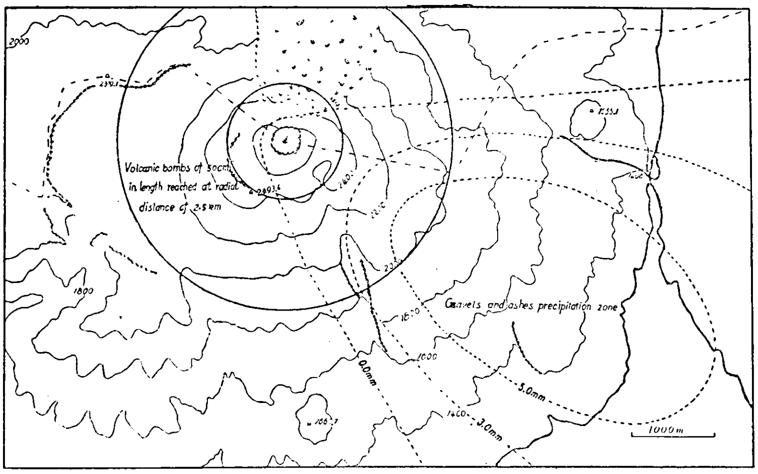


Fig. 4. Ashes-precipitation scatterd by the explosion on April 20, 1935.

bomb, which consisted of andesite, to be 2·5, the mass is 2×10^5 kg, or 200 tons. Fig. 18 is a photograph of this bomb taken on April 26, 1935, at 6 h a.m., six days after the explosion. This bomb had disintegrated about a week after this photograph was taken. Besides this large one, several smaller bombs larger than 3 m in diameter fell on the central cone. Fig. 19 is a photograph of the holes made by bombs that fell on the snow at Maekaké-Yama, distant about 600 m S. W. of the crater. Generally, the diameter of the holes made on the ground where small fragments of pumiceous lava or volcanic ashes were piled up, are about three to four times those of the volcanic bombs that fell there, while the shape of those holes, regardless of that of the bombs, was always an inverted cone. The cylindrical holes made in the snow are naturally slightly larger in diameter than the bombs themselves. Regardless of size, it is always possible to classify volcanic bombs into two types according to their shape; the one being either a regular spindle shape or spherical and the other irregular in shape. An example of the former type is shown in Figs. 21∼25, and the latter in Figs. 18∼26. The cause of these two types of bombs may be due to the particular materials composing the bombs, as also to its softness at the time they were shaped. Bombs of 0·5∼1·0 m in diameter travelled to distances within 2500 m from the crater. They are shown in Fig. 4. Small fragmental lava, such as volcanic gravel and ash, being easily transported by wind, travelled to distances more than 2500 m from the crater.

As will be seen from Figs. 4, 5, the gravel and ash precipitation zone was a narrow band, Tôkyô and Tiba (east-south direction from the crater) being included in it. Some of this was blown away into the Pacific Ocean.

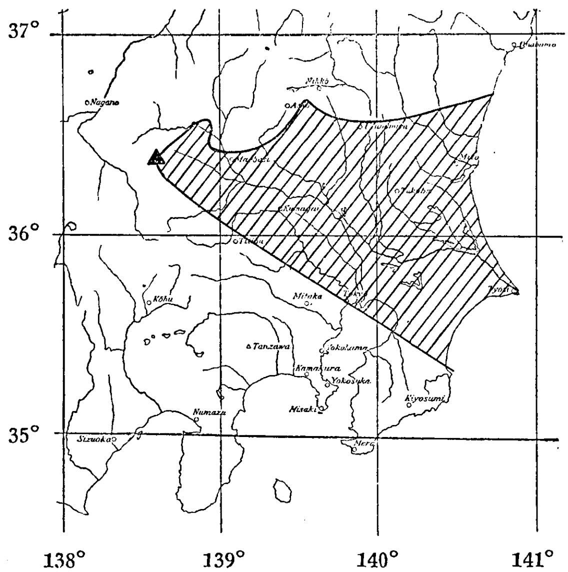


Fig. 5. Ashes-precipitation area.

Needless to say, the bombs at the moment they were projected from the crater, had a very high temperature. In fact, on April 21, at about 12 h, the surface temperature of bombs about 1 m in diameter, found 800 m east of the crater, was about 400°C, that is 20 hours after the eruption.

Moreover, the surface temperature of the largest bomb in this explosion (bomb shown in Fig. 18) was about 200°C at 6 h a. m. on April 26, six days after the explosion. On the other hand, according to temperature measurements of the lava in the crater floor made by the writer in September and October 1934 by means of an optical pyrometer and thermo-junctions, heated lava had a temperature of about 1000°C. From which it may be concluded that the maximum temperature of bombs at the moment of projection was about 1000°C.

Consequently, as soon as this explosion occurred, a field fire broke out southward of the volcano, destroying grass and bushes to the extent of an area 1 km square, the spot being shown in Fig. 7. Investigations showed that the fire originated from numerous small bombs that were only about 10∼20 cm in diameter. This field fire, which broke out at 4 h 22 m p. m. on the 20th died out at 11 h p. m.

(c) *The sound of the explosion.*

The sound of the explosion is perhaps the most noteworthy feature of the various volcanic phenomena of Asama. People who happened to be at the foot of the volcano at the time, were astounded while the earthquake caused by the explosion was not violent enough to be felt at the Observatory, the air vibration was so violent that people at the foot of the volcano were made aware of the explosion by the arrival of this sound about 20 seconds after the outburst.

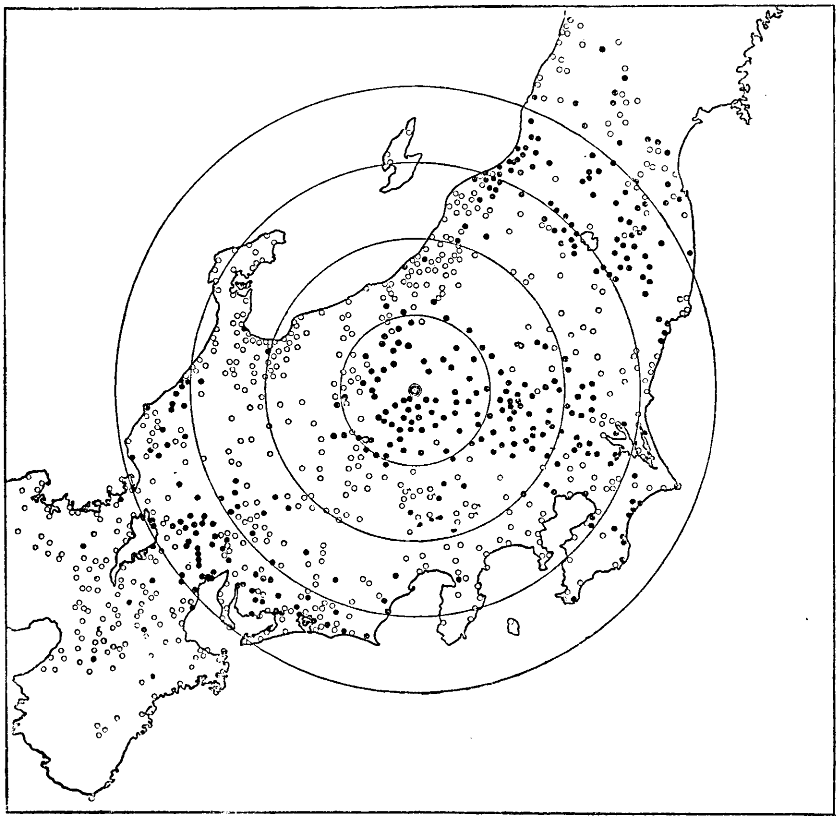


Fig. 6. Sound area ●; sound heard ○; sound not heard.
Radius of circles; 50 km, 100 km, 150 km, 200 km.

At Kutukaké, 10 km ESE of the crater, the air vibration was strong enough to shake houses and shatter window-panes that happened to face the volcano. At Kutukaké also, and at Karuizawa, another foot of the volcano, sliding doors were thrown out of their grooves by the air vibration. For the purpose of ascertaining the sound area, inquiries were sent out to some 2000 primary schools located in the principal islands of Japan. As will be seen from Fig. 6, the sound area may be regarded as being formed of two zones, the inner and the outer. The former extends to a distance of 50 km, North, South, and West, but to a distance of 200 km east of the volcano. The latter consists of two arcs, the inner one with a mean internal radius of 150 km and the outer with the same of 250 km. In the east direction, however, there is no such distinction in the sound area as the inner and outer zones.

The results of our detailed studies concerning the area and velocity of the sound will be reported in forthcoming papers.

4. Certain Aspects of Explosions that occurred after the One of April 20, 1935, at 4 h 21 m p.m..

The precipitation-zone of volcanic ashes projected by every violent explosion is always found to be in an eastward direction, the reason of which is that ashes projected to a height of from 3 to 5 km from

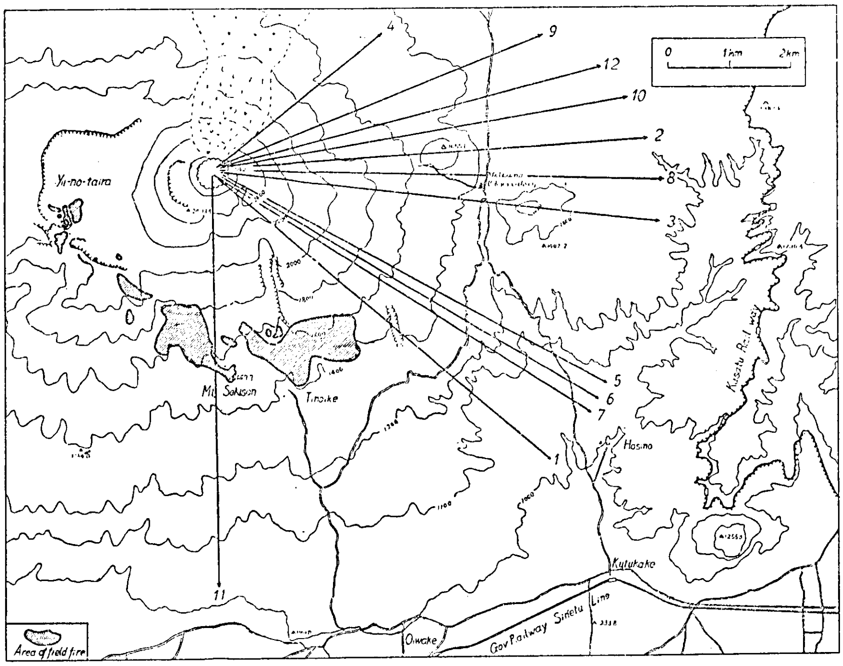


Fig. 7. The directions of ashes precipitation scattered by the following explosions.

1, April 20, 4^h p.m.	5, May 11, 2^h a.m.	9, May 20, 4^h a.m.
2, 〃 21, 10^h p.m.	6, 〃 11, 4^h a.m.	10, 〃 22, 11^h a.m.
3, May 5, 8^h a.m.	7, 〃 11, 6^h a.m.	11, 〃 24, 3^h p.m.
4, 〃 6, 8^h a.m.	8, 〃 16, 9^h p.m.	12, 〃 28, 6^h p.m.

the crater, are blown away eastward by the upper wind which always blows in that direction. Fig. 7 shows the directions of the precipitation-zone of the ashes. Of these directions of the precipitation–zone, those toward the north and south were caused by small eruptions, the ashes being blown away by the lower wind, as the result of which in most violent explosions, ashes fell at our Observatory, which is situated east of the volcano. The ashes never fell in a west-direction, even on occasions when they fell at Tôkyô. Komoro at the western foot of the volcano is generally safe from ash-precipitation. Field fires started by volcanic bombs occurred with every violent explosion. The total area of ruined fields caused by violent explosions amounting to 1·3 km square, is shown in Fig. 7 and in Table II. Changes in atmospheric pressure caused by the detonating explosions are registered by an aneroid installed in a room of the Observatory. In Table III, are shown the amplitudes of changes in atmospheric pressure.

Table II.

Date of explosion	Area of ruined fields	Date of explosion	Area of ruined fields
April 20, 1935.	138·35 hectares.	May 22, 1935.	10·00 hectares.
May 11, 〃	10·00 〃	〃 28, 〃	8·00 〃
〃 16, 〃	10·00 〃		Total **177·35** 〃

Table III. Explosions.

Date	Time of occurrence	Change in atm. pressure
	h. m. s.	
April 20, 1935	4. 21. 02. p.m.	6·1 mm./Hg.
May 5, 〃	8. 47. 05. a.m.	3·1 〃
〃 11, 〃	2. 22. 15. 〃	2·1 〃
〃 〃, 〃	4. 06. 54. 〃	1·1 〃
〃 〃, 〃	6. 26. 12. 〃	6·0 〃
〃 16, 〃	9. 15. 50. p.m.	3·0 〃
〃 22, 〃	11. 23. 21. a.m.	2.5 〃
〃 28, 〃	6. 14. 49. p.m.	1.8 〃

5. Volcanic Micro-tremors.

During the year 1934, the seismographs (magnification 100) of our Observatory did not register any volcanic micro-tremors. They were observed for the first time on January 2, 1935, and thereafter. In Table IV are shown the daily numbers of these micro-tremors that were recovered, from which it will be seen that more micro-tremors occurred on days previous to than on the day of the outburst. The total number of micro-tremors for ten days are shown in Fig. 8.

Table IV.

Date	Number of occurrence of micro-tremors	Date	Number of occurrence of micro-tremors	Date	Number of occurrence of micro-tremors
Dec. 1, 1934	0	Jan. 21, 1935	12	Mar. 12, 1935	9
″ 2, ″	0	″ 22, ″	4	″ 13, ″	3
″ 3, ″	0	″ 23, ″	6	″ 14, ″	5
″ 4, ″	0	″ 24, ″	16	″ 15, ″	7
″ 5, ″	0	″ 25, ″	6	″ 16, ″	11
″ 6, ″	0	″ 26, ″	2	″ 17, ″	17
″ 7, ″	0	″ 27, ″	10	″ 18, ″	5
″ 8, ″	0	″ 28, ″	3	″ 19, ″	4
″ 9, ″	0	″ 29, ″	4	″ 20, ″	4
″ 10, ″	0	″ 30, ″	6	″ 21, ″	4
″ 11, ″	0	″ 31, ″	10	″ 22, ″	5
″ 12, ″	0	Feb. 1. ″	13	″ 23, ″	1
″ 13, ″	0	″ 2, ″	5	″ 24, ″	7
″ 14, ″	0	″ 3, ″	15	″ 25, ″	25
″ 15, ″	0	″ 4, ″	7	″ 26, ″	12
″ 16, ″	0	″ 5, ″	9	″ 27, ″	3
″ 17, ″	0	″ 6, ″	0	″ 28, ″	11
″ 18, ″	0	″ 7, ″	2	″ 29, ″	11
″ 19, ″	0	″ 8, ″	16	″ 30, ″	11
″ 20, ″	0	″ 9, ″	6	″ 31, ″	4
″ 21, ″	0	″ 10, ″	32	Apr. 1, ″	7
″ 22, ″	0	″ 11, ″	6	″ 2, ″	3
″ 23, ″	0	″ 12, ″	5	″ 3, ″	11
″ 24, ″	0	″ 13, ″	5	″ 4, ″	6
″ 25, ″	0	″ 14, ″	12	″ 5, ″	10
″ 26, ″	0	″ 15, ″	24	″ 6, ″	8
″ 27, ″	0	″ 16, ″	9	″ 7, ″	3
″ 28, ″	0	″ 17, ″	6	″ 8, ″	4
″ 29, ″	0	″ 18, ″	5	″ 9, ″	4
″ 30, ″	0	″ 19, ″	6	″ 10, ″	1
Jan. 1, 1935	0	″ 20, ″	5	″ 11, ″	2
″ 2, ″	4	″ 21, ″	9	″ 12, ″	2
″ 3, ″	0	″ 22, ″	6	″ 13, ″	5
″ 4, ″	1	″ 23, ″	32	″ 14, ″	9
″ 5, ″	0	″ 24, ″	13	″ 15, ″	6
″ 6, ″	2	″ 25, ″	7	″ 16, ″	0
″ 7, ″	0	″ 26, ″	15	″ 17, ″	4
″ 8, ″	1	″ 27, ″	8	″ 18, ″	1
″ 9, ″	0	″ 28, ″	13	″ 19, ″	2
″ 10, ″	5	Mar. 1, ″	4	″ 20, ″	2
″ 11, ″	1	″ 2, ″	10	″ 21, ″	0
″ 12, ″	2	″ 3, ″	2	″ 22, ″	5
″ 13, ″	1	″ 4, ″	13	″ 23, ″	1
″ 14, ″	2	″ 5, ″	8	″ 24, ″	3
″ 15, ″	1	″ 6, ″	9	″ 25, ″	2
″ 16, ″	4	″ 7, ″	25	″ 26, ″	10
″ 17, ″	7	″ 8, ″	11	″ 27, ″	8
″ 18, ″	6	″ 9, ″	6	″ 28, ″	2
″ 19, ″	0	″ 10, ″	3	″ 29, ″	10
″ 20, ″	3	″ 11, ″	12	″ 30, ″	13

(*to be continued.*)

Table IV. (*continued.*)

Date	Number of occurrence of micro-tremors	Date	Number of occurrence of micro-tremors	Date	Number of occurrence of micro-tremors
May 1, 1935	18	May 13, 1935	1	May 25, 1935	14
〃 2, 〃	13	〃 14, 〃	6	〃 26, 〃	16
〃 3, 〃	37	〃 15, 〃	6	〃 27, 〃	56
〃 4, 〃	4	〃 16, 〃	16	〃 28, 〃	29
〃 5, 〃	0	〃 17, 〃	11	〃 29, 〃	15
〃 6, 〃	14	〃 18, 〃	5	〃 30, 〃	8
〃 7, 〃	10	〃 19, 〃	5	〃 31, 〃	9
〃 8, 〃	10	〃 20, 〃	20		
〃 9, 〃	19	〃 21, 〃	18		
〃 10, 〃	2	〃 22, 〃	30		
〃 11, 〃	3	〃 23, 〃	15		
〃 12, 〃	2	〃 24, 〃	8		

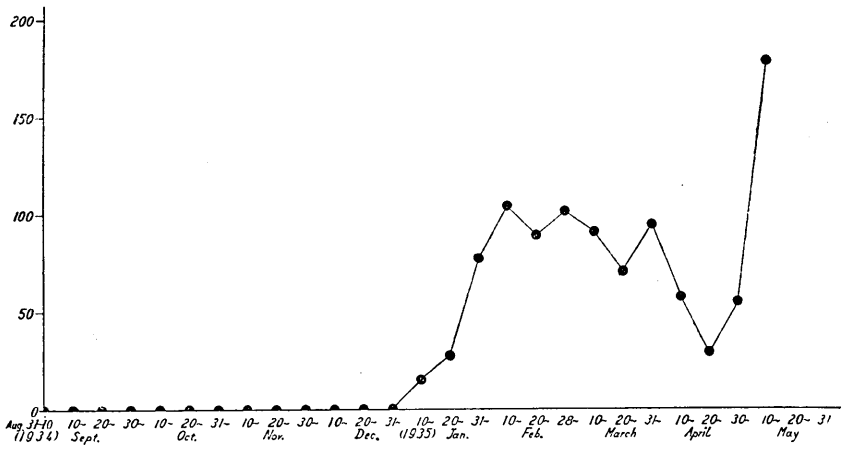


Fig. 8. The number of occurrence of micro-tremors.

6. Tilts of the Earth-surface.

With respects to the relation of volcanic activity to tiltings of the ground, T. A. Jagger[1], from his observations of volcano Kilauea, reported remarkable correlations between the elevation of lava in the crater and the inclinations of the ground. In the case of Asama, Prof. Takahasi[2], at the time of the explosions of 1932, installed a pair of clinographs at Komoro and studied the relation between the explosions and the inclinations of the ground.

In the recent explosions, one of the most outstanding observations made at our Observatory was these inclinations of the ground. Observations of these tilts were continued since 1933 with a pair of

1) T. A. JAGGER, *Bull. Seism. Soc., Amer.*, **19** (1929), 38.

2) R. TAKAHASI, *Bull. Earthq. Res. Inst.*, **11** (1933), 25.

clinographs constructed of fused quartz. This apparatus being installed in a cave hollowed out of a massive volcanic rock, atmospheric temperature and humidity in it are sufficiently constant.

In his previous paper, the writer reported that changes in the inclination of ground had increased since October 1934. Since then until the latter part of February 1935, no conspicuous variations were observed in the range of tilt-change. Since then, however, from the beginning of March 1935, extraordinary variations in inclination began to be observed. Figs. 9, 10, show the tilts of the ground during an

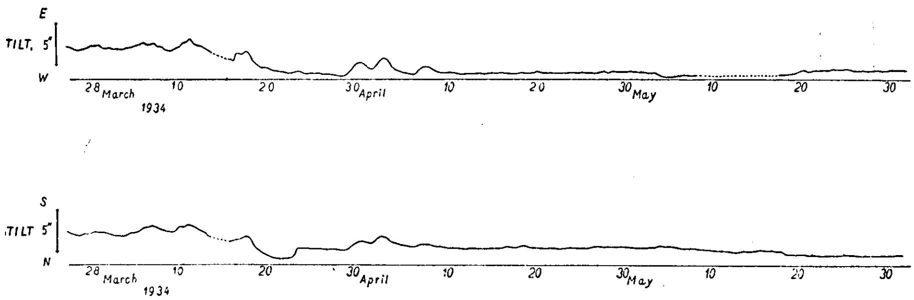


Fig. 9. The tilt-changes of earth-surface in 1934 (Mar.~May).

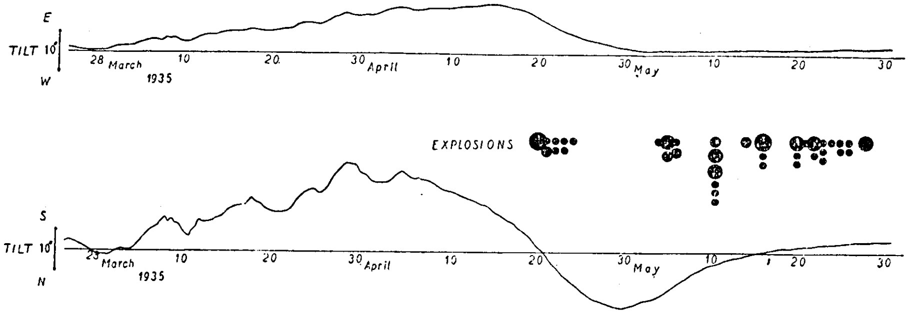


Fig. 10. The tilt-changes of earth-surface in 1935 (Mar.~May).

inactive period of the volcano (March, 1934~May, 1934), and in the present active period (March, 1935~May, 1935). A glance at these two figures will show the remarkable difference in the earth's surface in the two states of the volcano just mentioned. Namely, that the ground began to incline with a daily mean rate of 1·5″ toward the same direction from March to April, 1935. The amount of this inclination eventually reached 50″ with a maximum daily tilt of 2·5″. On April 17, the direction of tilt took a change in the opposite direction, when the ground began to tilt with an extraordinarily daily rate. On April 20, the third day after the foregoing direction of inclination had changed, the severe explosion occurred, when the tilt for that day reached 2·5″. Unaffected by this explosion, the direction of tilt remained unchanged up to May 2, 1935; the tilt having continued with a mean daily rate of 1·5″. On May 2, the direction of tilt changed again days after which another violent explosion occurred. After that, the daily rate of tilt began to decrease, due in all probability to the fact that the ground gradually began to resume the normal state.

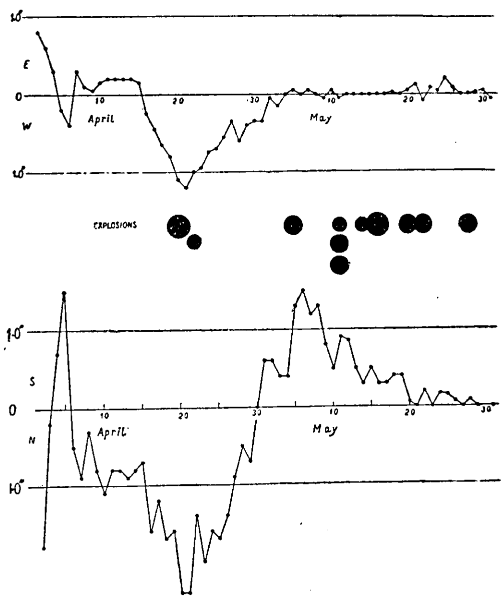


Fig. 11. Daily rate for the variations of tilt of the earth-surface.

The daily rate of inclination of the ground is shown in Fig. 11, from which it may be noted that the daily rate of tilt reached to as much as 3·0″. From Fig. 12, which gives the curve of the vector of inclination, it will be seen that the direction of inclination points neither toward or opposite the crater, which is probably place where the clinographs are due to crustal peculiarities of the installed.

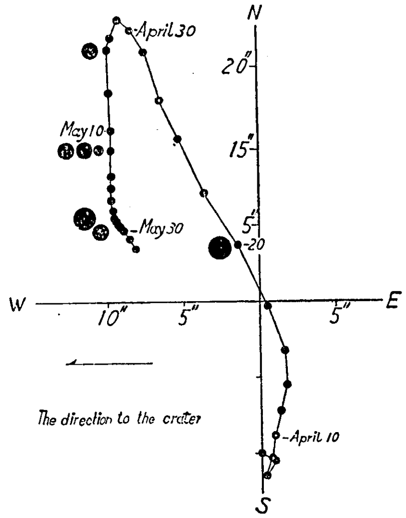


Fig. 12. ●; remarkable explosion.

It is interesting at all events that the extraordinary tilts of the earth's surface were invariably accompanied by violent explosions, after which the tilts diminished to what they were before the explosion. It may be pointed out in explanation that the pressure of the vapours that provide the energy of explosion acts at the bottom of the crater, but the lava in the crater floor resists it by virtue of its various properties, such as rigidity and viscosity, but with increase of vapour pressure, the resistance of the lava increases with the result that the tilting of the ground near the crater increases. But once the explosion has occurred, the new thinner lava bed in the crater bottom being unable to withstand the extraordinary pressure of the vapour, the volcano explodes with ease, hence with less intensity of explosion, so that the amount of tilt also gradually decreases. In support of this ideal theory, the writer offers the following facts, in addition to that of tilting.

(1) The crater floor rose about 50 m since October, 1934.

(2) The emission of vapour becomes irregular before the explosion, but two or three days prior to it, the amount of vapour becomes very small.

(3) The curve of the daily frequency of micro-tremors corresponds with the tilts of the earth's surface.

(4) The first explosion is always more violent than those that follow it.

Since, however, a pair of clinographs is insufficient for a satisfactory study of these inclinations appearing at periods of volcanic activity, more clinographs are going to be installed before long at other places near the volcano.

7. Variations in Earth-current.

The present volcanic activity was preceded also by remarkable variations in the earth-currents. To measure them a wire was stretched between two poles fixed in the direction of the volcano from the Observatory, the poles being about 110 m apart and 2 m in the ground.

The observations of earth-currents were begun in October 1934. On April 15, 1935, at 5 h p.m., five days before the violent explosion, a remarkable change of earth-current was observed. This change amounted to $1{\cdot}0 \times 10^{-3}$ volts per 100 m, while five or six hours before

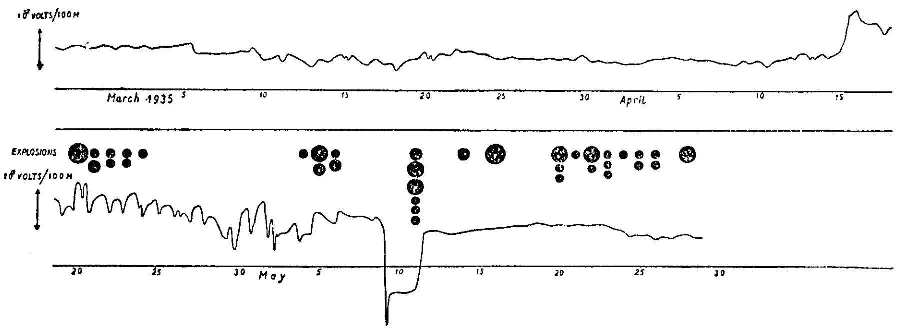


Fig. 13. Variations in earth-current and explosions.

the explosion on April 20, a new variation in earth-current appeared.

As will be seen from Fig. 13, marked changes in earth currents continued to occur until the middle of May. It will be noted that several hours preceding every violent explosion, extraordinary changes in earth-current manifested themselves, which ceased almost entirely as soon as the explosive activity of the volcano diminished. These extraordinary changes in earth-current were observed for several days, for a number of hours before every violent explosion.

8. Conclusion.

This paper describes the violent explosion of April 20, 1935, the changes in the tilting of the ground, and the variations in the earth-currents before and after the explosions. Volcanic micro-tremors occurred during the three months preceding the explosion, but none was observed in 1934.

These volcanic phenomena that were observed to precede every period of explosive activity, should throw some light on the question of the possibility of forecasting explosions. The changes in the intensity of the atmospheric currents observed at the moment of explosions, full details of all the explosions that followed the violent one of April 20, 1935, topographic changes wrought in the neighbourhood of the crater, all these will be dealt with in a forthcoming paper.

In conclusion, the writer wishes to express his cordial thanks to Professor Mishio Ishimoto for his kind advices and suggestions, and also to Mr. Madoka Iwashita and Mr. Teiichi Uchibori for their kind assistance in investigating the sounds of the explosion and field investigations.

50. 1935年の淺間火山の活動（其の1）

地震研究所 水 上 武

1. 1932年以來活動を示さなかつた淺間火山は1935年4月20日午後4時21分突然大爆發した. この爆發後, 4月, 5月の間に大小爆發數十回に達した.

1934年7月以來, 火口底の昇降の測定を行つたが, 7月より10月迄に約20mの沈降を示し, 10月終りより上昇を示して居る事は既に報告した如くであるが, 爆發直前には昨年10月より約50m上昇して居た.

2. 1934年を通じて1回の火山性微動も觀測されなかつたにも拘らず, 1935年1月2日以後に於いては, 一日に數回又は數十回の微動が現はれた.

シリカ傾斜計に依つて觀測された地表傾斜は昨年10月以來次第に大なる變化を示すに至つたが3〜5″程度の變化を繰返すに過ぎなかつた. 然るに1935年3月より4月20日迄平均1日に約1·0″の傾斜を同方向に繼續した. 卽ち3月20日より4月20日迄に約30″に達する傾斜を示したのである.

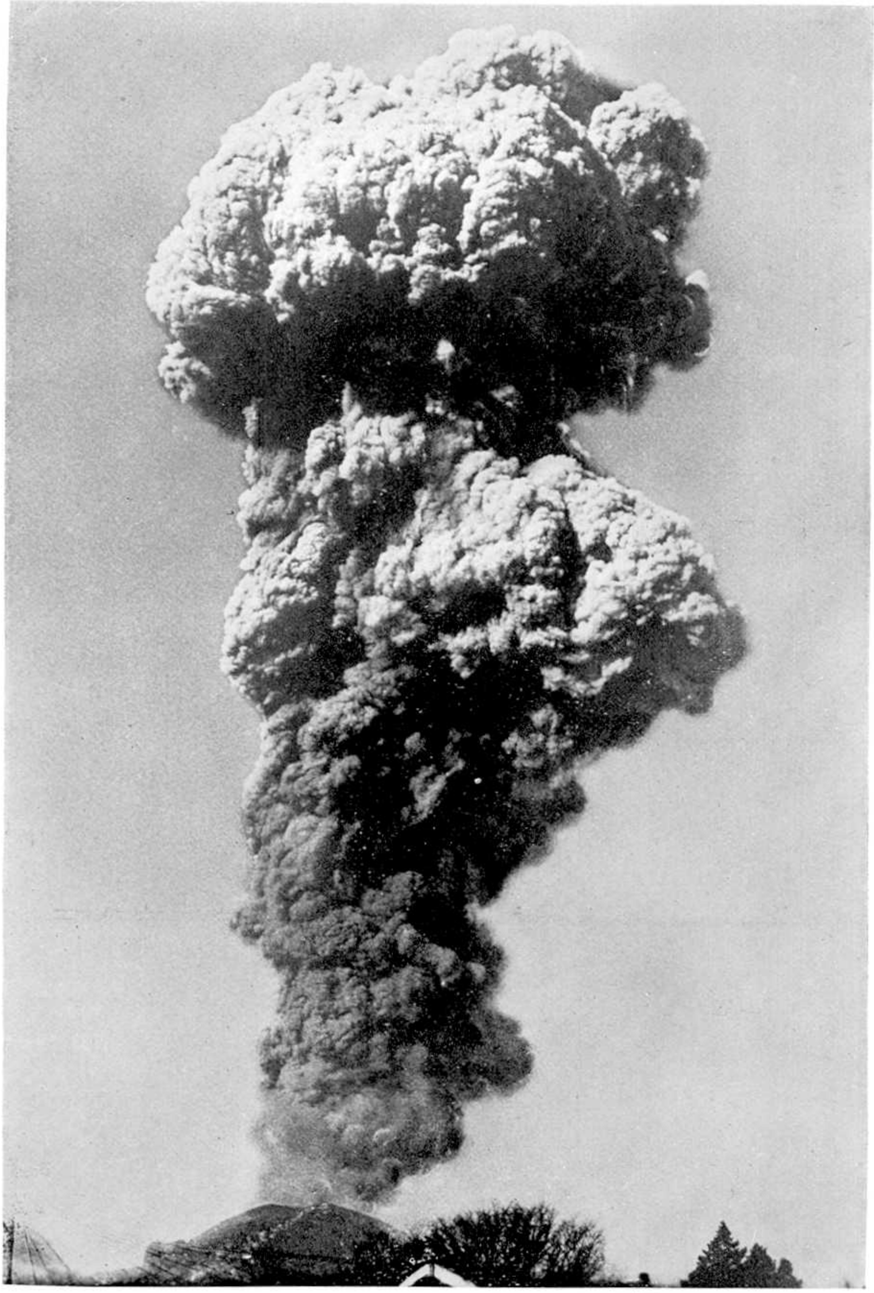
地表傾斜は爆發前約2ケ月前より異常の變化を認められたが, 最初の爆發後傾斜變化は次第に減少して行つた.

地電流は大爆發5日前の4月15日に大なる變化を示し, 以後大爆發前數日又は數時間前に大なる變化の現はれる事が確められた.

3. なほ4月20日の大爆發の音響調査の結果, 內外聽域の明瞭に表れる事がわかつた. この大爆發及びその後の爆發に依つて噴出した火山彈, 火山灰の分布, 並に火山彈の落下に依つて山腹に起つた野火の被害圖等が記述してある.

4. 爆發地震, 空電及び個々の爆發に關する記述は次の機會に報告する考へである.

最後に種々貴重なる御示敎を賜つた石本敎授, 高橋助敎授に感謝の意を表すると共に音響調査に御盡力された岩下園氏並に嚴寒零下20°Cの淺間山に在つて觀測を繼續された內堀定市氏に對して深謝の意を表する次第である. なほ又山腹野火の被害面積測量表並に圖は岩村田營林署長有馬農學士の御厚意に依るものなる事を附記して置きたい.



(Photo. Hayami.)

Fig. 14. The violent explosion on April 20, seen from Komoro at the distance of 15 km from the crater.

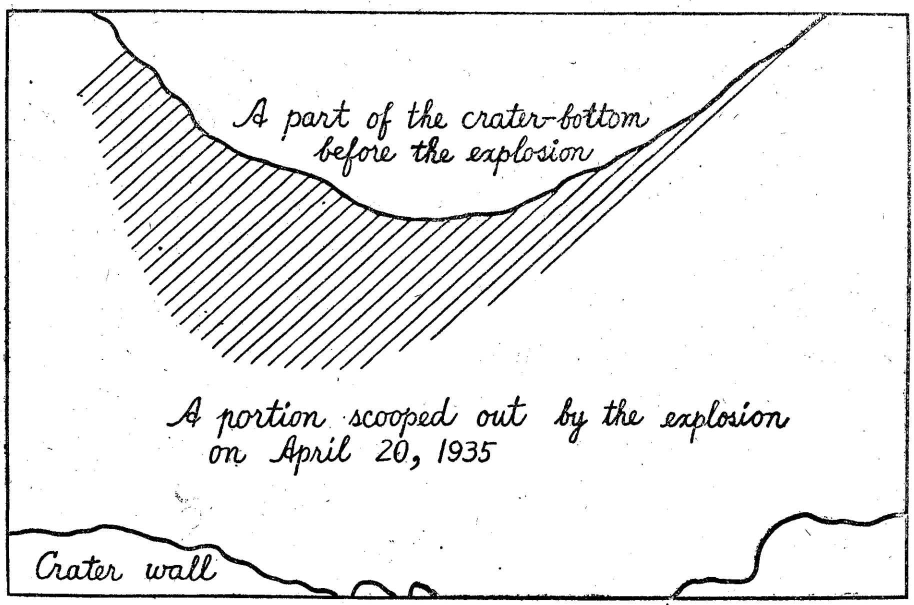
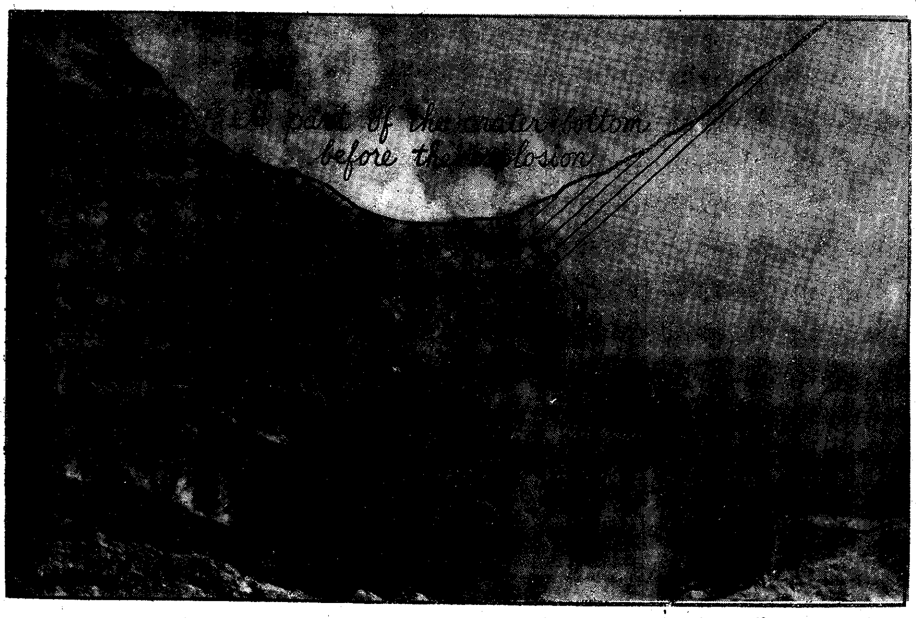

A part of the crater-bottom before the explosion
A portion scooped out by the explosion on April 20, 1935
Crater wall

Fig. 15. The crater floor taken from the south-side on the crater wall in October, 1934.



(*Photo. Minakami*, April 26, 1935.)

Fig. 16. The crater bottom seen from the same place and the same direction in Fig. 15.

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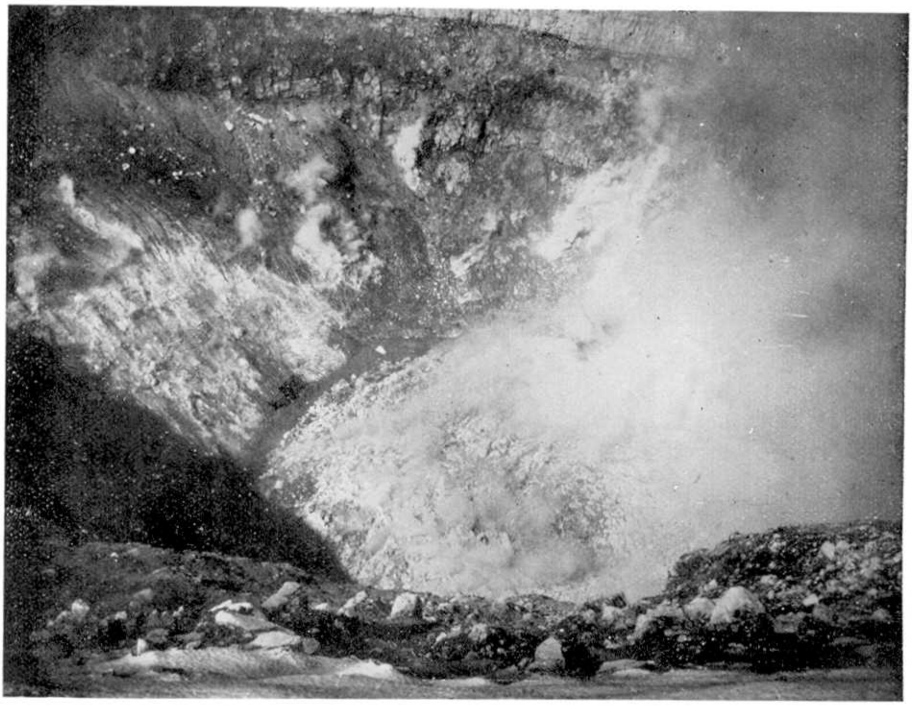
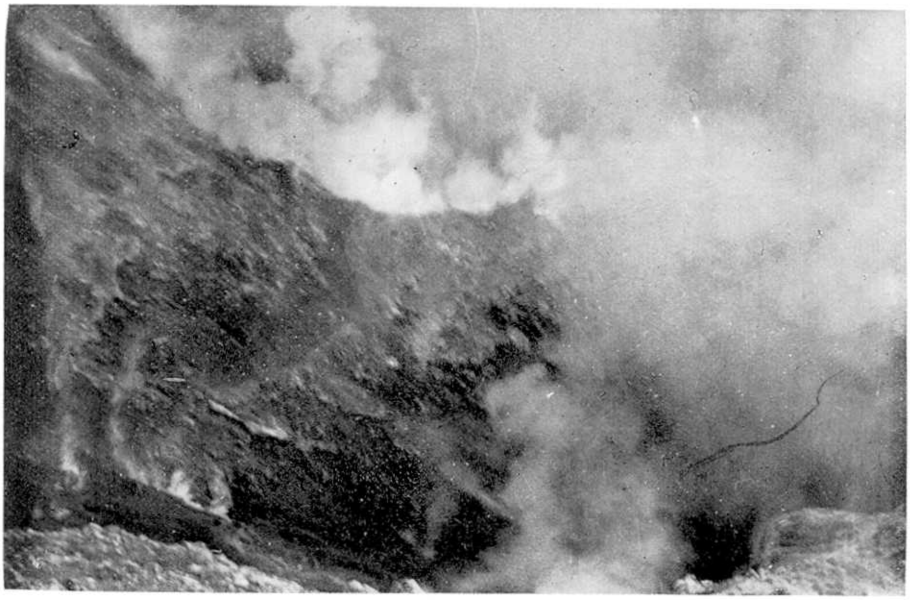
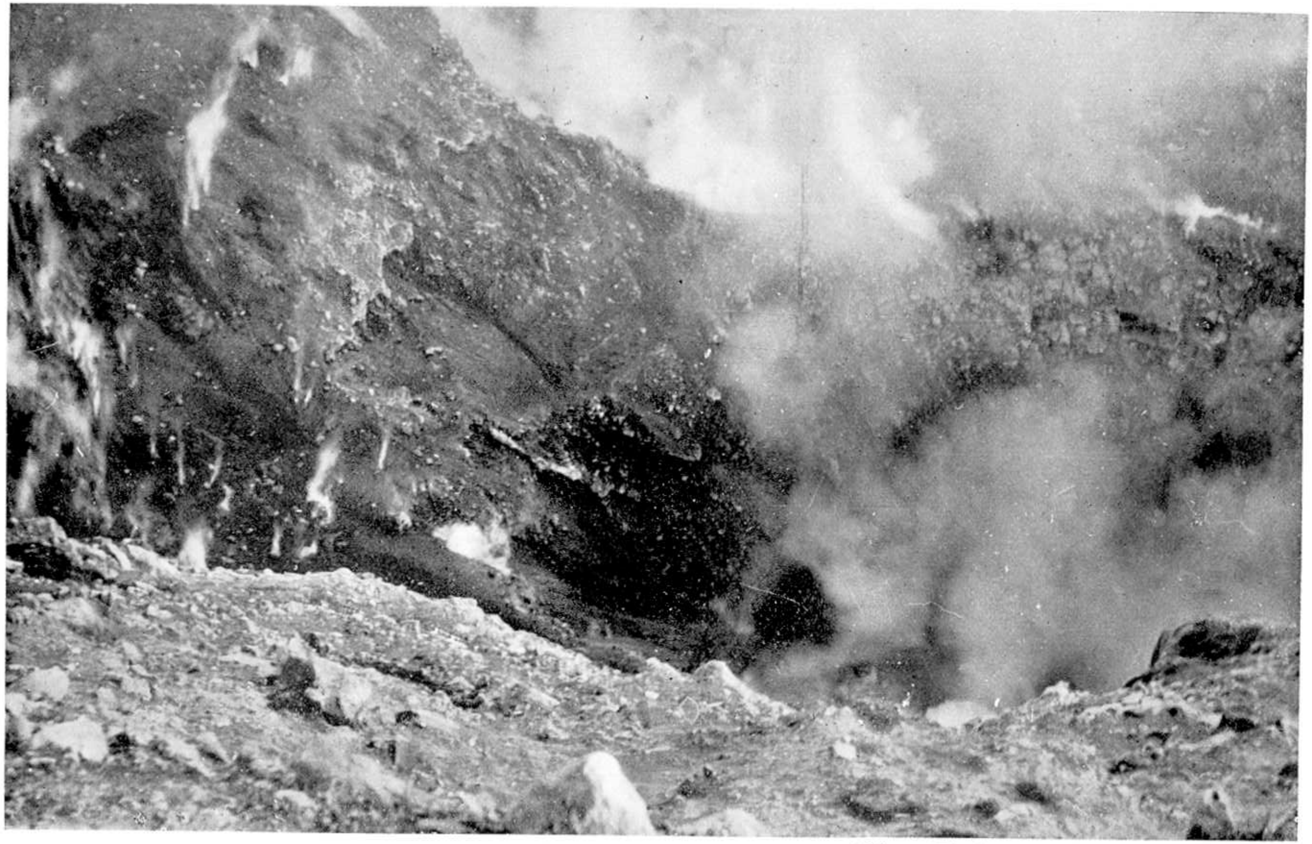


Fig. 15. The crater floor taken from the south-side on the crater wall in October, 1934.



(*Photo. Minakami*, April 26, 1935.)

Fig. 16. The crater bottom seen from the same place and the same direction in Fig. 15.



(*Photo. Minakami*, April 26, 1935.)

Fig. 17. The crater bottom seen from south-side on the crater wall.

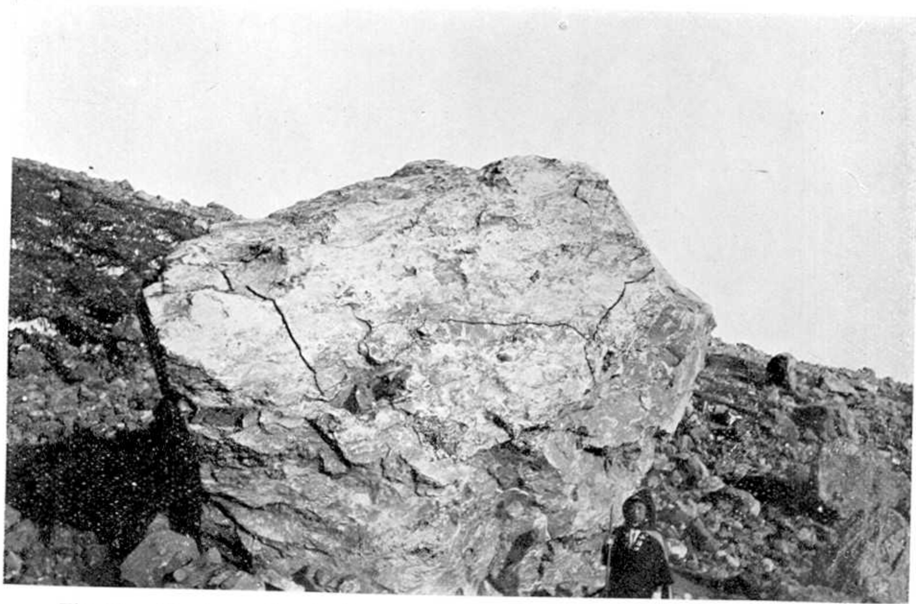


Fig. 18. The largest bomb, about 18 m in circumference, projected to the west-side of central cone by the strong explosion of April 20, 1935.

(*Photo. Minakami*, April 26, 1935.)

Fig. 19. The holes caused on the snow at Maekake-yama by the falls of volcanic bombs by the explosion of April 20, 1935.

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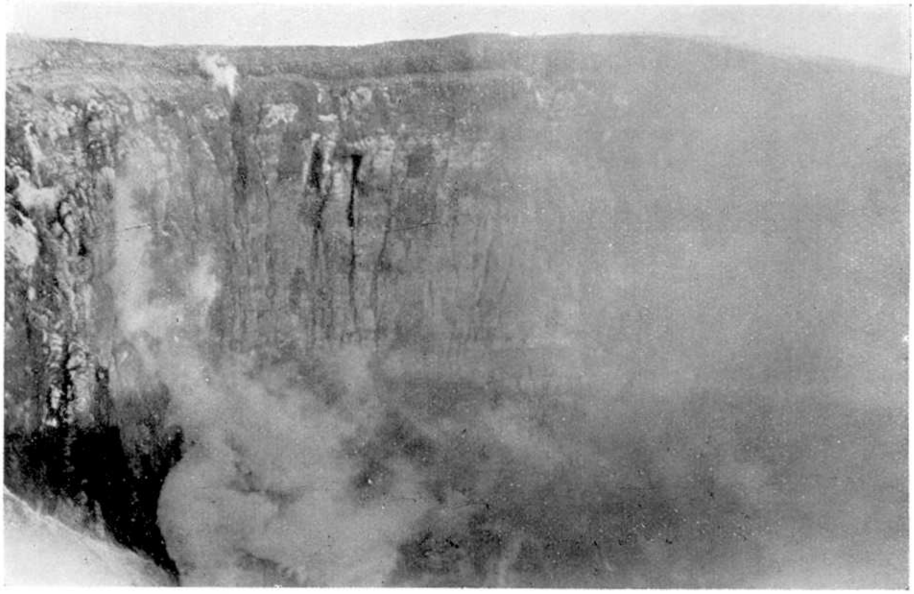


Fig. 20. The west-side of crater wall seen from south-side.

(*Photo. Minakami*, April 26, 1935.)

Fig. 21. A bomb projected on the west-side of crater wall by the explosion of April 20, 1935.

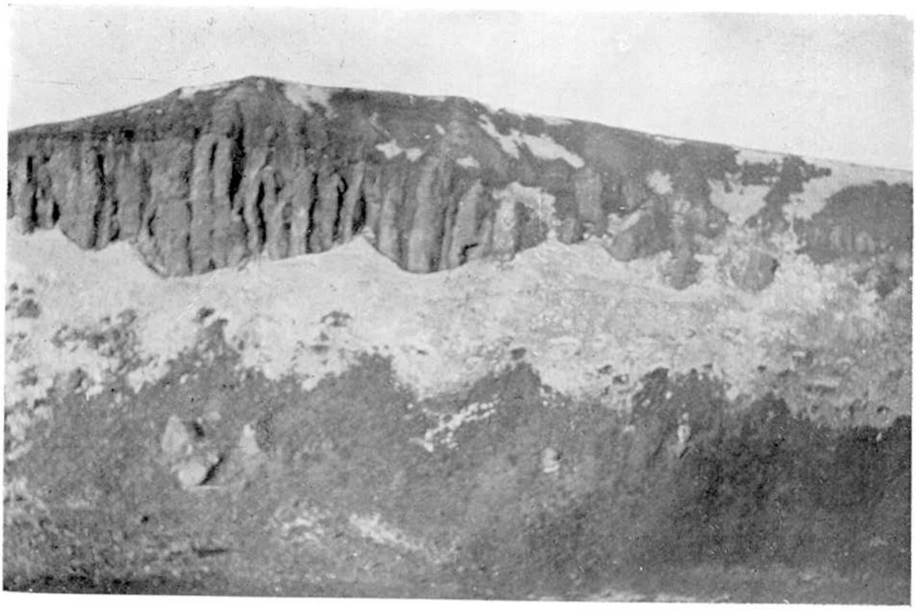
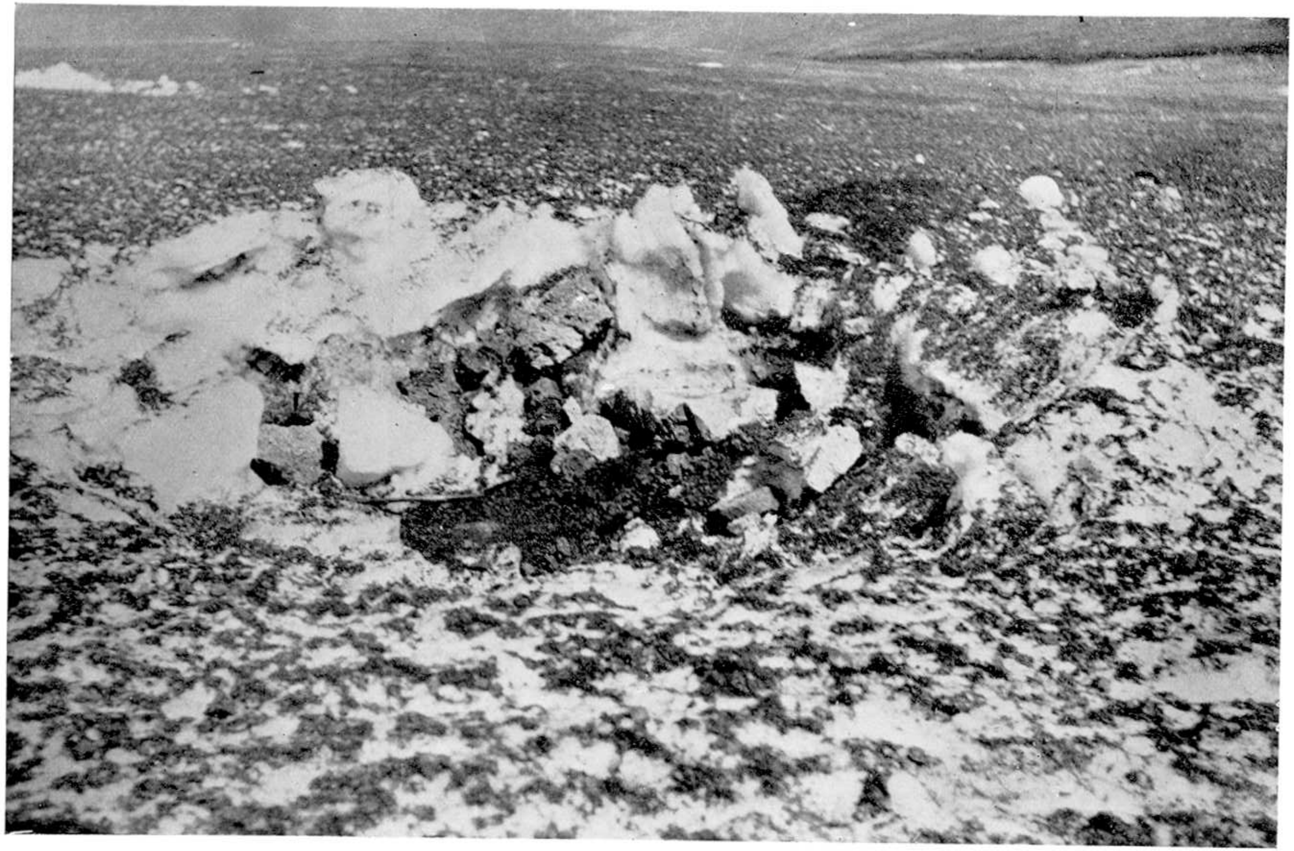


Fig. 22. Maekake-yama seen from the central cone. (April 26, 1935.)

(*Photo. Minakami*, April 26, 1935.)

Fig. 23. The volcanic bombs fallen on the west-side of Maekake-yama.



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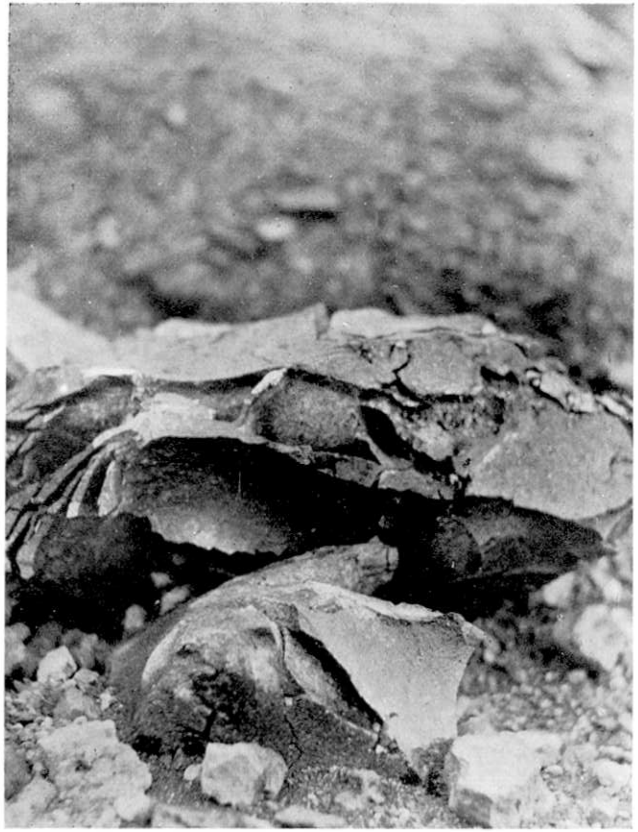
(*Photo, Minakami*, April 21, 1935.)

Fig. 24. A hole caused on the snow by the fall of a bomb, the volcanic ashes on the snow at the distance of 1500 m from the crater.



(*Photo. Minakami*, April 21, 1935.)
Fig. 25. A volcanic bomb projected to east at the distance of 1000m by the explosion of April 20, 1935.

(*Photo. Minakami*, April 21, 1935.)
Fig. 26. A volcanic bomb projected out by the violent explosion of April 20, 1935, at the distance of 2000 m.

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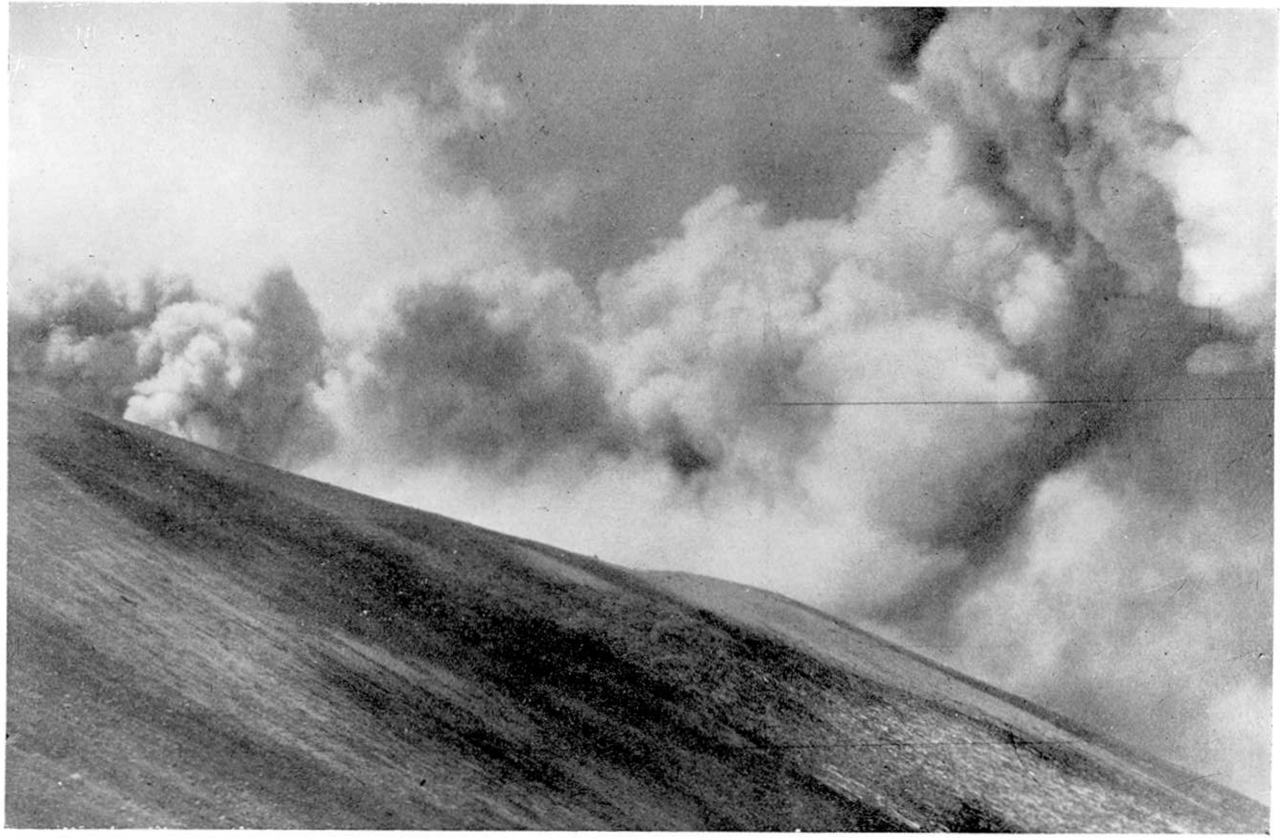
(*Photo. Minakami*, April 21, 1935.)

Fig. 27. The bombs broken into pieces at the distance of about 2 km from the crater.

(*Photo. Minakami*, April 21, 1935.)

Fig. 28. The volcanic ashes fallen on a roof of Hosino Onsen at the distance 12 km from the crater, by the explosion of April 20, 1935.



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(*Photo. Minakami.*)

Fig. 29. A small explosion of April 21, 1935, at about 12h, seen from east-side at the distance of 700m from the crater.

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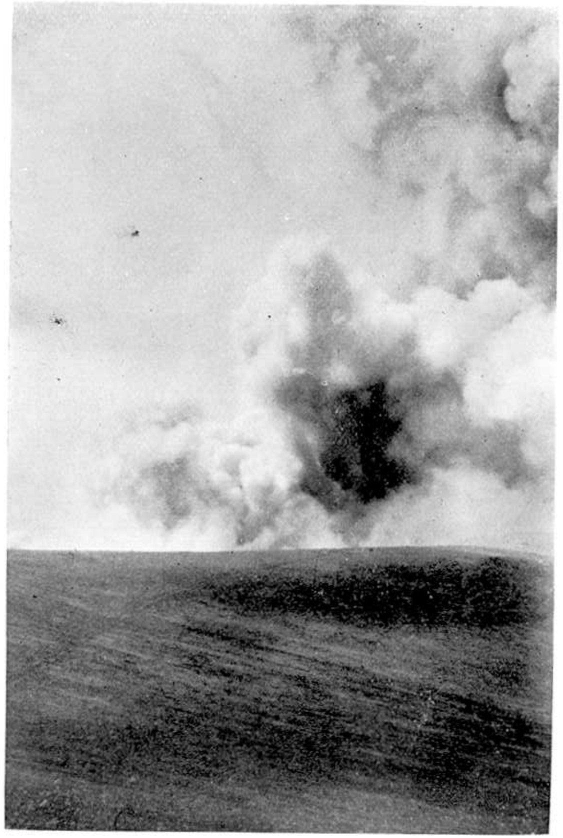
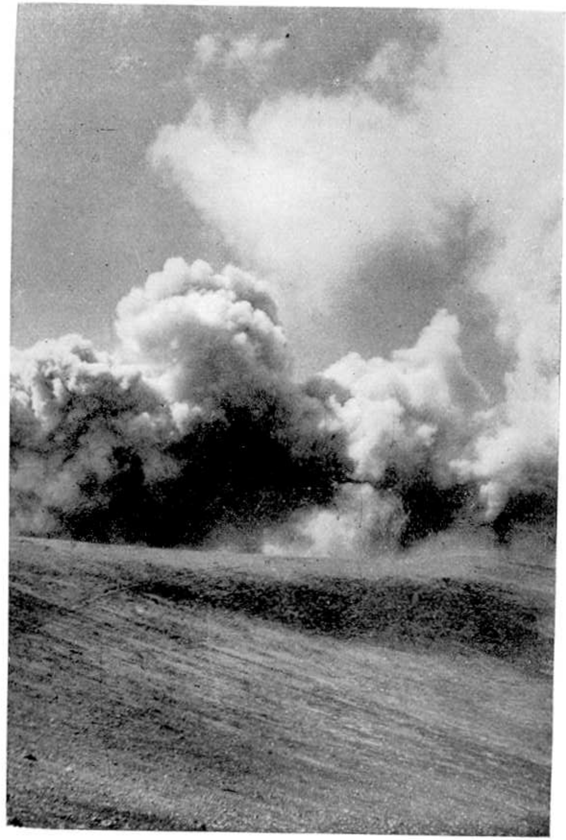


(*Photo. Minakami.*)
Fig. 30. A small explosion of April 21, 1935.



(*Photo. Minakami.*)
Fig. 31. A small explosion of April 21, 1935.