4. *The 1950-1951 Eruptions of Mt. Mihara, Oshima Volcano, Seven Izu Islands, Japan. Part I. The 1950 eruption.**

By Hiromichi TSUYA, Ryōhei MORIMOTO and Joyo OSSAKA,

Earthquake Research Institute.

(Read Sept. 19, 1950, June 19, 1951, and March 18, 1952.
Received Jan. 4, 1954)

I. Introduction.

After 10 years' repose, Mt. Mihara, the central cone of Oshima volcano, one of the Seven Izu Islands, about 110 km southwest of Tokyo, began an eruptive activity at the summit crater in the morning of July 16, 1950. The activity was exhibited as a continuous and progressive eruption of the Strombolian type, lasting for ten weeks until September 23, 1950, when it suddenly stopped. During the next year, from February 4 to June 28, the volcano displayed again eruptions on a larger scale, with more extensive lava outflows. This paper includes the results of our investigations of the eruptions, such as observation of the events, topographic survey of the active crater, measurement of temperature and specific heat of the new lavas, and estimation of the quantity of the lavas, besides petrography and chemistry of the lavas, incrustations, and sublimates, already reported in the previous papers[1].

The Seven Izu Islands consist of several Quaternary insular volcanoes that rest upon a submarine ridge elongating in NNW.-SSE. direction from Izu region through Southern Islands toward Marianas (Fig. 1). Oshima, the largest of the Islands is composed almost entirely of oversaturated basalts. It comprises a truncated central cone Miharayama (Mt. Mihara. "Mihara" means hole.) and a somma dotted with several parasitic knobs and explosion-hollows, besides the ruins of older volcanic bodies underlying the northwestern skirt of the somma. According

---

* Dedicated to Prof. Seitarô TSUBOI in celebration of his 61st birthday.

1) H. TSUYA & R. MORIMOTO, "Petrography of the 1950-lavas of Oshima volcano, Seven Izu Islands, Japan." *Bull. Earthq. Res. Inst.*, **29** (1951), 563-570.

H. TSUYA, R. MORIMOTO & Joyo OSSAKA, "Chemical composition of the 1951-lavas of Oshima volcano, Seven Izu Islands, Japan," *Bull. Earthq. Res. Inst.*, **30** (1952), 231-236.

R. MORIMOTO, & Joyo OSSAKA, "On the Miharayama lavas," *Jour. Geography*, **60** (1951), 136-140 (in Japanese).

to S. Tsuboi[2] who studied the geology of the island after the 1912–1914 eruption, the Oshima volcano came into being at a late date, probably in the late Diluvium. Mt. Mihara was born in a pre-historic age at the southern portion of the summit caldera by the volcanic activity rejuvenated after the cauldron subsidence of the somma volcano. The Quaternary Oshima volcano rests on the deeply dissected volcanic ruins represented by the basalts exposed along the seashore near Okata (Fig. 2). Sawamura[3] pointed out that the Okata basalts may be of the Pliocene age, seeing that they are accompanied with a tuff breccia containing fragments of altered andesites and gabbro, probably one of Miocene volcanics correlative to the Yugashima series on the adjoining Izu peninsula.

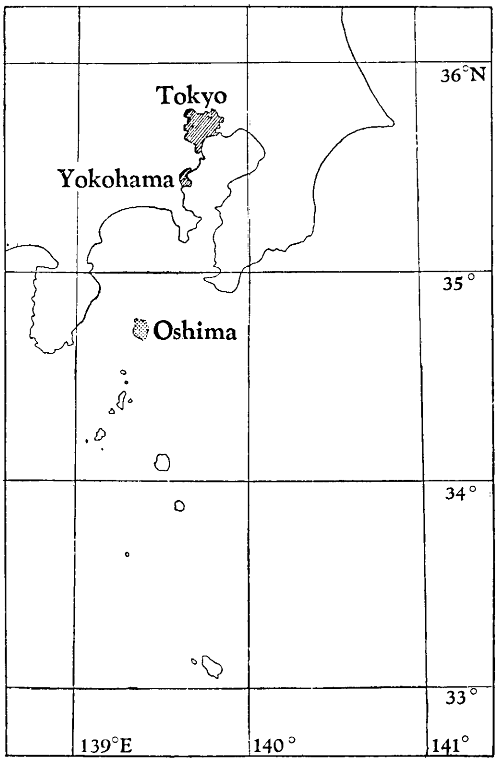

Fig. 1. An index map of Oshima volcano with Seven Izu Islands.

Mt. Mihara is one of the most active crater in Japan and has repeated many activities in historic times as shown in the following table (Table I). Among them, the 1684–1690 and 1777–1778 eruptions are most remarkable in having poured out lavas from the crater over the flanks of the somma and further down into the sea. The present eruptions may be comparable in scale to these historic eruptions. In the 1912–1914 eruptions, the most remarkable of the recent activities prior to the present ones, the lava filled the crater almost to its lowest brim but did not run over the crater rim. Since the end of the eruptions, the volcano had kept a considerable quiescence for about 25 years, its activities being represented only by occasional

2) S. TSUBOI, "Volcano Oshima, Idzu," *Jour. Coll. Sci.*, **43** (1920), **vi** 1–146.

3) K. SAWAMURA, "Development of the Oshima Island," *Jour. Geography*, **60** (1951), 104-106 (in Japanese).

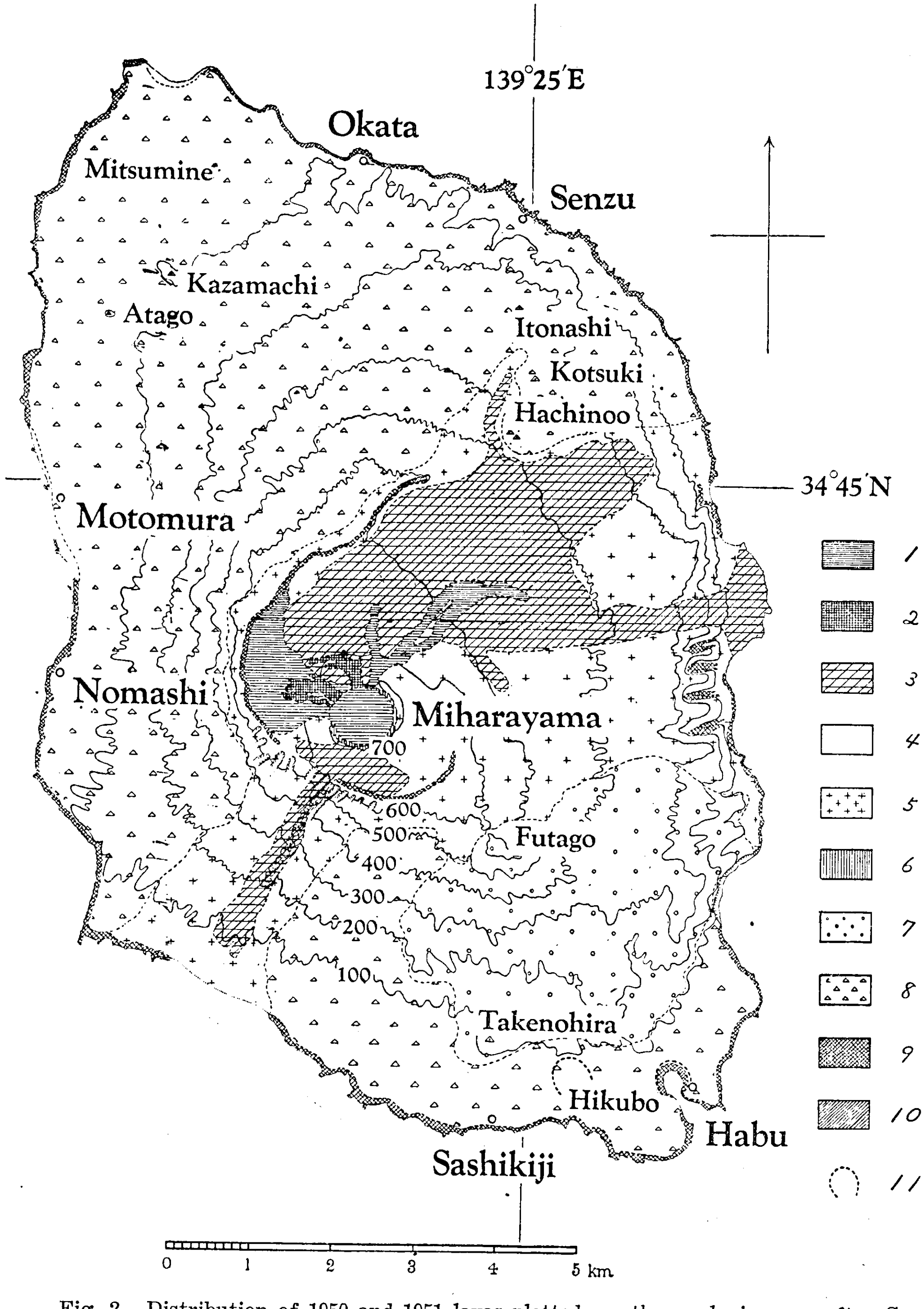

Fig. 2. Distribution of 1950 and 1951 lavas plotted on the geologic map after S. Tsuboi (1916–1918). The 1912–1914 lava was covered by the 1950–1951 lavas. 1: 1951-lava, 2: 1950-lava, 3: 1778-lava, 4: Beach deposits, 5: Central cone ejecta, 6: Central cone lava, 7: Scoriae from flank openings, 8: Somma ejecta, 9: Somma lavas, 10: Rocks of northwestern demolished igneous bodies, 11: Phreatic explosion-crater.

Table I. Recorded volcanic activities of Oshima in historic times.

684:	Nov. 29. It is said that the land increased on the western and northern sides of the island.
1112:	From Nov. 18 till the end of the next month, detonations were heard repeatedly in Kyoto.
1416:	Sept. 2. An eruption took place.
1421:	May 14. An eruption occurred, noises were heard in Kamakura. Sea water became hot.
1600–1601:	Minor eruption.
1612–1613:	Minor eruption.
1636–1637:	Minor eruption.
1684–1690:	On March 31, a violent eruption began and continued for 7 years. It is said that a crater, ca. 1 km in dia., was formed on the summit of Mt. Mihara. On Apr. 22, lava flowed down toward NE. and poured into the sea.
1777–1778:	Most violent eruption ever recorded in the history of the volcano. (Fig. 2)
1803:	On Nov. 14, eruption took place, and ashes fell in Tokyo on the next day.
1822:	Ashes fell in Tokyo.
1846:	Eruption.
1870:	Minor activity.
1876–1877:	From the end of Dec. 1876 to Feb. 6, 1877. Lava poured out in the crater of Mihara but it did not run over the brim of the crater. A minor spatter cone was formed at the bottom of the crater.
1912–1914:	March-June 10 in 1912, welling out of lava at the bottom of the crater. July 27–29, depression of solid lava due to its own weight accompanied with breaking up of spatter cone and squeezing out of lava. Sept. 16–Oct. 29, 1912, extrusion of lava at the crater bottom and formation of a spatter cone. Jan. 14, 1913, depression of lava layer accompanied with extrusion of lava. Lava emission lasted for 12 days. During May 15–21, 1914, paroxysmal lava extrusion occurred, followed by intermittent emission of lava for a few days.
1915:	Minor activity from Oct. 10 to the end of the month. Roarings and air-quakes were felt and ash fell in the southwestern part of the island. No lava poured out.
1938:	Aug. 11, the bottom of the pit turned into an incandescent lava pool and scoria fell around the mouth of the pit.
1939:	Minor activities in Sept. 2–3, and Sept. 16. Incandescent lava appeared at the bottom of the crater. Quantities of bombs and scoria were thrown up, though they did not reach above the rim of the pit.
1940:	Minor activity in Aug. 18–19. Ejection of incandescent bombs and emission of gas from the fissure opened in the solidified lava at the bottom of the pit on Apr. 18. Incandescent bombs and lapilli were ejected in quantity up to 500 m in height above the summit of the central cone, and were deposited thickly on the 1912–1914 lava field on Apr. 19.

Remarks on the eruptions from 684 to 1915 are compiled from S. Tsuboi's paper (*Ibid.* pp. 53–59), and those of 1938–1940 from T. Nagata's ("A geomagnetic study of the minor activities of Volcano Mihara, Oosima Island, August 1940", *Bull. Earthq. Res. Inst.*, **19** (1941), 402–410.)

volcanic rumblings and earth tremors, vapour emissions, ejections of a little volcanic ashes, etc. But the crater-floor covered with the 1912–1914 lavas had changed its topographical features in that period. Thus, after the end of 1912–1914 eruptions, the central portion of the crater floor had been depressed in the form of a circular pit, although it is not clear when the central pit was formed. The central pit had increased its mean diameter linearly with time due to collapses of the wall[4], while the pit had decreased its depth linearly with time till the beginning of the 1940 eruption[5]. A small mass of red-hot lava could be seen from time to time on the floor of the pit. The crater had been quiet for ten years since the minor explosive activity in August of 1940. Just before the beginning of the present eruptions, July 16, 1950, the crater was virtually identical in topography with that shown in the map prepared by Takahasi and Nagata in 1936[6]. But the pit had become a little shallower being about 170 m[7] in depth and about 310 m in mean diameter. The surface of the 1912–1914 lava-field was more or less flat, being veneered with the 1940 ash and scoria. Relief of the crater immediately before the eruptions is also inferred to have differed not greatly in topography from that observed by two of the writers a few days after the beginning of the activity (Fig. 20), though the pit wall had already been destroyed by outbursts and the bottom of the pit had been filled by a new lava.

Our works on the volcano were assisted by many eyewitnesses of the eruptions, especially, Messrs. S. Watanabe, K. Mase, Y. Fujita, and T. Yoshinari, inhabitants of Motomura village, to whom our thanks are due. The daily sketches and photographs of the eruptions taken by Mr. Watanabe were useful to complement our observations of the eruptions. Our thanks are also due to Mr. T. Kizawa, Chief of the Meteorological Observatory, for his kind information on the state of the crater before the eruptions. We express our cordial thanks to Dr. R. Takahasi and Mr. D. Shimozuru of the Earthquake Research Institute, who kindly allowed us to publish one of the crater maps prepared by them. Our cordial thanks are also due to Dr. T. Yamanouchi and Dr.

4) R. Takahasi and T. Nagata, "Geophysical Studies of Volcano Mihara, Oosima Island: The general aspect of physical conditions in the crater," *Bull. Earthq. Res. Inst.* **15** (1937), 1047.

5) T. Nagata, "Mihara-yama, Oosima, Izu," *Bull. Volc. Soc. Japan.* **4** (1940), 196 (in Japanese).

6) R. Takahasi and T. Nagata, "Geophysical Studies of Volcano Mihara, Oosima Island: Topographic survey of the Crater of Mihara and the magnetic survey of Oosima," *Bull. Earthq. Res. Inst.* **15** (1937), 441–462.

7) Oral communication from Mr. T. Kizawa, Chief of the Meteorological Observatory of the island. Data from the expedition of the pit by Mainichi Press, May 13, 1950.

Y. Shiraki, and to Mr. H. Suzuki of the Tokyo Institute of Technology for their kind instructions on some of our laboratory works. We are indebted to Messrs. T. Aoki, T. Sakamoto, and Y. Shimazaki, students of the Mineralogical Institute of our University, for helping us in measuring temperatures of the flowing lavas. We are also indebted to Messrs. T. Watanabe and A. Okata, Miss F. Toraiwa and T. Fukuda, for their assistance in the field and in the laboratory.

A part of the expense necessary for the investigations was defrayed from the Grant in Aid for Scientific Research from the Department of Education.

II. History of the 1950 eruption.

Premonitory symptoms were not reported before the present eruptions.[8]

(1) Opening of the first vent and collapse of the pit wall:

The 1950 eruption began at 09h15 m (Japanese Standard Time), July 16, with sudden explosions on an arcuate and almost vertical fissure (Fig. 3) which had already been formed along the southern periphery of the central pit.[9]

Owing to the explosions, the pit wall adjacent to the fissure scaled off several meters in thickness, and collapsed on the bottom of the pit, making a pile there in the form of a talus. These explosions were heard at the crater floor like noises of a diving aeroplane, and fine pieces of the broken wall were seen to rise as dark ash clouds blown away by the wind northeastward. Explosions were repeated in like manner at intervals of about 4 to 10 minutes. In the intervals of two successive explosions, vapours continuously rising from the exploded portion of the pit wall were visible through the misty air, but red-hot lava was not found at that time[10].

Just after noon of the same day, according to Mr. H. Yamazaki of Motomura village, a narrow stream of incandescent lava could be recognized hanging over the slope of the above-mentioned talus, from a crack on the collapsed pit wall, about 20 m below the southern rim

8) In this connection, it must be taken into consideration that seismographical observations of the volcano by sensitive seismometers had long been interrupted during and after World War II.

9) A seismograph of the Meteorological Observatory of the island began to record the volcanic tremors on 09h07m23s (Japanese Standard Time).

10) After Mr. B. Hirata of Okata village, the first eyewitness of the eruption.

of the pit, toward the pit floor (A in Figs. 4, 5, and 7). It is remarkable that the fluidal basalt lava rose halfway up the fissure in the pit wall, the upper part of which had already been destroyed by the forerunning gas explosions, instead of welling out of the bottom of the pit. It is said that another smaller stream of red-hot lava was hanging down from the point on the side of the previously formed crack designated as A in Figs. 4, 5 and 7. The collapses of the pit wall continued for hours; they became most remarkable in the afternoon, from 13h to 16h, July 16. The lava streams hanging on the pit wall had disappeared before the noon of July 18, owing to the accumulation of ash and rock debris of the collapsed wall[11-12].

Ash clouds, about 300-500 m in height above the crater, were sometimes observable even from the skirt of the somma.

(2) *Enlargement of the explosive vent*:

Dense misty weather often interrupted the observations by eyewitnesses at the beginning stage of the present eruptions. Thus, on July 17 and 19, the crater was put out of sight by dense clouds day and night.

In the morning of July 20, the crater took off her misty veil. Then, at last, one of the writers (R. M.) caught his first opportunity to observe the actual scene of the activity.

The upper portion of the southern wall, about 30 m in length, 20 m in height, and several meters in width, of the central pit had collapsed down to form a talus beneath. Fumarolic activity continued along the cracks on the destructed wall behind the talus and along the fissure between the talus and the wall. Two red-hot points were visible on the wall near A and B respectively (Figs. 4 and 5), through the rising vapour like a fenestella of a furnace. At 10h30m, an explosion took place at the east end of the fissure (B in Figs. 5, 7, and 9), about 20 m below the rim of the pit; gas was jetted vertically, dark ash clouds were thrusted to the sky every two minutes, the rocks around the new explosion opening were gradually heated into a red-hot state. Outpouring of fluidal lava began at the southwestern corner of the bottom of the pit. At 12h27m, a severe explosion occurred on the same fissure at a point designated as C in Figs. 5, 7, and 9. Explosions

11) An informal report from the Meteorological Observatory of Oshima.

12) Vapours and ash clouds rose from the crack on the pit wall; lava was hanging down; wall was crumbling down with rising columns of dense dusty smoke; earth-rumblings were felt in the crater; extrusion of lava from the bottom of the pit was not observed (10h15m, July 18, after B. Hirata).

at C repeated at intervals from 20 to 30 seconds, with ejections of dark grey smokes of fine ashes. At 14h00m, red-hot fume became observable at C with brown ash-clouds. At that time, activity at A had already subsided, exhibiting a gentle vapour emission.

In the evening of July 20, the explosions at B appeared to be more active and stationary: Noises like surfs on seashore were heard at intervals from 10 to 15 seconds; with every roar, a jet of red-hot fume was seen; ejected red-hot rock fragments fell to crumble on the slope of the talus; collapses of the pit wall near the explosion-openings continued; and incandescent lava was squeezed out through clefts on the already solidified crust of lava at the southwestern corner of the bottom of the pit. These activities must have continued through the next day, but they could not be observed because of bad weather.

On July 22, the explosion-opening at B was enlarged up to 10 m in width along the fissure, and the talus grew larger owing to the collapse of the pit wall. At 12h55m, activity at B declined comparatively, and lava poured out from the bottom of the pit (Fig. 6), while the opening at C was awakened again to be active from a relative calmness in the preceding several hours. In the afternoon, violent explosions often took places. Ejections of ashes, which were brought about by the explosive emissions of gas through different openings, were followed every time by stationary ejections of lava-blocks and scoria, lasting for about 10 to 20 minutes. Repeating these explosions, and sometimes being accompanied with temporary squeezing-out of lava from the bottom of the pit, the eruption became gradually larger in scale.

On July 23, the activities became so violent that explosions were heard frequently even on the skirt of the somma. Explosions at B and C occurred either alternately or simultaneously (Fig. 9). Frequently, the centre of explosive action moved along the fissure step by step from B toward C, or from C toward B.

On July 24, at 06h30m, B and C were united with each other to form a large opening (the 1st vent) by explosions accompanying heavy ash-falls. Thereafter, the first vent repeated explosions without interruption, until the end of the same month, resulting in the formation of a cinder cone, about 20 m in height above the crater floor (Figs. 11 and 15).

During July 31—Aug. 1, the explosions occurred at the 1st vent; the vent was enlarged; and two bowl-shaped openings were formed within it (Fig. 32).

(3) *Welling out of lava from the pit-bottom:*

It was reported that, on July 16, an incandescent lava began to well out from two spots near the southwestern corner of the bottom of the central pit at 21 h[13]. Spreading over the pit-bottom, the lava flow was soon covered with a dark solidified crust, although the underlying still fluidal lava was visible through clefts in the crust. Lava fountains were being displayed on a small scale temporarily, but always at the southwestern corner of the pit-bottom (Figs. 6, 8, 10, 16, 18, and 19).

The lava fountains in the pit-bottom seemed to have some connection in activity with the explosion-openings along the fissure. Thus, their activities, as observed during 13 h 59 m–18 h on Jnly 30, were as follows: the stationary explosive activity at the openings along the fissure was disturbed by the lava fountainings on the pit-bottom, in such a manner that the former decreased its violence as the latter increased. Lava-outpouring at the fountains was continual, although a sudden engulfment of the fountaining lava into the feeding channel below was temporarily observed at 15 h 10 m. At 16 h 55 m, the lava-outpouring gradually declined, while the explosions at the openings became violent. At 17 h 30 m, simultaneously with the subsidence of activity of the latter, the former became vigorous again, being supplemented later at 17 h 40 m by a "boiling" action at the lava fountains. Toward 18 h, the lava-outpouring became stationary and rather weak, while the explosive activity at the opening recovered from its declining activity, coming back to its stationary state of repeating explosions. Then, both the lava fountains and explosive openings continued their activities side by side. The following is a fuller account of the feature of the lava fountainings observed by one of the writers (R. M.) on July 30.

An incandescent lava wells out like water pouring forth from a big pipe. The force of splashing of the lava in the fountain is not so strong as that observed in the Hawaiian eruptions[14] and also as that observed in the 1951 eruption of the present volcano. But at the climax of fountainings, the lava is splashed like water around its source (Fig.

13) T. KIZAWA, "Geophysical phenomena in volcanic activity (1)", *Journal of Meteorological Research from the Central Meteorological Observatory*, **3** (1951), No. 7, 249 (in Japanese).

2) G. A. MACDONALD & J. B. ORR, "The 1949 summit eruption of Mauna Loa, Hawaii," *Bull. Geol. Surv. U.S.A.*, 974-A (1950).

19). The lava flows with a speed of about 18 m every minute from its source to the lower portions in the pit-bottom (Figs. 10, 16, and 18). Temperatures at the surface of the lava in and about the fountains are high, sometimes attaining up to 1200°C, as measured with an optical pyrometer on the spots illuminated in orange-yellow. Viscosity of the lava may be small as inferred from the appearance of the lava splashes.

The head of lava column in the central pit was rising continually with or without outpouring of an incandescent lava to the surface, probably owing to the continuous feeding of liquid lava from below to the bottom of new lava pool in the pit. Thus, the level of the new lava in the pit became higher day by day, its depths from the rim of the pit (C in Fig. 20) being 140 m, 125 m, 123 m, 99 m, and 60 m, on July 21, 24, 25, 28, and 30, respectively, and 52 m on Aug. 1.

From midnight of Aug. 1 to dawn of the next day, a new lava began to appear beneath the talus, which was described in a foregoing section, with tremendous earth-trembles amid heavy rain-falls. On Aug. 2, at 11 h 00 m, extrusion of the lava took place vigorously, thrusting up northward on the already-solidified surface of the lava column in the central pit. Such extrusions of the lava further occurred in the following Aug. 3, to form a mound at the foot of the talus.[15] Cinders were piled on the mound and its topography, thus formed, remains even after the cease of the present activity (Figs. 31, 61).

(4) *Ejecta at the initial stage of the eruption:*

The materials ejected by explosions were different in certain respects, as the initial provisional explosion-openings were enlarged to a definite explosion-vent (1st vent) on the new cinder cone, and as the head of lava column in the central pit upheaved at the initial stage of the eruption. Thus at the initial stage of the eruption, volcanic ashes were blown out, forming dense ash-clouds in the air. They were deposited on the southern half of the crater-floor, especially on its southernmost corner where old fumaroles[16] were still active. They consist mainly of old rock fragments, probably derived from the pit-wall smashed by the explosions.

---

15) K. SAWAMURA, "On the volcanic activity of Mt. Mihara, Izu Oshima Is. in 1950," *Bull. Geol. Surv. Japan*, **4** (1953), 175.

T. KIZAWA, *Ibid.* 253.

16) Almost constant in temperature, about 50°C before and after the beginning of the 1950 eruption. (Oral communication from Mr. T. Kizawa).

Juvenile volcanic bombs and scoriae are comparatively rare in the ejecta at the beginning of the eruption. Some of the bombs, so far found, carry an angular fragment of old rocks as their central cores. Ash-clouds were usually blown out whenever an explosive activity began after a time of repose, particularly when an explosion began at a new opening. Juvenile volcanic bombs and scoriae were ejected when the explosive activity entered in a stationary state, with a succession of explosions showing a volcanic eruption of the Strombolian type.

(5) *Shifting of the explosive vent (1st vent)*:

For ten days from Aug. 1, the eruptions were recurrent without any long repose, as suggested by frequent detonations, but nothing important of the activity could be seen, for the mountain was shrouded for most of the time with a dense cloud accompanying heavy rain-falls.

In the morning of Aug. 5, the top of the cinder pile on the northern side of the explosive vent had reached to the rim of the central pit, and the cinder pile on the southern side of the vent had grown into a cone, about 50 m in height above the old crater-floor.

On Aug. 7, the vent, situated about 20 m above the rim of the pit, had shifted southward (Figs. 22–23) to be surrounded by a complete cinder cone. The southern side of the cinder cone, which covered the old crater-floor, was connected with adjoining old crater-wall. The cinder pile which was deposited on the talus formed by the debris of collapsed pit-wall, adjoining to the northern side of the cinder cone had been pushed from below by the rising lava column in the pit and moved somewhat to the north. The rising of the lava column in the pit was accelerative; the lava, which was fed through a concealed path at the southern corner of the pit, continued to flow northward on the surface of lava column in the pit. Both the upward movement of the lava column and the northward movement of the overflowing lava caused a northward drift of the cinder pile on the northern side of the cinder cone, bringing the latter to the centre of the central pit. The southward shift of the explosive vent, which resulted in the formation of a separate cinder cone, suggests the shifting in that direction of the underlying feeding channel of a gaseous lava, probably due to a lateral pressure of the rising lava column in the pit. The upward extrusion of the lava column, which brought about the remarkable shifting of the vent and the cinder pile, is inferred to have occurred mainly during Aug. 4–5.[17]

17) Earthquakes were felt 10 times or more in the island on Aug. 5.

On Aug. 9, explosive activity was rather small, both in noise and in force of ejection, compared with that in the preceding two days. The same day, however, rising of the lava column in the central pit and emission of lava from the southern part of the pit became more conspicuous, accompanying remarkable volcanic tremors about every 5 minutes. In the next two days, the explosive activity was violent together with powerful emissions of incandescent lava through clefts in the solidified crust of the lava column. In the evening of Aug. 11, the explosions were heard as severe rumblings even on the skirts of the volcano.

On Aug. 12, at noon, lava welled out from two openings, situated at the southeastern corner of the central pit and adjacent to the east of the active cinder cone, spurting light-bluish fumes. There, lava fountainings were being displayed to a height of several metres, and the southern half of the pit was covered with the incandescent lava, exhibiting something like a sea of flames. The surface of the lava in the pit was about 20 m in average below the edge of the crater-floor (Fig. 34). At that time, the explosive vent was almost in a dormant state. But on the next day, the vent resumed an explosive activity, ejecting cinders and bombs, 200 m or more above the rim of the vent. The cinder cone, which was formed around the explosive vent, attained to a height, only 2 m lower in altitude than the southern crater-wall. Moreover, from an opening adjoining to the cinder cone and corresponding to the site of the explosions at the initial stage of the eruption, lava welled out with an upward jet of about 1 m in height, and ran down with a speed of about 1.5 m/sec, forming ripply streams. Then, these glowing lava streams advanced slowly on the floor of the central pit along its southwestern wall, and transformed before long into a pahoehoe lava.

On Aug. 14, emissions of lava from the same spot as mentioned above, became again conspicuous, their jets attaining to a height of about 3 m or more. The lava filled up the central pit almost completely. The solid crust of the lava near the southwestern edge of the pit became about 1 m higher than the edge of the pit. The cinder cone also became about 1 m higher than the southern wall of the crater.

(6) *Outflows of lavas from the central pit to the crater-floor* :

On Aug. 15, explosions were rather weak, as in the foregoing two days ; lava cinders and bombs were ejected only about 50–60 m above the rim of the vent at intervals of about 2 to 6 seconds. Red-hot lava was emitted from a spot, about 5 m above the crater-floor, on the western side of the active cinder cone, and flowed down the slope northwestward. Before noon, the lava flow arrived at the margin of the central pit, and early in the afternoon, it ran over the pit-wall to the crater-floor.

On Aug. 16, the head of lava column in the central pit was still rising, accompanied with overflowing of the lava from the pit. Thus, at dawn, the rising lava in the pit attained to a height of about 5 m above the edge of the northern section, about 30 m in length, of the pit-wall. Then, a red-hot lava welled out through clefts in the crust of the lava, and flowed with a speed of several meters every minute. But the lava fronts were advancing in various directions on the crater floor with a speed of about 1 m every 10 minutes. As the lava-flows advanced on the crater-floor, their solidified crusts were broken into plates of various size, from 1 m to 4 m in diameter, sometimes forming chaotic masses of angular lava blocks.

At noon, the same day, the lava, which had filled up the southeastern half of the central pit since Aug. 12, ran over the eastern periphery of the pit at three spots adjoining each other. The red-hot lava, which welled out at those spots through clefts in the already-solidified lava in the pit, advanced on the crater-floor with a speed of several metres every minute, forming three separate flows, about 2 m in width and parallel with each other. About 30 minutes later, they were united to a single lava-flow covering an area of about 100 m^2 of the crater-floor (Fig. 24).

On Aug. 17, red-hot lava poured out from an opening, 30 m in altitude above the crater-floor, on the northwestern slope of the cinder cone. The distribution of the lava-flows on the crater-floor is shown in Figs. 24–26. Thus, the lava-flows covered more than half of the crater-floor on Aug. 18.

In association with these lava-outflows in and around the central pit, depression of the solidified lava-surface occurred here and there, probably due to withdrawal of the underlying liquid lava. Thus, for example, the eastern side of the cinder pile, about 200 m in length and about 10 m in width, was depressed remarkably. The outflowing of lava from the opening on the western slope of the active cinder cone was incessant.

On Aug. 19, at dawn, the liquid lava that continued to outflow from the opening on the western slope of the active cinder cone became stagnant on the southwestern corner of the crater-floor, forming a temporary red-hot lava-pool, 150 m or more in diameter. The lava that ran over the northern rim of the central pit extended to cover the northern half of the crater-floor.

(7) *Opening of the second explosive vent* :

On Aug. 20, rainy and misty weather closed the view of Mihara crater all day long. On Aug. 21, the crater was seen to be displaying a conspicuous eruption : A red-hot lava-pool was still active in the southwestern corner of the crater-floor ; lava flows were spreading over the northern and northeastern lava-fields in the crater ; and explosions were taking places in repetition at intervals of about 2 to 3 seconds from the more or less enlarged vent on the cinder cone. In the evening of the same day, a new vent was opened on the eastern slope of the cinder cone, about 30 m in altitude above the crater-floor (Fig. 26). From the new vent, incandescent lava was ejected in pieces up to a height of 200 m or more above the crater, by explosions that occurred in succession together with continuous loud noises like the sound of a drum. Explosions were going on at the 1st and 2nd vents simultaneously (Fig. 36). But the activity of the 2nd new vent differed from that of the first vent in that the former was accompanied by lava-outflowings from the same vent, besides repeated explosions.

Thus, simultaneously with explosions, a red-hot lava, which filled up the second vent, ran over the eastern lowest rim of the vent, and flowed down northeastward on the crater-floor. The lava-pieces that fell on the lava-flow by explosions were carried away from near the rim of the vent by the flow as it advanced. It was principally due to this action that the vent was left breached on its east side, without being closed with a pile of the ejecta, and that the lava-flows from the vent had the appearance of a block lava of the *aa* type.

The activity at the second vent went on with an increasing intensity, while the activity at the first vent, which was represented by about ten explosions every minute at the most active period, gradually declined. Thus, the next morning, the second vent was seen to have developed into an elliptical opening, about 15 m and 7 m in major and minor diameters respectively.

On Aug. 23, the first vent had already stopped its activity, having been transformed into a shallow dish-shaped hollow, about 50 m in diameter, on the cinder cone which was the largest ever observed, having a height of about 80 m above the old crater-floor. The lava-pool at the southwestern corner of the old crater-floor was buried under the ejecta from the first vent, after having survived for about ten days since Aug.

13. But, red-hot lava continued to well out from clefts in the solidified lava-crust. The second vent was active as the day before, both in outpouring lava and in ejecting lava-pieces by explosions. The lava-flows from the vent were spreading over the 1912–1914 lava in the north-eastern part of the crater-floor, covering the latter 40 m–50 m thick.

In the afternoon of Aug. 24, the lava-pool, about 20 m in diameter, in the second vent was still active. Thus, its surface was very rough, moving several meters up and down in the intervals of successive explosions, and whenever its surface rose above the lowest rim of the vent, the lava ran over the latter to flow away. The explosions at the vent were being displayed in three different ways: (a) just before an explosion, the lava-pool swelled in the form of a dome; then the lava-swell was broken open by the explosion, just like a half-open lotus-flower (Figs. 38 39,); the lava, broken into pieces, spattered in and about the vent, within less than 100 m in radius; and just after the explosion, the surface of the lava-pool was engulfed in a moment, (b) an explosion occurred at a stroke without any forerunning dome-shaped swell of the lava-pool; the lava, broken into pieces by the explosion, was ejected straight upward to a height of about 200 m above the pool; and the ejecta were scattered about the vent, within a range of about 200 m in diameter (Fig. 37), (c) explosions occurred at several spots in the lava-pool, separately but simultaneously; a small mass of lava-pieces was ejected by each explosion, either straight upward or obliquely, to a height of less than 200 m above the pool; and at times only a single lava-piece was projected in the air by such an explosion.

The explosions of the above-mentioned types occurred irregularly at intervals of several seconds, although puffing noises were heard every one or two seconds, together with a sound like the roar of the sea. Bluish gases like a faint smoke issued from the vent at the time of the explosions. Besides, a black ash-cloud was spouted only when the explosion occurred just after the lava-pool was covered temporarily with cinders tumbling down from the surrounding walls, or in case the explosion blew off a part of the walls.

In the evening, the same day, the incandescent lava-pool in the second vent had a temperature ranging between 1040° and 1140°C, and the lava-flow just outside the vent, about 1020°C, as measured with an optical pyrometer.

On Aug. 25, the second vent continued its activity in the same way as the day before, but with a more or less increasing intensity, although the scene of the activity could not be observed because of the rainy clouds that screened the volcano from view. At times the explosions were felt in the village of Motomura, together with rattlings of doors due to air-concussions. In the afternoon of the same day, cinders and bombs were being ejected from the second vent to a height of a few hundred meters, as viewed from the western top of the old crater-rim through breaks in the rainy clouds. Occasionally, some of the ejecta were seen to fall on the outside of the southeastern old crater-rim, after flying through the air for about 500 m in horizontal distance. The cinder cone, breached on the east side with the second vent, had grown up to a height of about 60 m above the old crater-floor, its top having attained almost to the same level with the crest of the southern old crater-rim, and the southern slope of the cinder cone had abutted midway on the old crater-wall.

The old crater was becoming gradually full of the new lava-flows. Thus, on Aug. 25, at the northwestern corner of the crater, adjacent to the cottage (Kakôjaya or Kakôchaya), the new lava-flows were one or two meters higher in level than the narrow ledge of the 1912–1914 lava that was left uncovered on the adjoining crater-wall; whereas, on the day before, the former was nearly at the same level with the latter. In various places, red-hot lava was being squeezed from under the solidified crust of the new lava-flows.

On Aug. 26, the eruption continued on all day long in the same manner as in the preceeding two days, presenting in the fine weather a magnificent view of repeated explosions and outpourings of lava from the second vent. The explosions were being displayed in three more or less different ways as observed on Aug. 24. But, this day, it was found that an islet of black lava-mass, a few meters in diameter, appeared occasionally in the second vent, and that small explosive jets of gases were liable to occur along the islet.

From Aug. 27 to the end of the month and covering the first two-third of the next month, the second vent displayed explosions intermittently and with rise and fall of intensity.[18] As the activity proceeded, the cinder cone that surrounded the vent became higher with cinders and bombs ejected by the successive explosions. Thus, the top of the cone attained to heights of 730 m, 739 m and 754 m above the sea,

18) Pouring of liquid lava from the 2nd vent into a continued until Sept. 1. and after the cessation of the lava-outpouring, the breached cone grew into a complete form.

respectively on Aug. 31, Sept. 7 and Sept. 23.[19]

(8) *Overflowing of lavas from the crater*:

The new lava-flows spread over the old crater-floor, and at the same time their surface level approached to the upper rim of the old crater-wall. In consequence, the northwestern front of the lava-flows reached to a level of about 20 m below the crest of the northwestern crater-wall on Aug. 28, and only about 10 m below the same crest on Aug. 30. On Sept. 13, at 17 h, a lava-front reached to the saddle (Kawajiri) on the northern crater-rim, at the level of about 660 m above the sea and about 200 m northeast of the cottage (Kakôjaya), and at 18h05m, a lava-flow, about 5 m in width, ran over the saddle, extending for a distance of about 7 m on the outer slope of the central cone (Fig. 46). On the next day, at dawn, another lava-front reached to the crest of the northwestern crater-wall, about 670 m in height above the sea and about 100 m southwest of the cottage, and at 16h, it began to flow down in the form of a lava-tongue, 20 m in width, on the outer slope of the cone.

On the morning of Sept. 19, northern front of the lava in the crater overlapped the crater rim about 400 m NNE. of the cottage (Kakôjaya), and several minutes after noon, a lava-tongue, 8 m in width, began to flow out on the northern slope of the central cone. The lava overflowings from the crater occurred successively until Sept. 24, even after the cessation of the explosive activity at the cinder cone on Sept. 23, at night. The lavas did not flow down simultaneously over a wide range of the crater rim, but ran down successively as narrow lava streams, about 5–10 m in width, and 2–3 m in thickness, on the northern and northwestern slopes of the central cone. The central portion of each lava-flow ran down the slope almost as a stationary current[20], piling solidified lava-blocks of *aa* type on both sides (Fig. 47). So the movement of the central portions of these lava-flows appeared like that of escalators or of belt conveyers carrying piles of cokes. These flows that ran down the outer slope of the central cone were always terminated with comparatively thick piles of *aa* lava-blocks (Fig.

19) R. TAKAHASHI, "The activities in 1950 and the accompanying topographic changes of Volcano Mihara-yama," *Geogr. Mag.* **60** (1951) No. 3, 115 (in Japanese).

20) Viscosity of one of these lavas was measured as $(1.3 \pm 1.1) \times 10^5$ poise, where the maximum temperature of the lava surface was 1040°C. I. MURAI, N. NASU, A. SUGIMURA, & T. SAMEZIMA, *Monthly Meeting of the Earthquake Research Institute*, (Oct. 17, 1950), *Jour. Geol. Soc. Japan*, **58** (1952), 73.

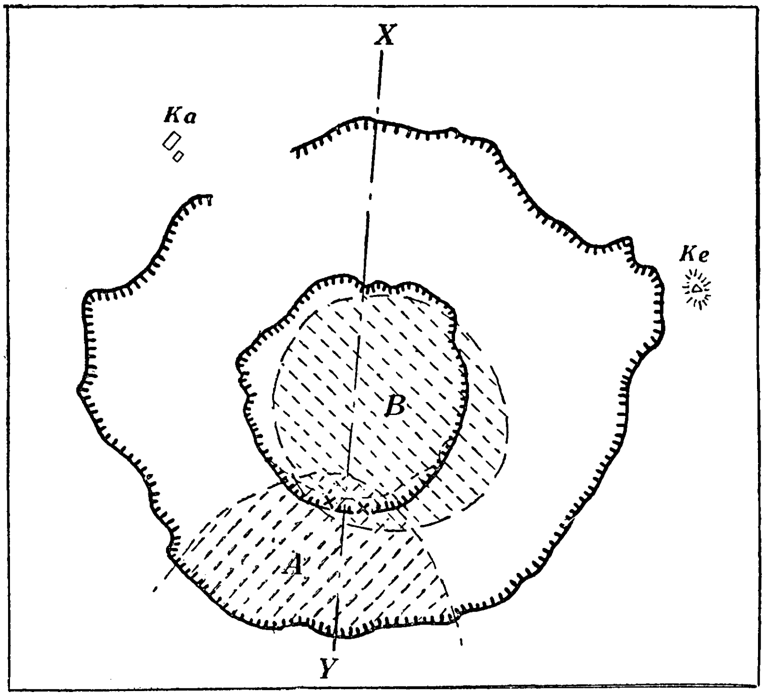

Fig. 21. July 23.

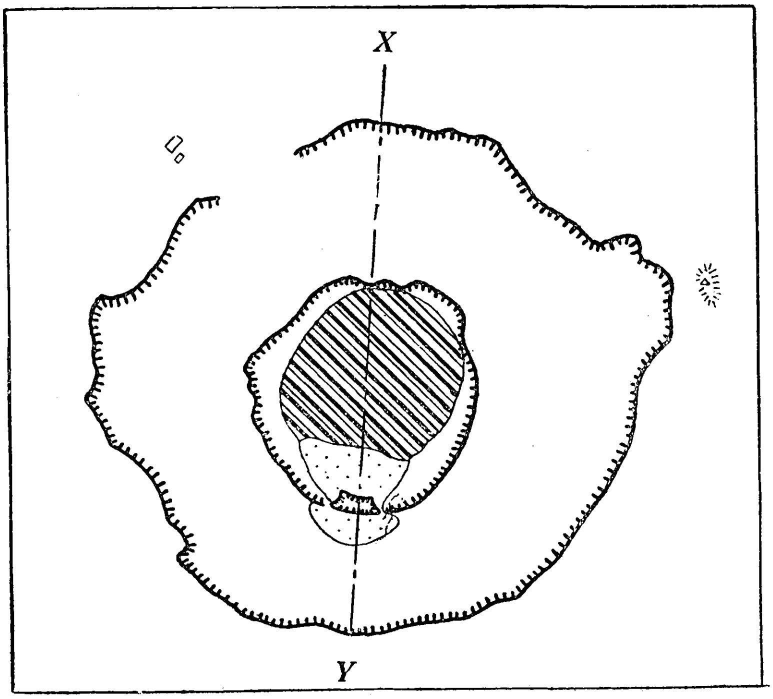

Fig. 22. July 30.

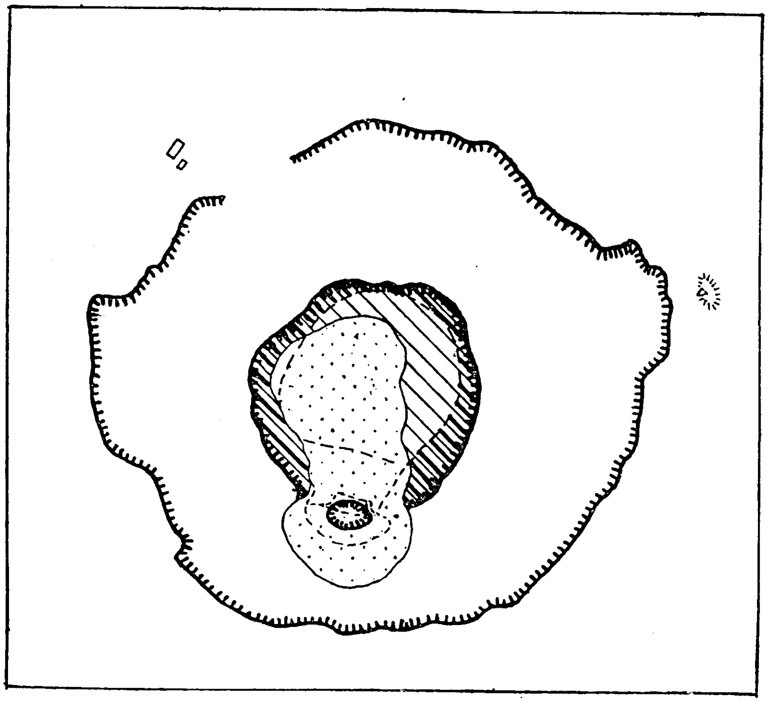

Fig. 23. Aug. 13.

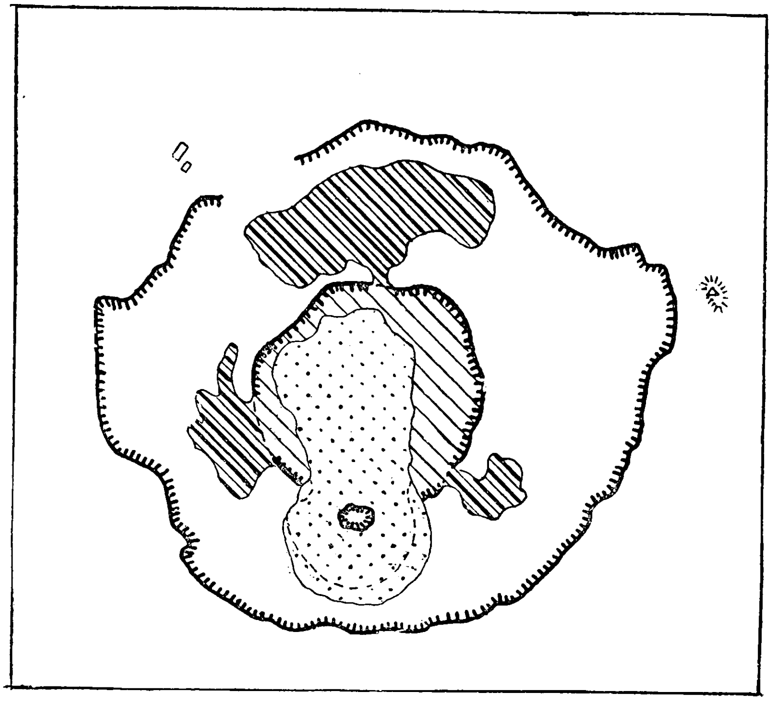

Fig. 24. Aug. 16.

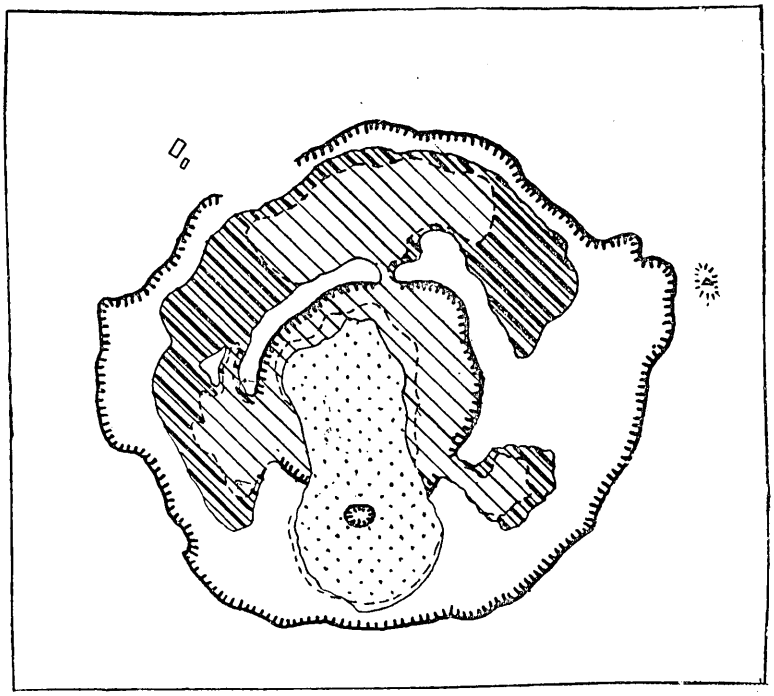

Fig. 25. Aug. 19.

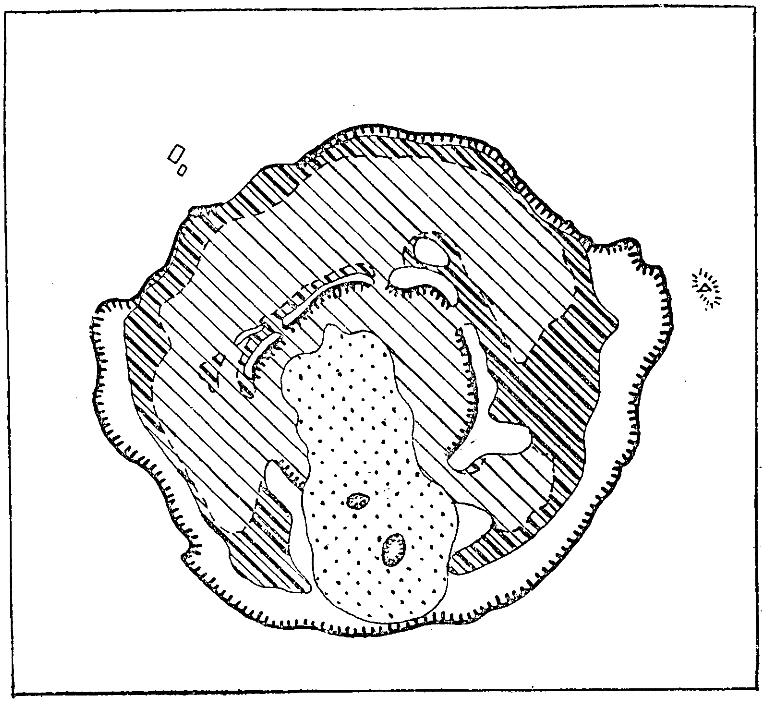

Fig. 26. Aug. 24.

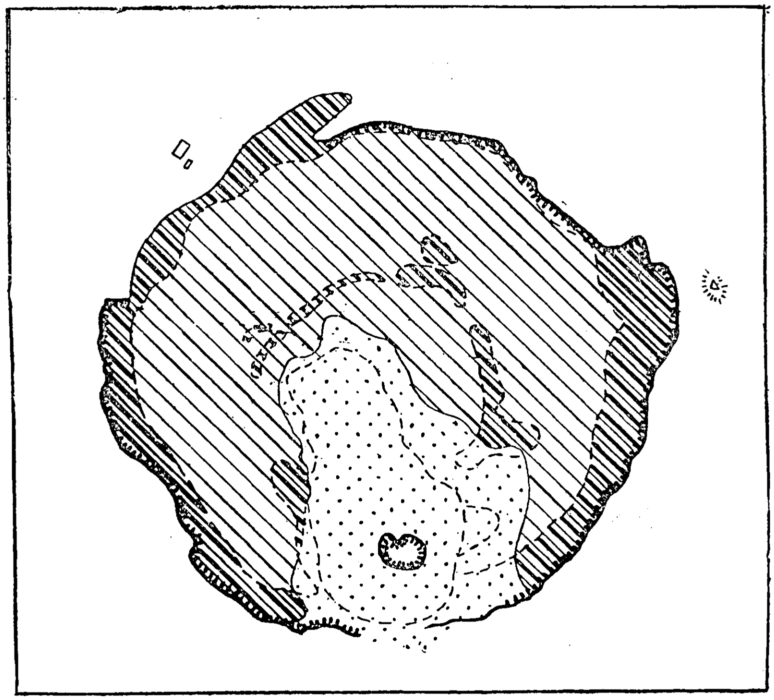

Fig. 27. Sept. 7.

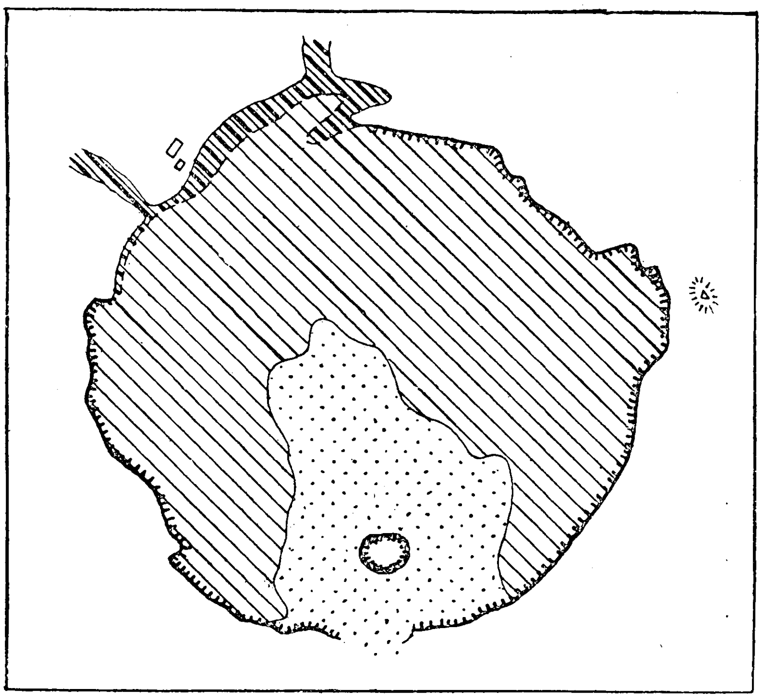

Fig. 28. Sept. 17.

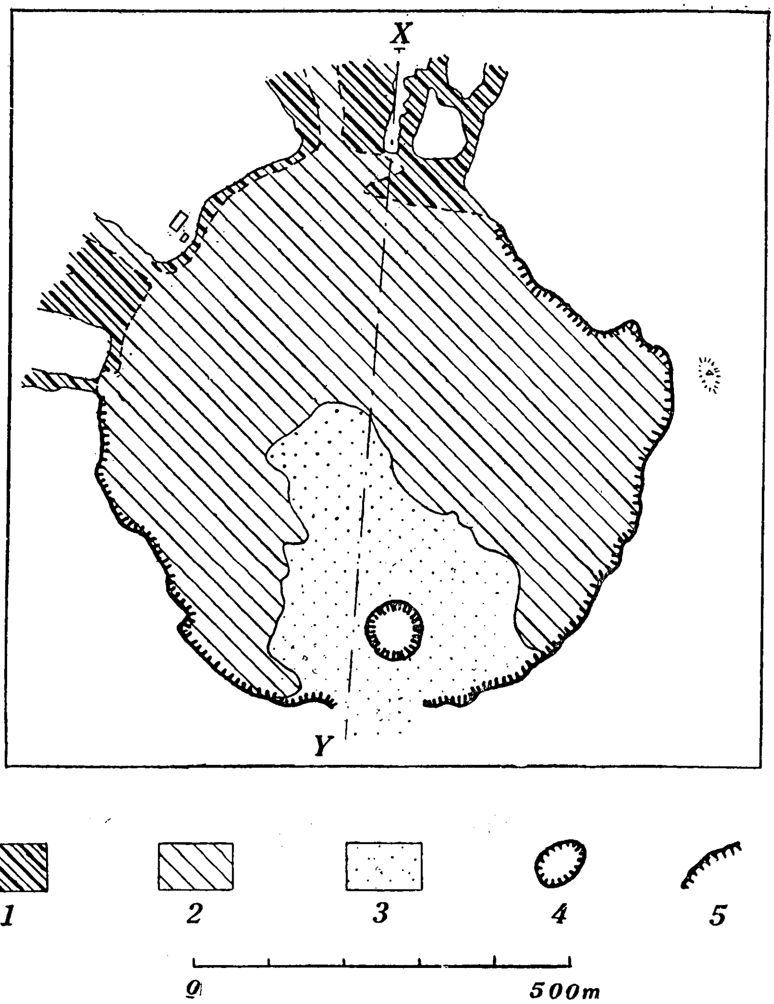

Fig. 29. Sept. 24.

Figs. 21–29. Showing changes in distribution of new ejecta and lavas during the present eruptions.

1. Increase of the area covered with new ejecta and lavas within a period of time between two successive dates of observation.
2. Area covered with lavas already before the first of the two successive dates of observation.
3. Cinder pile Ke Kengaminé
4. Explosive vent Ka Kakôjaya
5. Cliff

A, B in Fig. 21 show distribution of ejecta of July 21 and 23 respectively.

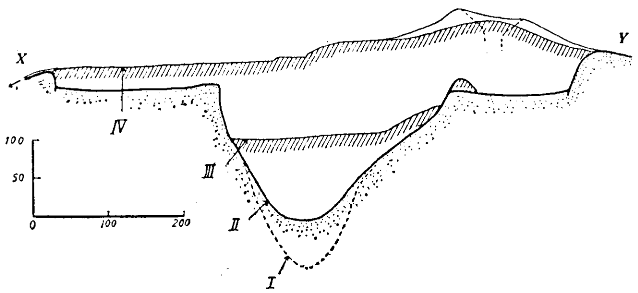

Fig. 30. NW—SE profile of Mihara crater, showing changes in depth by the present eruptions.
I. 1936 III. July 30, 1950
II. May 1950 IV. Sept. 23, 1950.

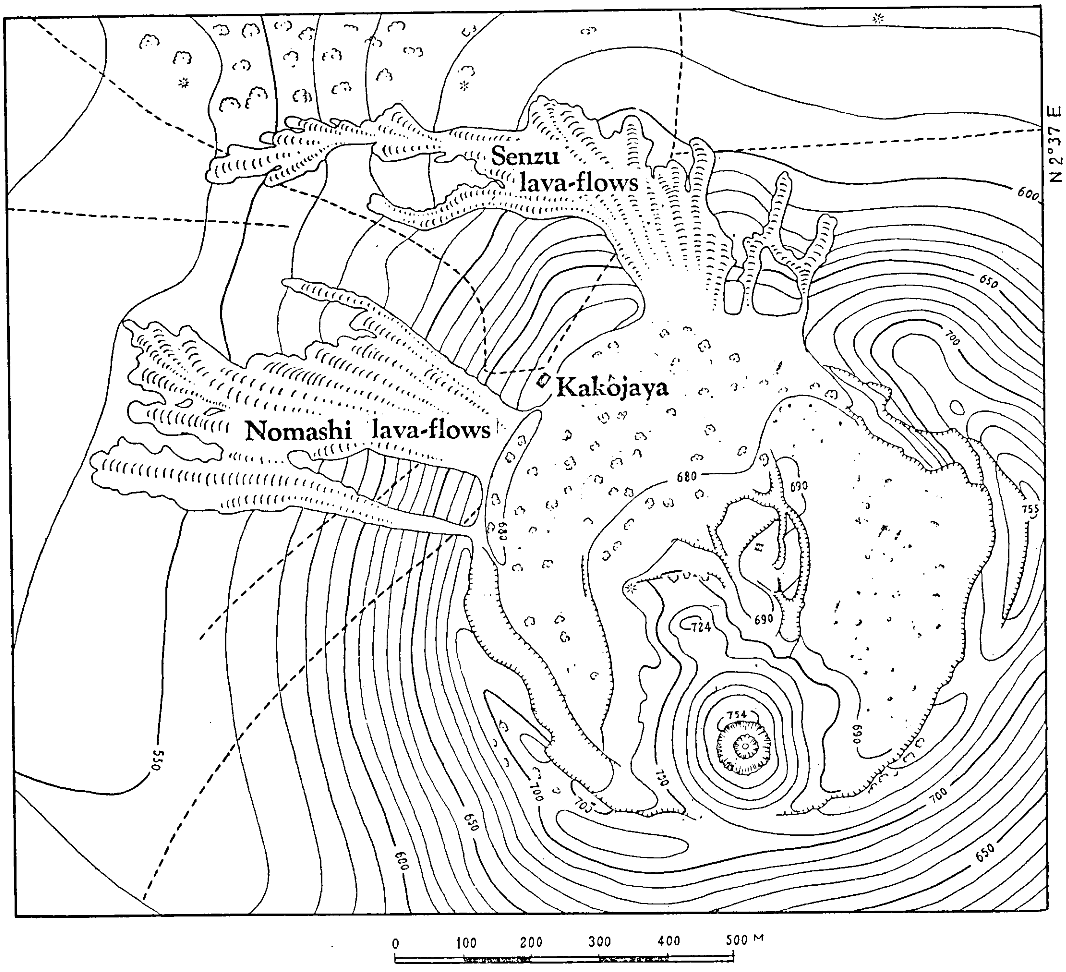

Fig. 31. Topographic map of Mihara crater (Sept. 24, 1950) after R. Takahasi and D. Shimozuru.

48). Velocities of advancing lava-fronts on the slope were measured as shown in the following table (Table II). Figs. 52–60 show the sequence

Table II. Velocities of the fronts of lavas flowing down the slope of central cone on Sept. 17, 1950.

	Inclination of slope	Time for passing through 10 m min.	sec.	Velocity of moving front of lava (cm/sec)
1	29.5°	9	31	1.75 (1050°C)
2	28.0	13	15	1.26
3	26.5	15	15	1.09
4	26.0	18	34	0.896

of the lava outflows from the crater, together with the rise of cinder cone, cinder pile, and lava field in the crater. As shown in Fig. 59, a lava-flow, which ran over the crater rim at about 250 m south of Kakôjaya on Sept. 23 at night, flowed down the northwestern slope of the central cone, forming an extensive new lava field on the next day. Thus, the lavas that flowed out northward (Senzu lava) and those northwestward (Nomashi lava) spread to occuppy the areas of 102,300 m^2 and 123,300 m^2 respectively (Fig. 31).

(9) *Decline of the 1950 eruption*:

On Sept. 18, explosions at the vent became weak: Dark ash columns rose instead of the ejections of incandescent lava pieces; sounds like feeble surfs on the seashore were heard as in the initial stage of the present eruptions. Continuous and stationary activity at the vent became more or less irregular, sometimes violent and sometimes weak. On Sept. 21, depressions of the inner portion of the lava field in the crater along the circular line on the old pit-wall and along the inside wall of the crater became remarkable, though it was said that such depression had already begun in the middle of September. Successive explosive actions at the vent began to be interrupted by timely reposes on these days. On Sept. 22, explosive action at the vent became quite weak, and the times of repose became longer, and vapour emission took the place of explosion. At last, the activity at the vent ceased on Sept. 23, after its 70 days continuation. As was mentioned above, outflowings of lava continued in more or less remarkable extent on the next day, and advancement of the fronts of these outflowing lavas lasted until Sept. 25. Thus, the continuous and progressive eruptions of the crater stopped, and Mt.

Mihara entered into a dormant state until the outburst on February 4, 1951.

III. Temperatures of the new lavas.

Temperatures of the new lavas were measured many times with optical pyrometers at various stages of the 1950 eruption. Besides, after

Table III. Temperatures of the lavas, Mihara crater, Oshima volcano, 1950.

Date	Object	Locality	Temperature (°C)	Instrument
July 30	Incandescent lava (a lava fountain)	Bottom of the pit	1210 1170	Optical pyrometer*
	Flying lava pieces	The 1st explosive vent	1100	Optical pyrometer*
Aug. 24	Incandescent lava	The 2nd vent	1040 1110	Optical pyrometer⁺
			1050	Optical pyrometer⁺
Sept. 3	Red-hot lava in crevice of a secondary flow at the lava-front	Lava front approaching to the crater rim, about 200 m east of Kakôjaya.	1080 1090	Optical pyrometer⁺
Sept. 16	Red-hot lava in the clefts of solidified crust of the lava-front.	Crater rim, about 100 m NE of Kakôjaya.	1020 950	Optical pyrometer⁺
	Red-hot lava in the clefts of solidified crust of the lava-front.	Crater rim, about 100 m NE of Kakôjaya.	824 820	Thermo-couple Optical pyrometer⁺
	Secondary red-hot lava outflowing from the clefts on the lava front.	In the crater, 10 m SE of Kakôjaya.	946 836	Calorimeter Calorimeter
Sept. 17	Front of a flowing lava	The western slope of the central cone about 100 m W of Kakôjaya.	1030 970	Optical pyrometer⁺
	Red-hot lava block tumbling down from the front of flowing lava	Ditto., about 150 m W of Kakôjaya.	806 735	Calorimeter
	Central portion of rapidly flowing lava from crater rim	Crater rim, about 50 m S of Kakôjaya.	1050 1100	Optical pyrometer⁺

* Optical pyrometer, made by the Yokogawa Electric Works, was used. The instrument was adjusted especially at the Machine Research Institute of the Ministry of International Trade and Industry.

⁺ Optical pyrometer, made by the Hokushin Electric Works, was used. The Yokogawa-made and Hokushin-made pyrometers were tested and found correct by comparing with each other at the same condition. Red absorption filters were always used in both cases.

the outpouring of the lavas from the central pit, temperatures of some of the accessible lava-flows were measured with a thermoelectric thermometer. The results of these measurements are shown in the foregoing table (Table III), together with temperatures of red-hot lava pieces, obtained by calculating their specific heats after a method we shall describe in a later chapter.

Measurement of lava temperature with a thermo-junction:

Temperature of a red-hot lava was measured by inserting the almel-chromel thermocouple[21] with an iron-tube cover, 30 cm–50 cm deep into the lava through the clefts of its solidified crust. As no ice was available in the field, water in a vacuum flask was used for the cold junction of the electric thermometer. During the experiments, the temperatures of the water in the flask were observed, and they were taken into consideration in correcting the measurements. Thus, in an experiment, the temperature of the water showed a rise of only 0.6°C in 30 minutes,

Table IV. Rising of the temperature, with time, at the hot junction of the thermocouple in one of the temperature measurements of the 1950 lavas of Oshima volcano.

Time (min.)	Temperature (°C)	Time (min.)	Temperature (°C)
1	306	17	818
2	473	18	818
3	588	19	818
4	656	20	819
5	695	21	822
6	720	22	823
7	737	23	828
8	748	24	832
9	761	25	836
10	775	26	837
11	783	27	839
12	790	28	839
13	798	29	841
14	805	30	843
15	808	31	842
16	812	32	840

21) Corrected by comparing with the Standard Siemens's Pt-PtRh thermocouple at the Tokyo Institute of Technology. For this test, the writers are indebted to Prof. T. Yamanouchi and to Mr. H. Suzuki of the Institute.

because the cold junction was kept off by using a 10 m-long compensated wire, in order to minimize as far as possible the effect of heat radiation from the lava. Retardation of the temperature at the thermo-junction in attaining to that of the lava, owing mainly to the heat capacities of the thermocouple itself and of the iron tube, is shown in Fig. 63 and Table IV.

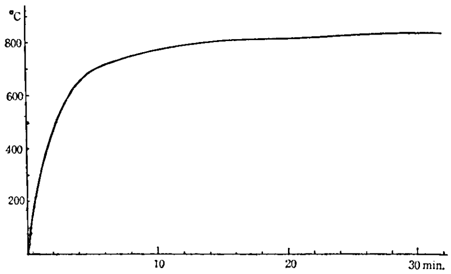

Fig. 63. Rising of temperature with time, at the hot junction of the thermocouple in one of the temperature measurements of the 1950 lavas of Oshima volcano.

IV. Specific heat of the new lava pieces.

In order to know something about the relations between the rate of cooling and the crystallinity of the living lavas, we picked up pieces of the flowing red-hot lavas and quenched them quickly in water (Figs. 49, 50). For the quenching of the lava pieces, a simple portable water calorimeter (Fig. 64) was prepared, so that specific heat of the lavas could be measured at the same time. Inner walls of the calorimeter are made of a thin steel plate (S) whose heat capacity is small. They are covered with saw-dust (C) filled in a wooden box (B). A definite

Table V. Rising of temperature with time of the water in the calorimeter, into which a hot lava-piece was put.

Time (sec.)	Temperature (°C)	Time (sec.)	Temperature (°C)
0	26.4	60	31.3
10	26.4	70	31.3
20	26.4	80	31.4
30	26.4	90	31.4
40	31.2	100	31.4
50	31.2		

quantity, 1200 cc, of water is put in the calorimeter, and while being mixed by stirring with a handle (H), its temperature is read with a thermometer (T) graduated in every 1/10 degree.

A piece of red-hot lava, picked up with a hammer from a flowing lava, was put quickly into the water in the calorimeter. Then the temperature of the water heated by the piece was read with the thermometer every 10 seconds. Two examples of the results

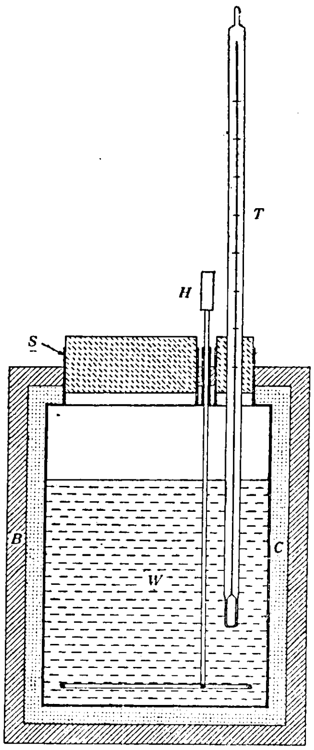

Fig. 64.

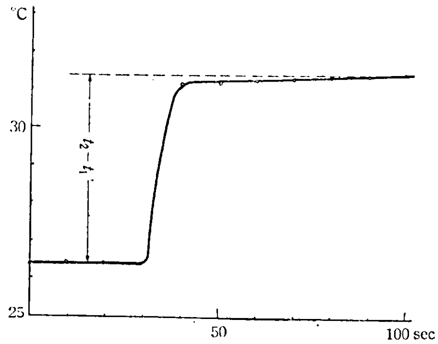

Fig. 65.

Table VI. Rising of the temperature with time of the water in the calorimeter, into which a hot lava piece was put in the field.

Time (sec.)	Temperature (°C)	Time (sec.)	Temperature (°C)
0	31.45	90	48.92
10	31.45	100	49.10
20	31.46	110	49.12
30	31.46	120	49.20
40	31.46	130	49.21
50	42.00	140	49.21
60	47.00	150	49.22
70	47.60	160	49.22
80	48.54		

thus obtained are shown in the above tables (Table V, VI, and Figs. 65, 66). The lava-piece, which was used in the field experiment, was weighed in the laboratory (Wr). Then, heated at 100°C in the boiling water, it was put into the same calorimeter. The temperatures of the water in the calorimeter, before and after throwing-in of the lava piece, were measured as t_1 and t_2 respectively (Table VII and Fig. 67). The specific heat of the lava piece was calculated as shown in the following table (Table VII).[22] Repeated experiments have shown more or less different values of the specific heat (Table VIII). But $Cr=0.213$ may be taken as the mean value.

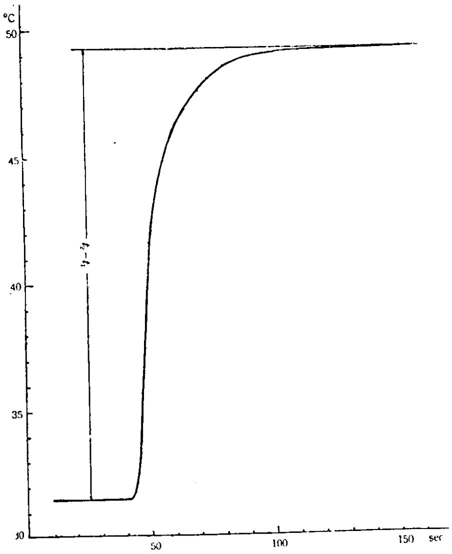

Fig. 66.

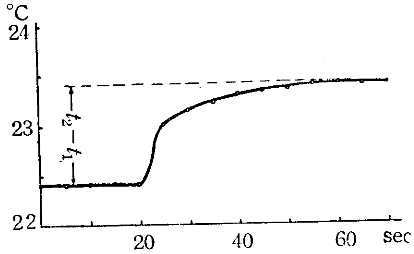

Fig. 67.

Table VII. Rising of the temperature with time of the water in the calorimeter, into which a lava piece heated at 100°C was thrown.

Time (sec.)	Temperature (°C)	Time (sec.)	Temperature (°C)
0	22.41	40	23.31
5	22.41	45	23.32
10	22.41	50	23.33
15	22.41	55	23.40
20	22.41	60	23.41
25	23.00	75	23.38
30	23.16	70	23.40
35	23.22		

22) $Cr=\dfrac{(t_2-t_1)CwWw}{(t_3-t_1)Wr}$ where

- Cw : Specific heat of the water.
- Ww : 1200 gr.
- t_3 : Temperature of the lava-piece (100°C in the laboratory).
- Wr : 68.9 gr for an example.

Table VIII. Specific heat of the 1950 lava-pieces, Oshima volcano.

No.	t_1 (°C)	t_2 (°C)	t_2-t_1 (°C)	Cr
1	21.92	22.92	1.00	0.2259
2	23.19	24.00	0.81	0.1856
3	22.41	23.40	0.99	0.2250
4	23.46	24.40	0.94	0.2165

Specimen numbers are the same in Tables X, XI.

Table IX. Temperatures of the lava-pieces, measured by means of a calorimeter, from Oshima, 1950.

No.	t_1 (°C)	t_2 (°C)	t_2-t_1 (°C)	Wr (gr)	t_3 (°C)
1	26.4	31.4	5.0	29.8	946
2	41.5	49.2	7.7	61.2	735
3	38.8	40.9	2.1	38.3	340
4	40.4	41.2	0.8	39.4	152
5	41.2	43.7	2.5	58.1	279
6	41.2	44.1	2.9	25.3	669
7	34.2	44.4	10.2	73.0	806
8	36.5	47.0	10.5	72.5	836
9	42.4	44.4	2.0	41.2	309
10	42.0	42.2	0.1	66.6	55

By assuming that the value of the specific heat of the lava pieces, $Cr=0.213$, is constant even at high temperatures, Table IX shows the results thus calculated.[23] The temperatures of the lavas from which the lava pieces were picked up must have been more or less higher than the temperatures (t_3) shown in the table.

V. Specific gravities of the new lavas.

In order to estimate the quantity of the 1950 lavas and for some other purposes, specific gravities of various portions of the lavas were determined by means of a pycnometer, as shown in the following table (Table X). As a measuring medium, water mixed with a small quantity

23) $t_3=\dfrac{Cw\cdot Ww\cdot(t_2-t_1)}{Cr\cdot Wr}-t_2=\dfrac{1200(t_2-t_1)}{0.213Wr}-t_2$, where t_1 and t_2 are the temperatures of the water in the calorimeter before and after the quenching of each lava-piece, measured in the field.

Table X. Specific gravities of the 1950 lavas.

No.	*W (gr)*	*R (gr)*	*R′ (gr)*	*d*
1	2.381	69.43	67.84	3.02
2	1.078	68.57	67.84	3.13
3	1.524	68.87	67.84	3.10

Modes of occurrence of the specimens 1, 3 are shown in the next table.

No. 2: One of the bombs that fell on the crater-floor near the northern side of the pit on July 24.

W: Weights of the specimens.

R : Sum of weights of specimen, pycnometer, and water in pycnometer.

R′: Weights of pycnometer filled with water.

d : Specific gravities.

Table XI. Apparent specific gravities (*Ga*), bulk specific gravities (*Gb*), apparent porosities (*P*) of the 1950 lavas.

No.	*W (gr)*	*Q (gr)*	*S (gr)*	*V (gr)*	*Ga*	*Gb*	*P (%)*
1	35.07	21.25	41.87	20.41	2.54	1.72	33.3
3	28.56	18.82	29.45	10.44	2.93	2.74	8.5
4	3.61	1.93	5.05	3.27	2.16	1.10	38.7
5	37.99	22.40	46.72	22.73	2.44	1.23	38.4
6	25.06	15.63	35.41	18.92	2.66	1.33	54.7
7	58.02	37.86	58.90	20.60	2.88	2.82	4.3
8	20.63	13.62	21.77	8.15	2.94	2.53	14.0

1: One of the lava pieces that fell on the crater-floor near the southern periphery of the pit on July 22.

3: A specimen of the lava that ran over the crater-rim southwest of Kakôjaya on Sept. 18.

4: One of the bombs that fell on the southern slope of the central cone on Sept. 23.

5: Specimen collected from the lava-crust at the front of the Nomashi lava flow.

6: Cinder collected from the cinder cone (2nd vent).

7: Specimen collected at the front of the Senzu lava flow.

8: Specimen collected from the lava field in the crater.

of ethylether was used. Powders of the rock piece were put in a pycnometer filled with the medium, and they were heated on a water bath for about 48 hours to avoid air. The experiments were done always at a constant temperature 70°C.[24] The values of true specific gravity thus obtained are almost constant in each specimen in spite of its different modes of occurrence.

---

24) For these measurements, we owe much to Dr. Y. Shiraki of the Tokyo Institute of Technology.

As the rocks were various in their porosities, the apparent specific gravities (Ga), bulk specific gravities (Gb), and apparent porosities (P) were determined in several specimens in the laboratory,[25] as shown in the foregoing table (Table XI).

Takahasi and Shimozuru calculated the total volume of the lavas and ejecta produced during the 1950 eruption as $2{,}105 \times 10^4 m^3$.[26] So their total quantity may be estimated to be about 50,000,000 tons.[27]

(To be continued)

---

4. 伊豆大島三原山昭和25年及び26年の噴火
その1　昭和25年の噴火

地震研究所 {津屋弘逵 / 森本良平 / 小坂丈予}

伊豆大島三原山は，昭和25年7月16日中央火孔南縁より噴火を開始，漸次その活動規模を増大しつゝ連続的噴火を行い，9月23日噴火を休止，翌26年2月4日噴火を再開，4月1日まで，更に大規模な熔岩流出を伴った活動を継続した．ついで，噴火は，間歇的かつ爆発的になり，6月28日活動を停止した．本篇では，昭和25年の噴火経過の観察を詳細に述べ，地形変化，噴出熔岩の温度，比熱の測定，噴出物の量(大約5千万噸) などについて記載した．

---

25) $Ga=\frac{W}{W-Q}$, $Gb=\frac{W}{V}$, $P=\frac{S-W}{W}\times 100$, where
W: Weight of a specimen,
Q: Weight of a specimen in water,
S: Weight of specimen saturated with water, and
V: Volume of water excluded by the water-saturated specimen.

26) They calculated the volumes of
(a) lavas filling up the crater as $1{,}584 \times 10^4 m^3$
(b) cinder cone and cinder pile as 422 〃
(c) lavas flowing out the crater as 99 〃
(R. TAKAHASI, "The activities in 1950 and accompanying topographic changes," *Jour. Geography* **60** (1951) 117 (in Japanese).)

27) If we assume the densities as 2.8, 1.4, and 2.6 for a, b, and c respectively then the quantity may be given as 5,000,000 tons.

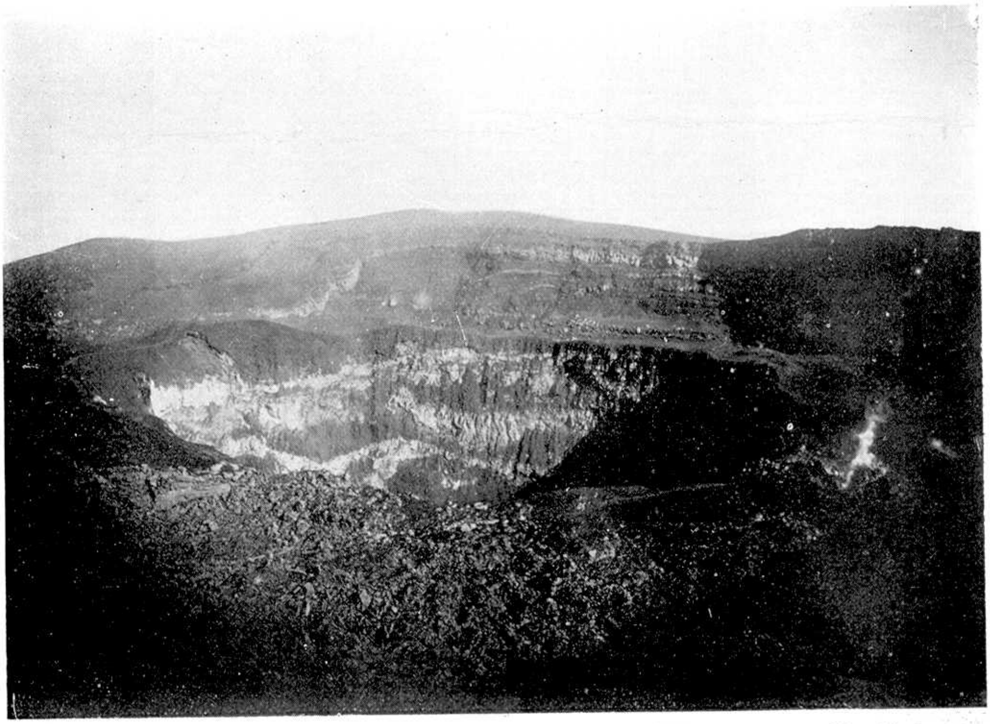

Fig. 3. Northeastward view of the central pit in the Mihara crater. The highest point in the background is Kengaminé, 775 m above sea level, highest peak of the island. Fumaroles in the right indicate a part of the arcuate fissure from which the present eruptions began on July 16, 1950. Photo. S. Watanabe, 1933.

(震研彙報 第三十二号 図版 津屋・森本・小坂)

Fig. 4. A narrow lava-stream (A) hanging on the collapsed pit-wall. Photo. H. Yamazaki, 12 h 30 m, July 16.

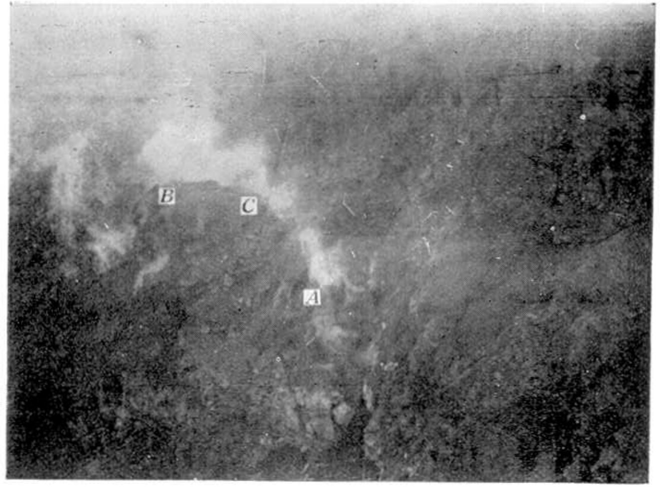

Fig. 5. White vapours issuing from openings (A, B, C) on the fissure between talus and collapsed pit-wall. A calm fumarolic phase of the present activity. July 20.

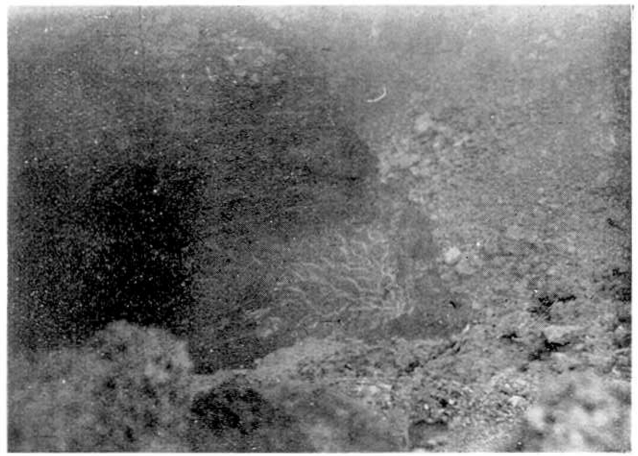

Fig. 6. Incandescent lava welling out from the south-western corner of the pit-bottom. July 20.

Fig. 7. A minor explosive puffing of white vapours from the opening B, July 22.

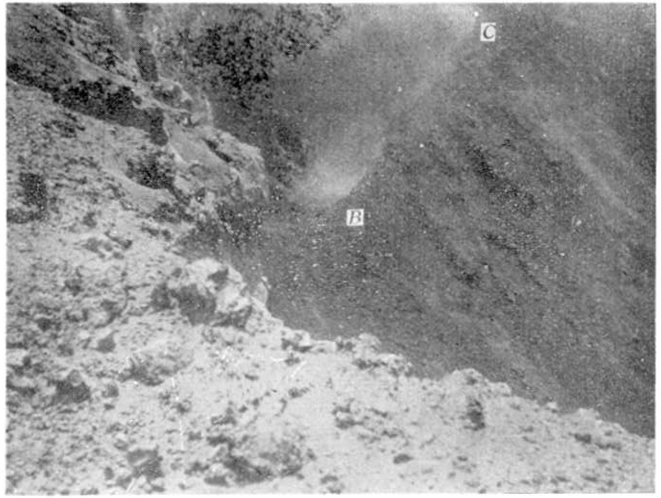

Fig. 9. Ejection of incandescent lava fragments from an explosive vent (corresponding to B in Fig. 7.). July 24.

Fig. 8. The pit-bottom showing welling out of incandescent lava. July 22.

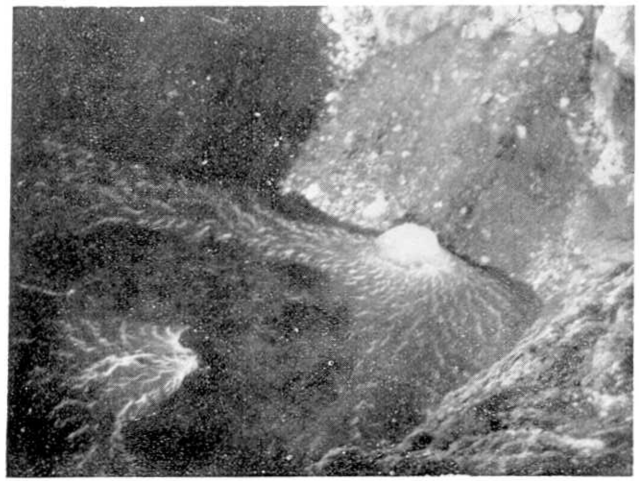

Fig. 10. Lava fountains at the southwestern corner of the pit-bottom July. 24. Photo. S. Watanabe.

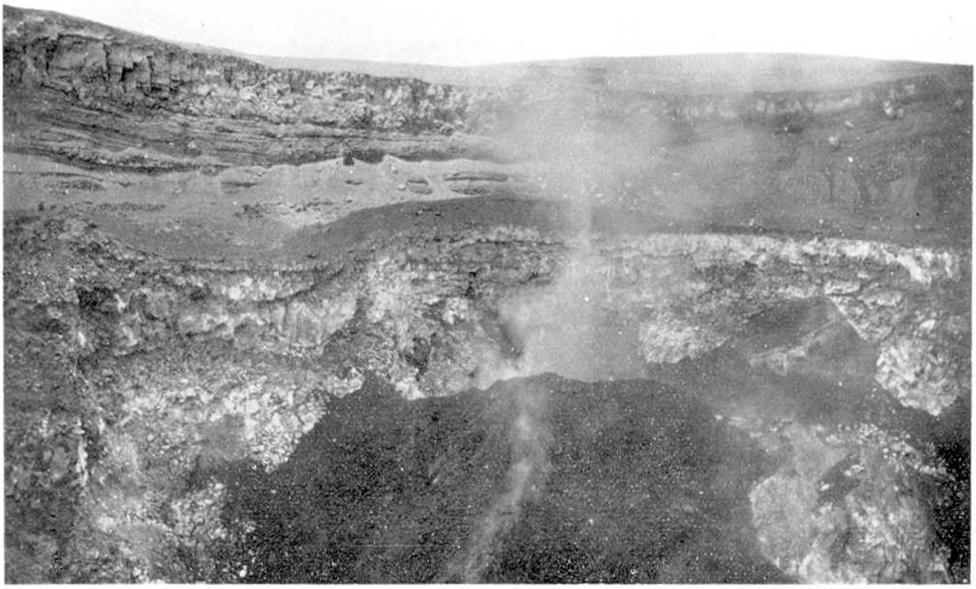

Fig. 11. New cinder piles on the talus in front of the explosive vent, and on the crater-floor (outside of the pit) behind the vent. Photo. S. Watanabe, July 25.

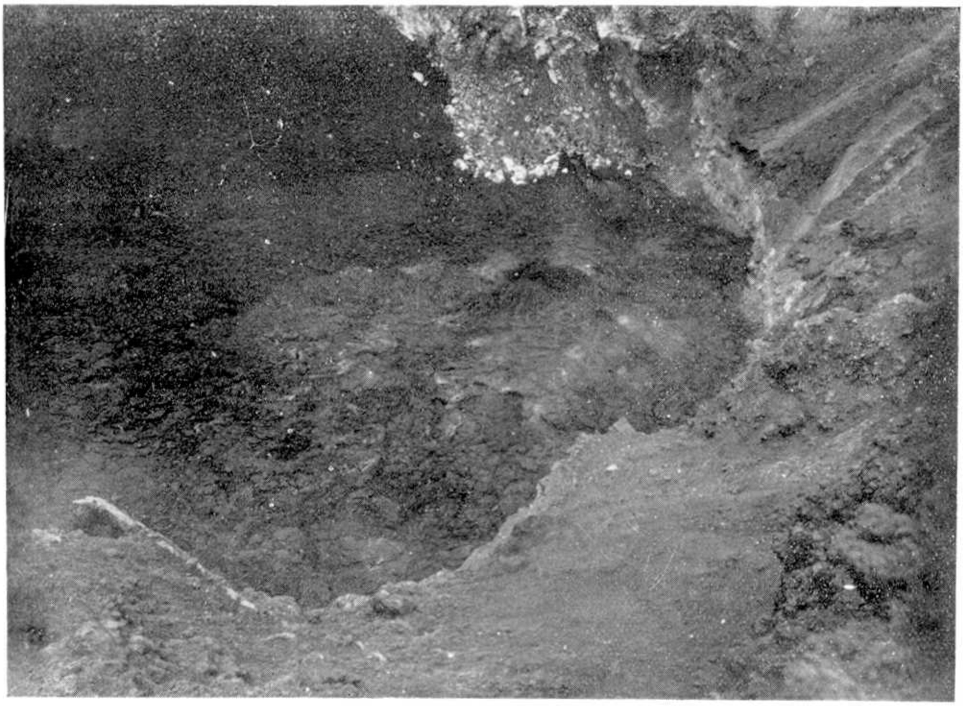

Fig. 12. New lava-pool in the pit, showing red-hot lava visible through many clefts on its solidified surface. Photo. S. Watanabe. July 25.

（震研彙報 第三十二号 図版 津屋・森本・小坂）

Fig. 13. Showing ejecta scattered on the crater floor. A picture taken from the crater-floor, south of active vent, July 28.

Fig. 14. Head of new lava in the pit. July 26. Photo. S. Watanabe.

（震研彙報 第三十二号 図版 津屋・森本・小坂）

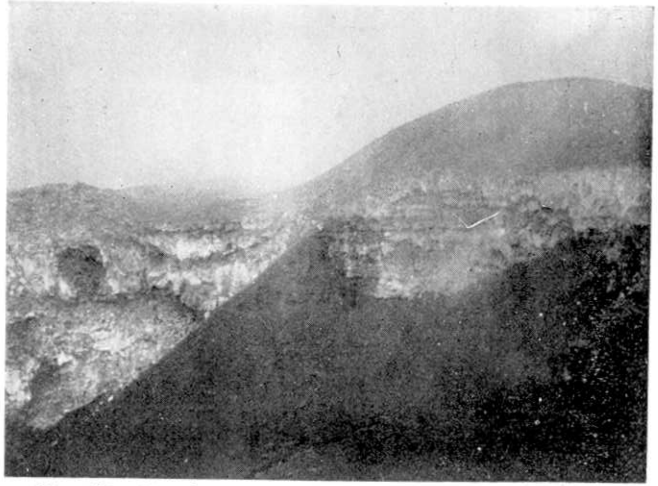

Fig. 15. Development of cinder pile on the talus in front of active vent and on the crater-floor behind the vent. July 30.

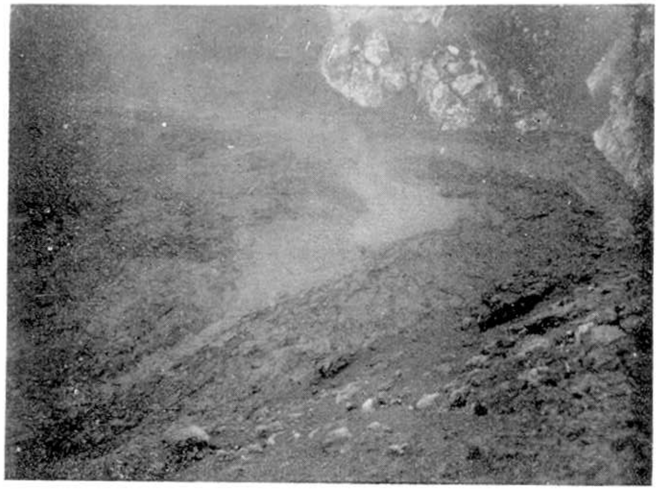

Fig. 16. Incandescent lava welling out from the pit-bottom. July 30.

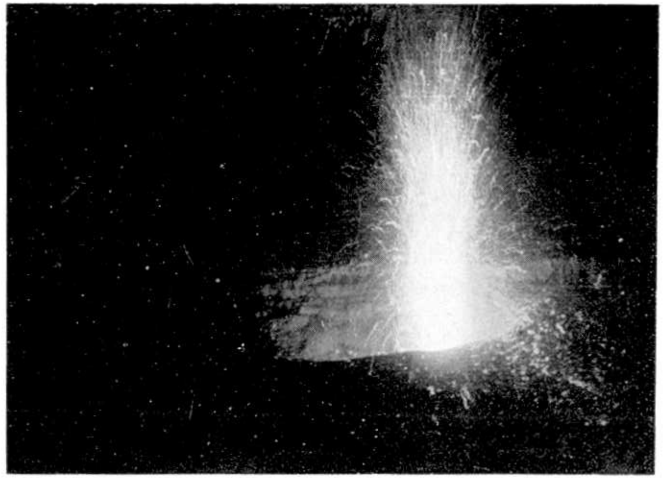

Fig. 17. Night view of the eruption, as seen from the same spot as Fig. 15. July 30.

Fig. 18. Night view of the same lava flow as that shown in Fig. 16. July 30.

Fig. 19. Night view showing a climax of incandescent lava-fountainings through the solidified crust of lava in the pit-bottom. July 30.

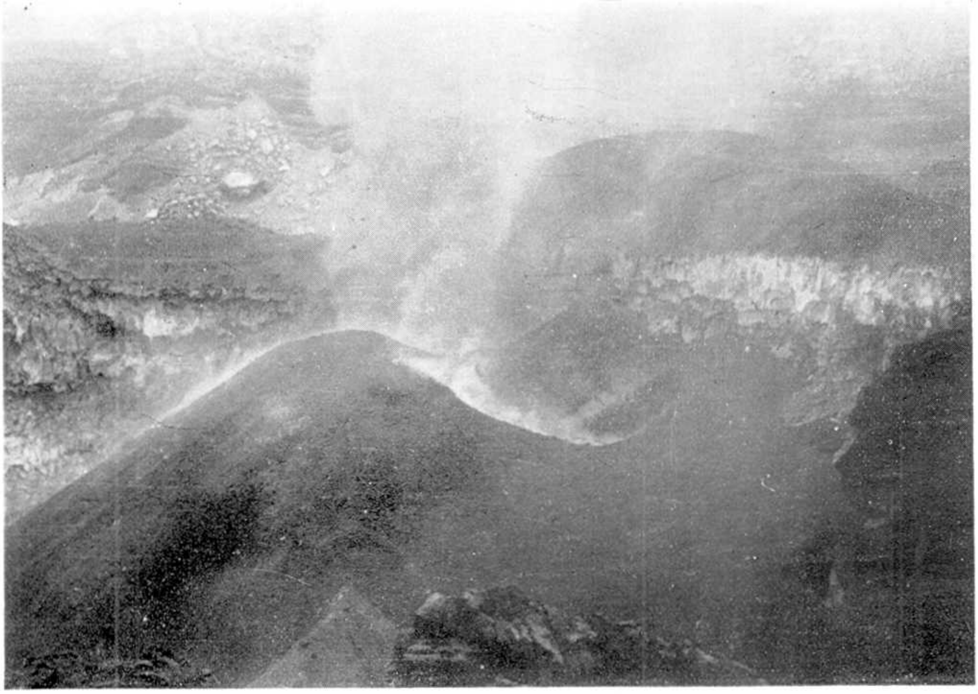

Fig. 32. Cinder pile growing up day by day around the explosive vent. Two bowl-shaped openings are seen in the vent. Aug. 1.

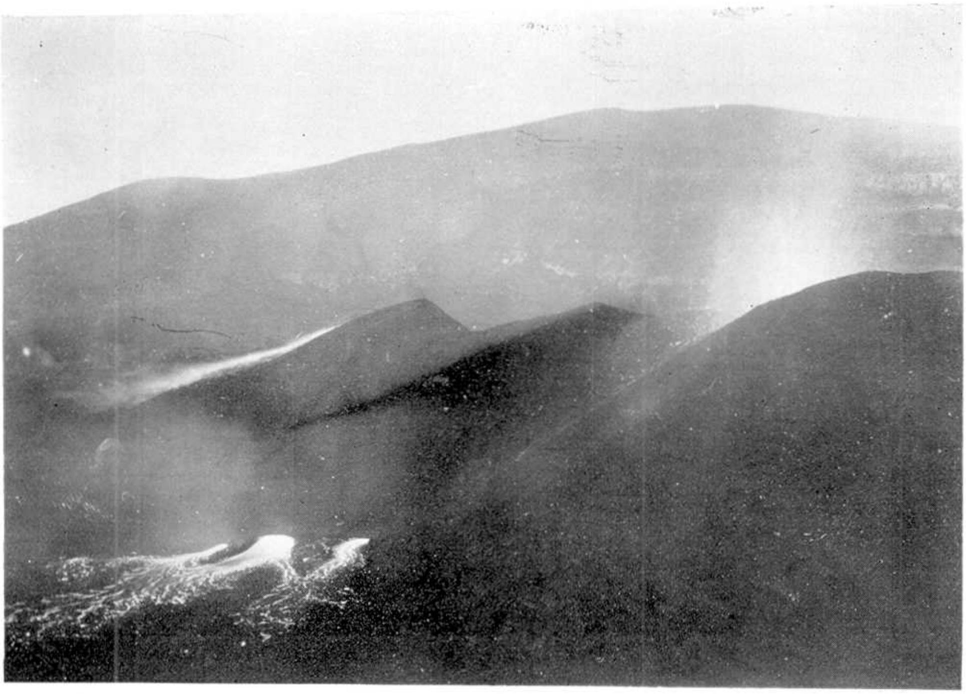

Fig. 33. Incandescent lava-flows outpouring from southwest and northeast sides of the cinder cone. Photo. S. Watanabe, Aug. 13.

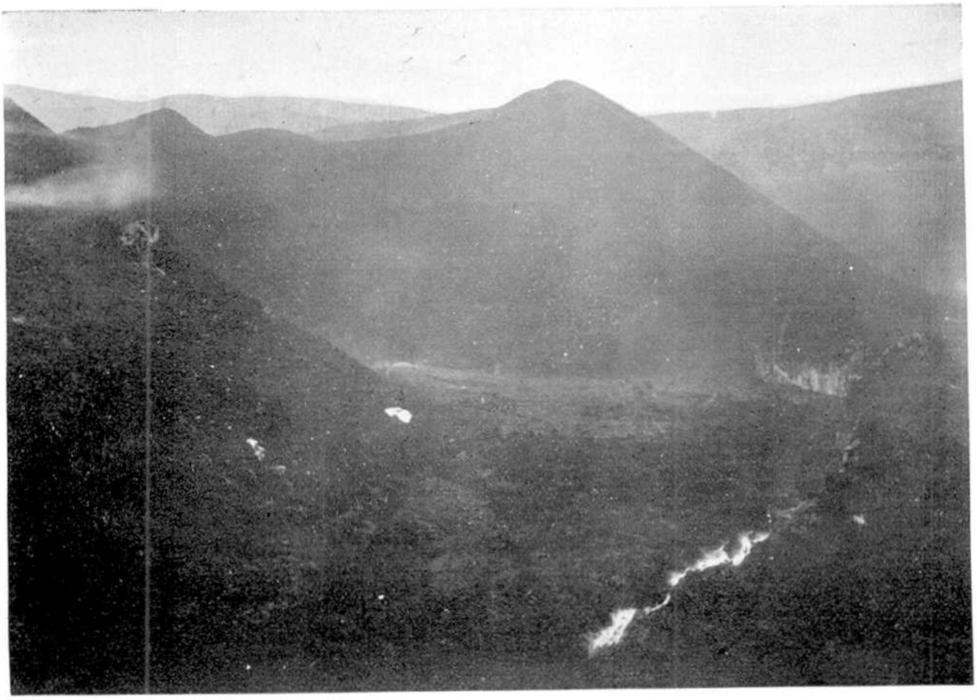

Fig. 34. Outpouring of lava at the northern foot of the new cinder cone. Head of lava column in the pit rose nearly to the level of the upper rim (lower right in the picture) of the central pit. Photo. S. Watanabe, Aug. 13.

Fig. 35. Southwestern part of the crater-floor, covered with new lava-flows and cinder cone. Aug. 15.

（震研彙報 第三十二号 図版 津屋・森本・小坂）

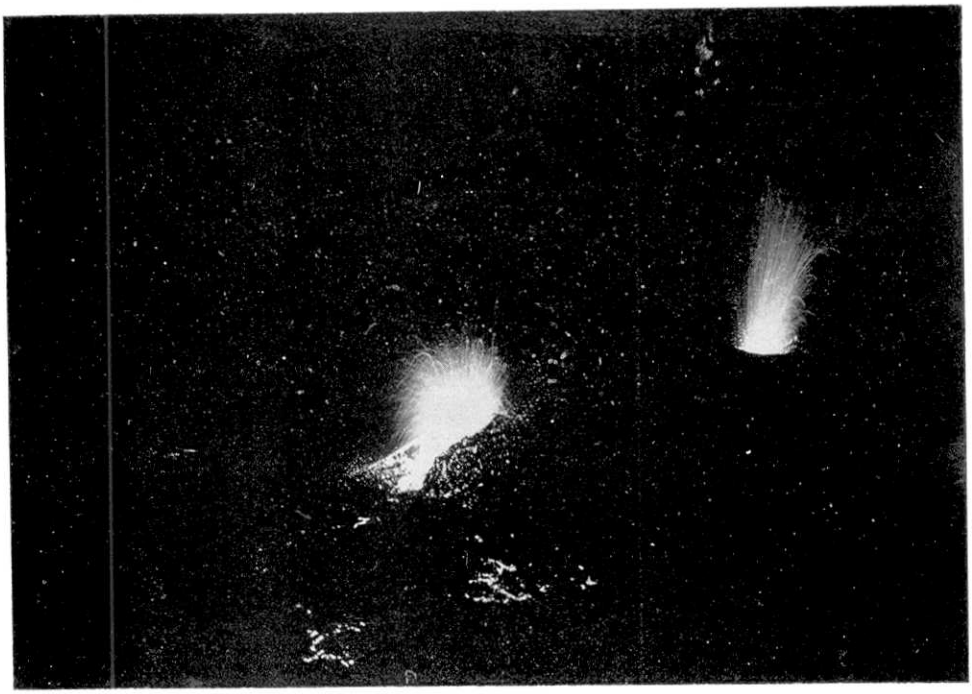

Fig. 36. Night scene of eruptions displayed simultaneously at two vents (upper right: the 1st vent; lower left: the 2nd vent). The 1st vent was pouring out incandescent lava, besides ejecting lava bombs and cinders. Photo. S. Watanabe. Aug. 21.

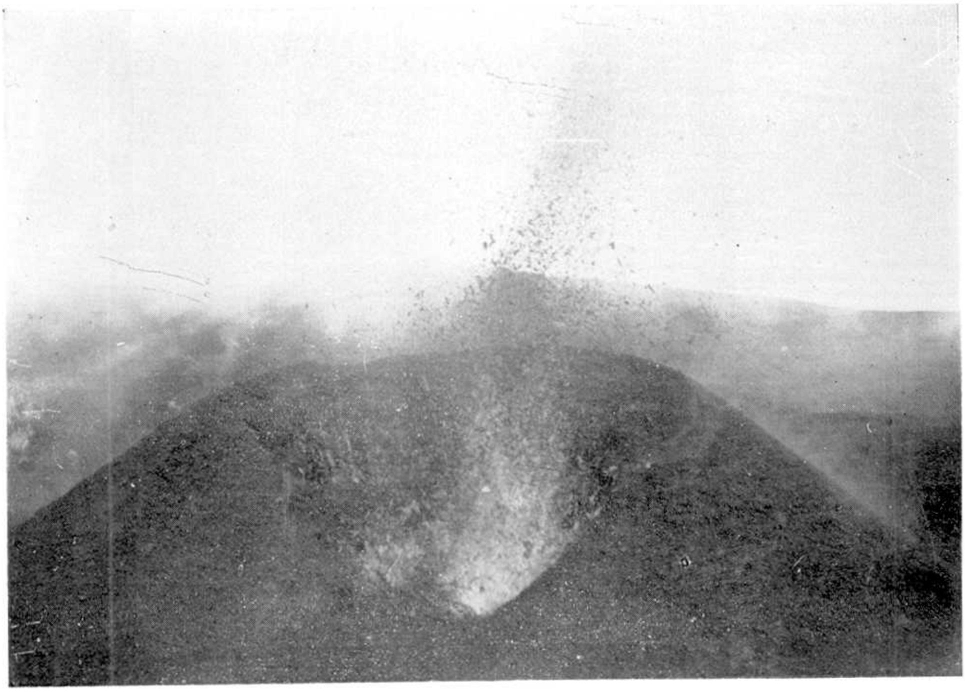

Fig. 37. Explosion at the 2nd vent, Aug. 24.

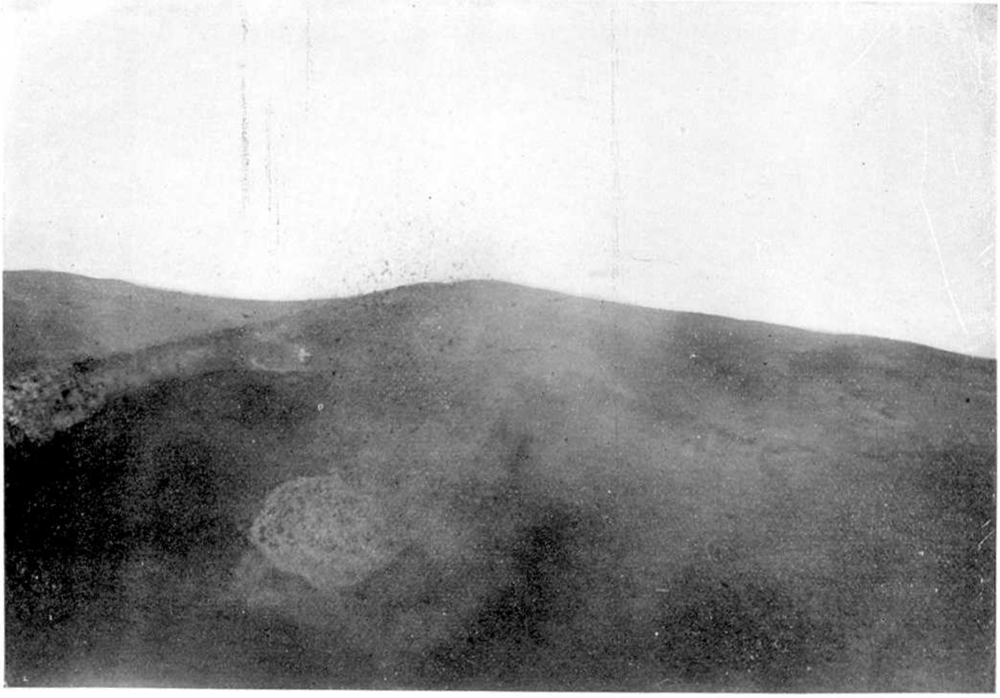

Fig. 38. Explosion at the 2nd vent. Aug. 24.

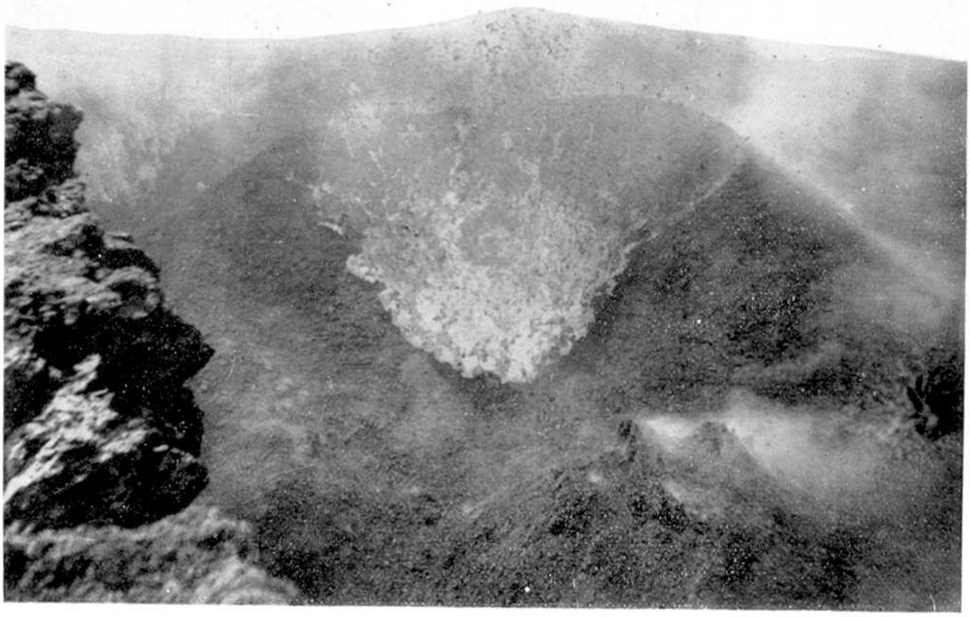

Fig. 39. Ditto. Immediately after the scene shown in Fig. 38.

(震研彙報 第三十二号 図版 津屋・森本・小坂)

Fig. 40. A panoramic view of Mihara crater filled with 1950 lavas. Aug. 24.

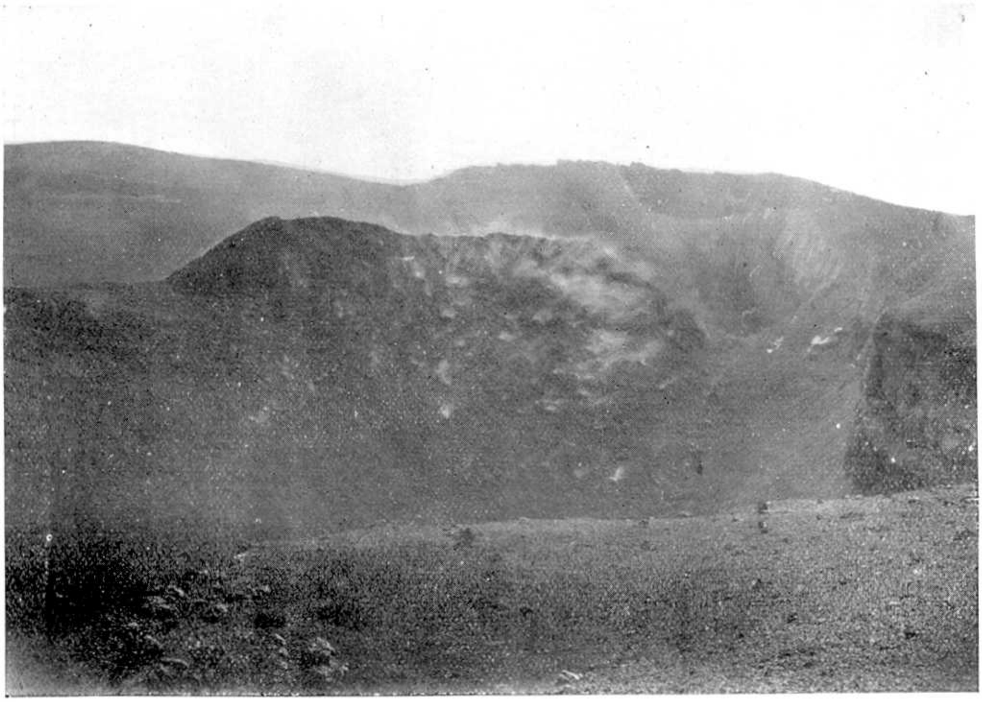

Fig. 41. Cinder pile around the second vent (centre) overlapping the 1st vent (left). The southern slope of the former was connected with the southern wall of the old crater. Aug. 26. Photo. S. Watanabe.

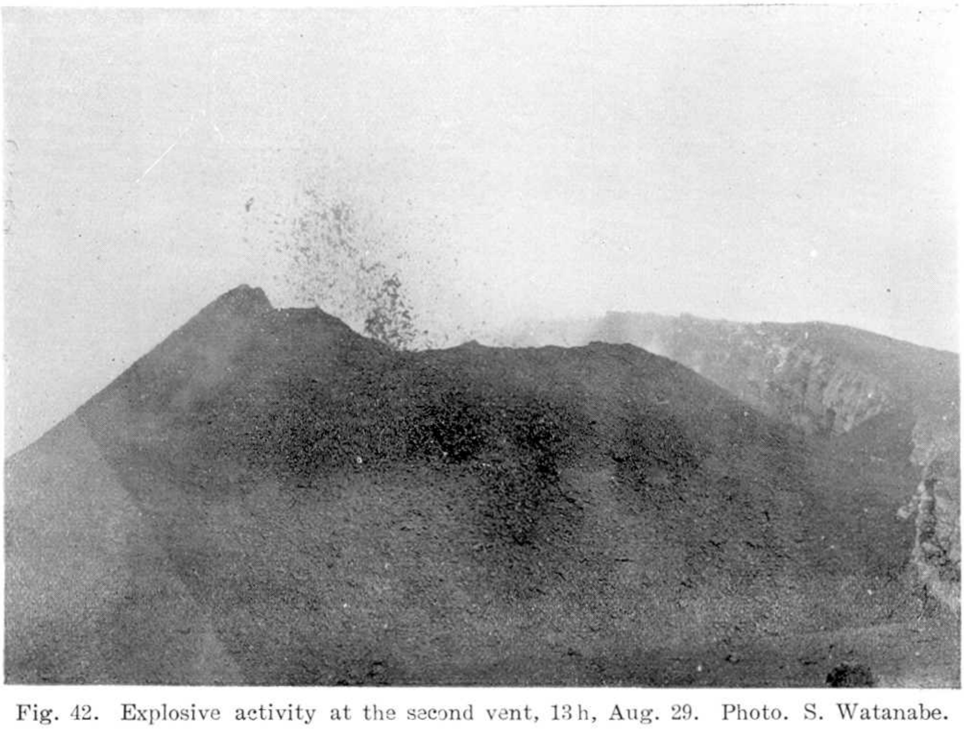

Fig. 42. Explosive activity at the second vent, 13h, Aug. 29. Photo. S. Watanabe.

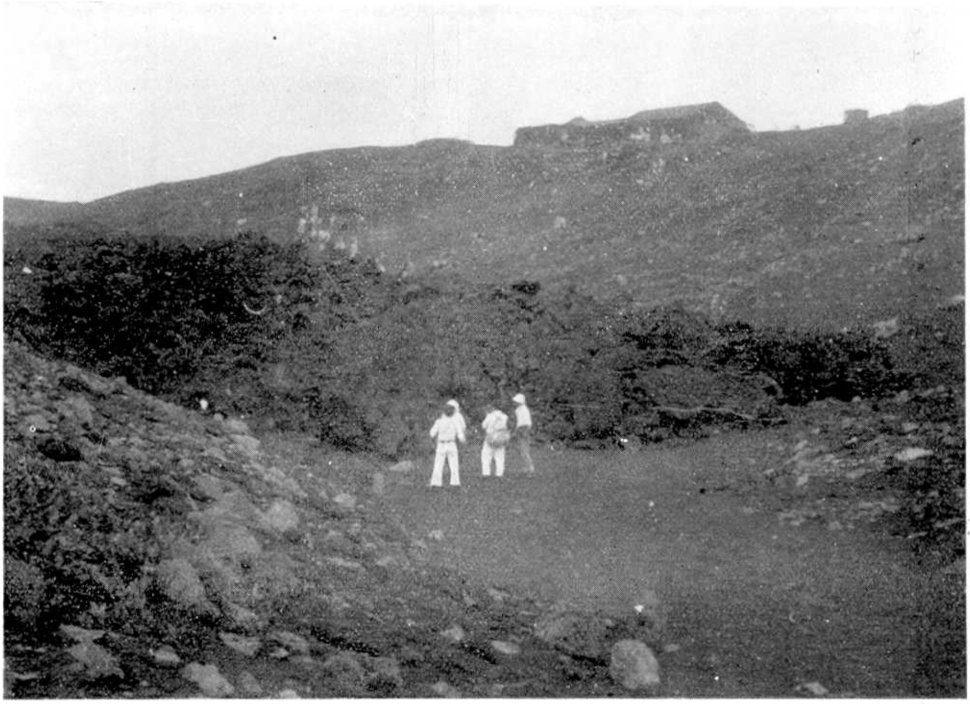

Fig. 43. Front of lava approaching to the northern rim of the crater. Sept. 3.

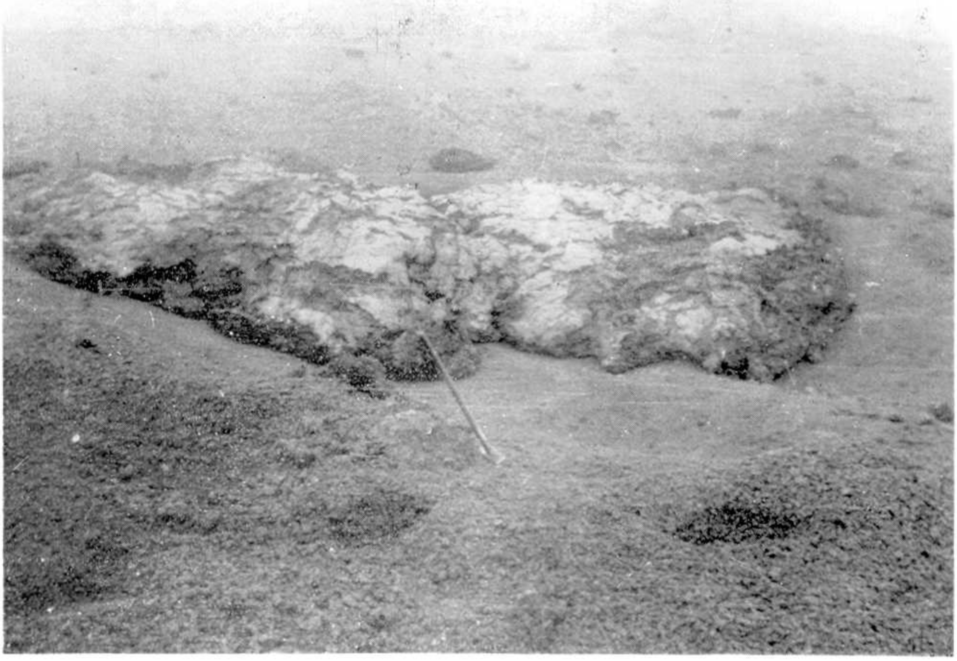

Fig. 44. A huge lava block, 4 m in diameter, ejected from the 2nd vent and flattened upon landing on the crater rim, 200 m SE of the vent, Sept. 3.

(震研彙報 第三十二号 図版 津屋・森本・小坂)

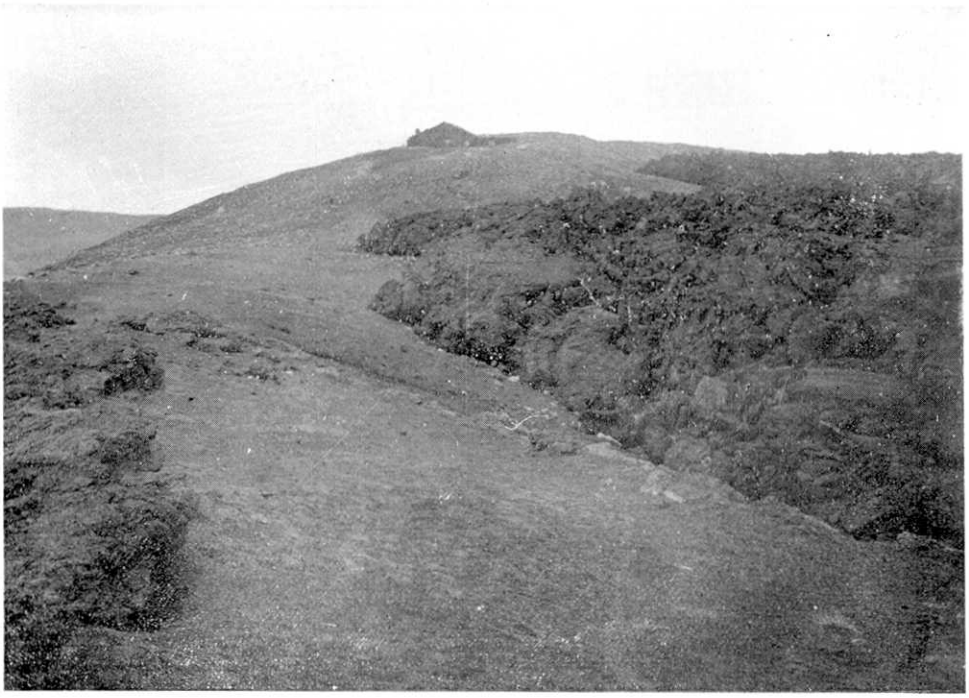

Fig. 45. Front of lava approaching to the crater rim, 80 m south of Kakôjaya. Sept. 11, Photo. S. Watanabe.

Fig. 46. Lava tongue running through the crater rim Sept. 13, 18h05m, Photo. S. Watanabe.

Fig. 47. Lava flow advancing the northwestern slope of the central cone. On both sides of the flow, spinose clinker-like *aa* deposited, forming ridges like a natural levee.

Fig. 49. Measurement of temperature of lava approching the crater rim by means of a thermocouple.

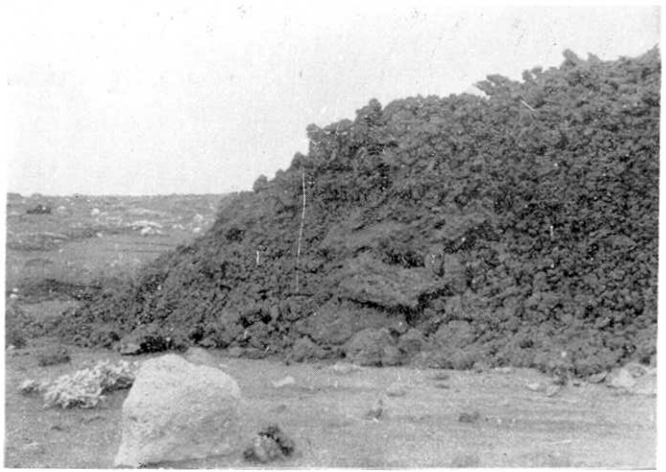

Fig. 48. Side view of the lava front.

Fig. 50. Ditto. Measurement of specific heat of the lava with calorimeter.

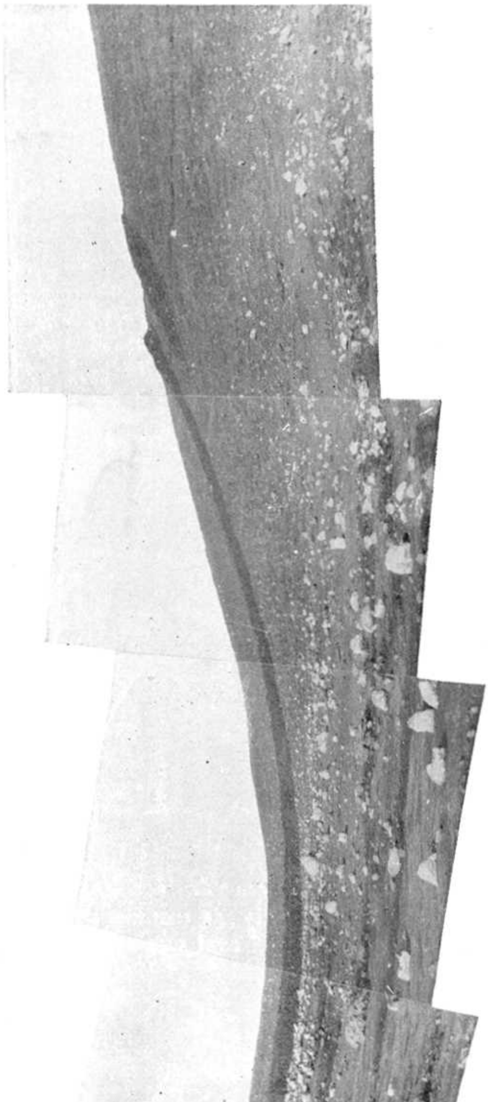

Fig. 51. A narrow lava stream running down the southwestern slope of the central cone.
Thickness of the lava flow was about 1 m. or less.

Fig. 52. Sept. 1.

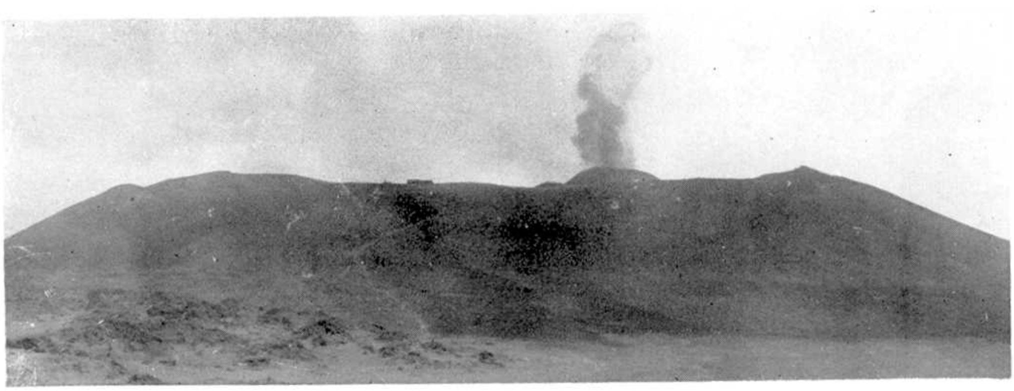

Fig. 53. Sept. 5.

Fig. 54. Sept. 11.

Fig. 55. Sept. 14.

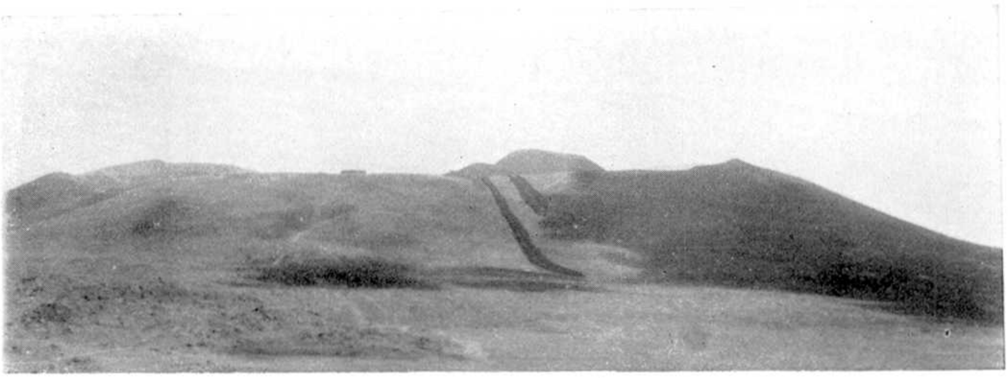

Fig. 56. Sept. 15.

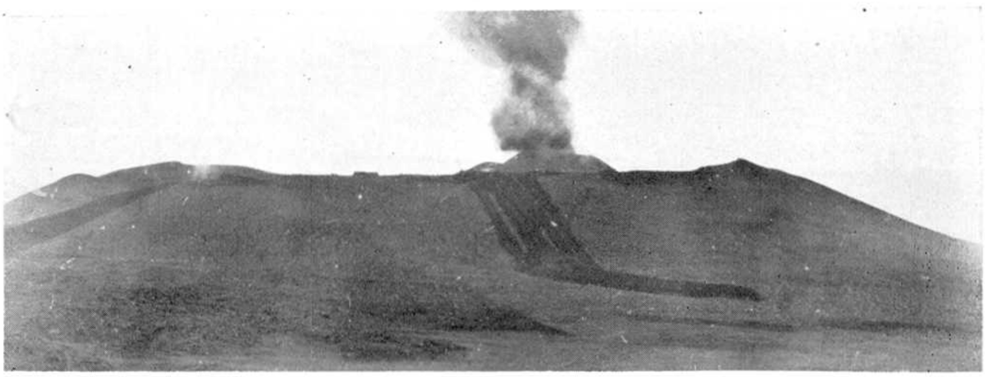

Fig. 57. Sept. 18.

（震研彙報 第三十二号 図版 津屋・森本・小坂）

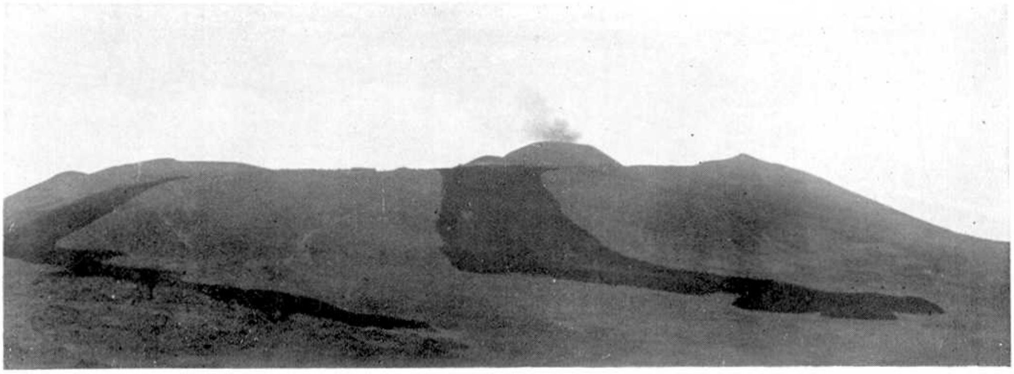

Fig. 58. Sept. 22.

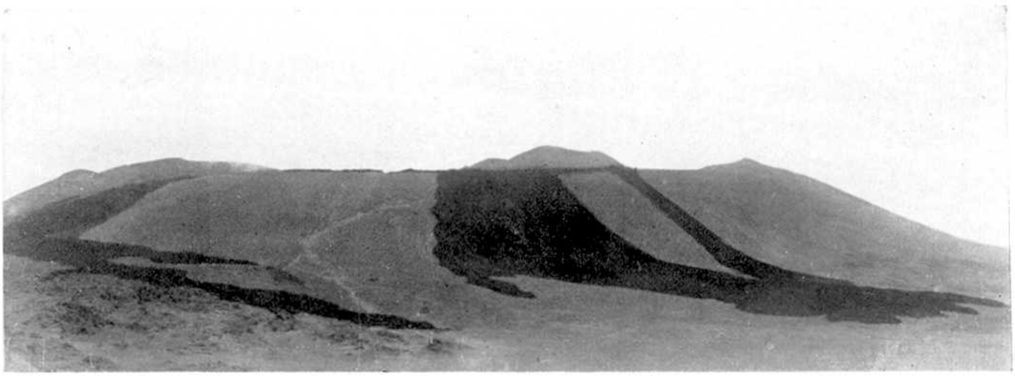

Fig. 59. Sept. 24.

Figs. 52–59. Mt. Mihara, central cone of Oshima volcano viewed southeastward from Goshinkajaya on the western somma, showing successive stages of growth of the new cinder cone and also of advance of the new lava flows during the 1950 eruption.

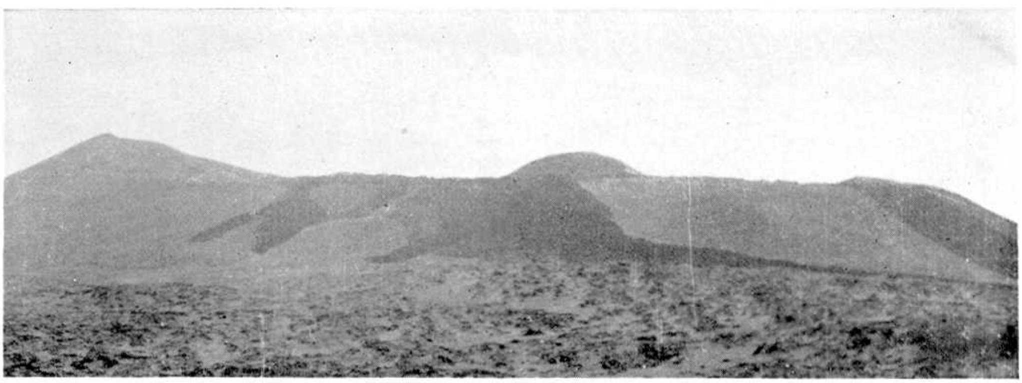

Fig. 60. Southward view of Mt. Mihara. Senzu-lava in the centre. Lava flow left in the figure flowed out from the crater on Sept. 19.

（震研彙報 第三十二号 図版 津屋・森本・小坂）

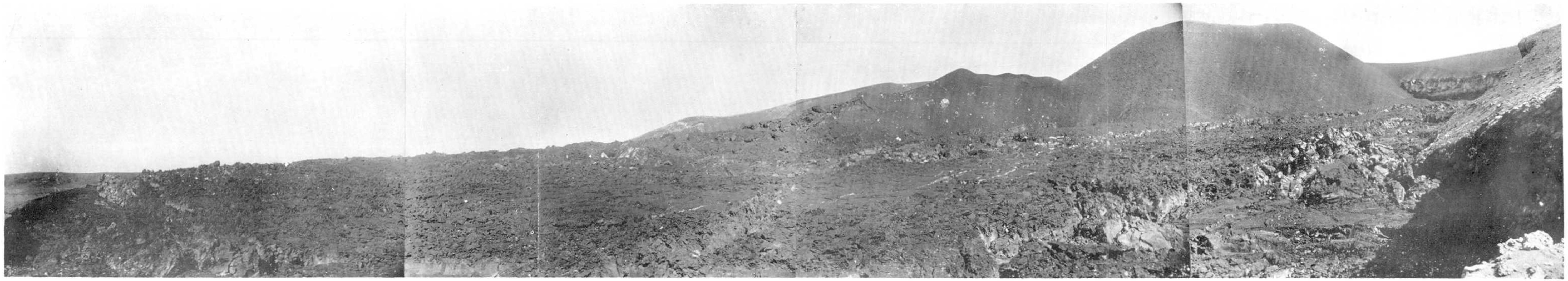

Fig. 61. A panoramic view of Mihara crater after the 1950 eruption ceased. Photo. S. Watanabe 14h, Sept. 26.

（震研彙報 第三十二号 図版 津屋・森本・小坂）

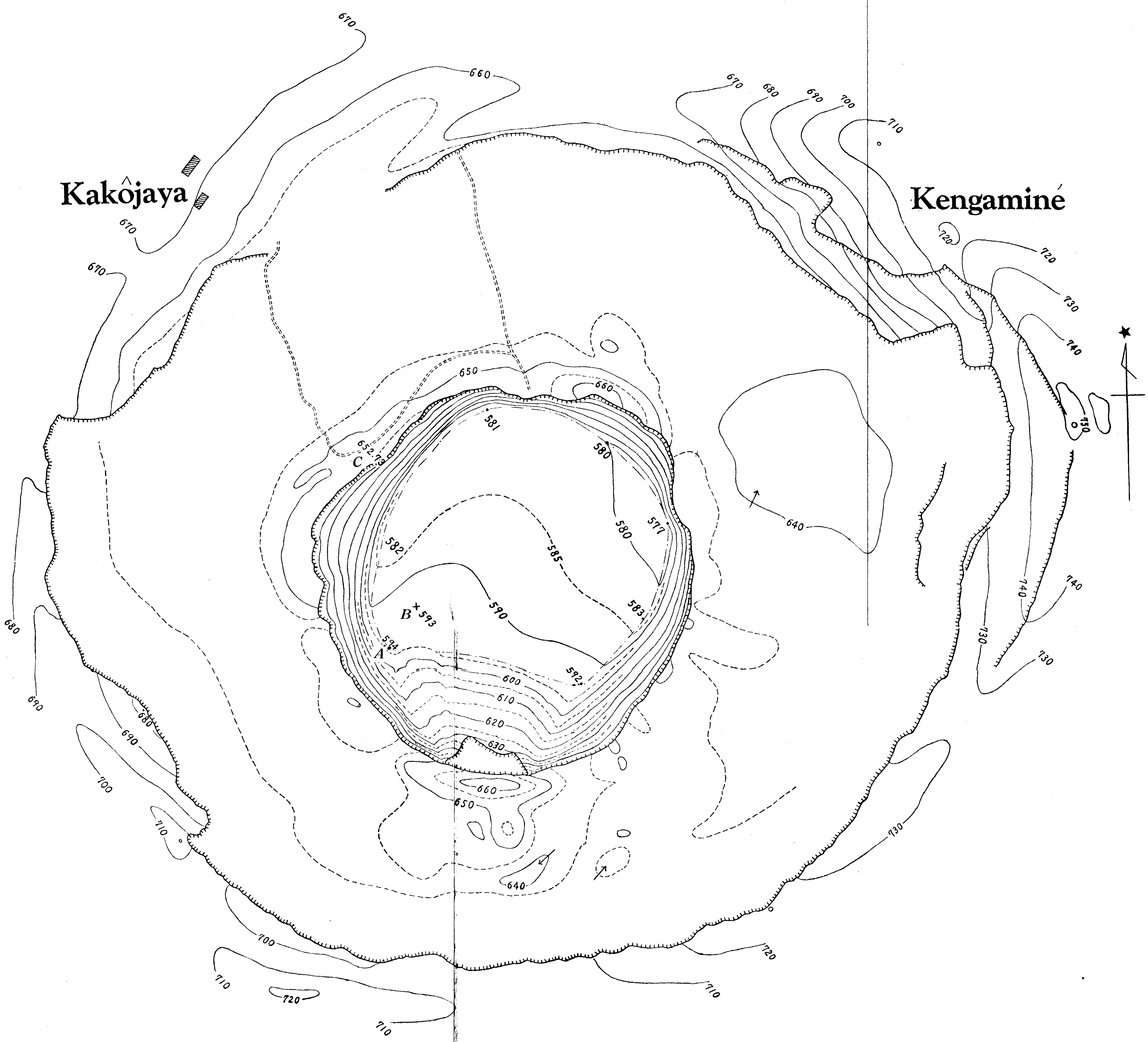

Fig. 20. Topographic map of Mihara crater surveyed by R. Morimoto and J. Ossaka. General topography of the crater-floor and crater-rim is based on the map prepared by Nagata and Takahasi in 1936. (R. Takahasi and T. Nagata, *Ibid.*).