26. *Geophysical Studies of Volcano Mihara, Oosima Island; Topographic Survey of the Crater of Mihara and the Magnetic Survey of Oosima.*

By Ryutaro TAKAHASI and Takesi NAGATA,

Earthquake Research Institute.

(Read Oct. 20, 1936 and Jan. 19, 1937.—Recieved Mar. 20, 1937.)

Introduction.

The typically double-coned volcano Mihara in Oosima, one of the seven volcanic islands of Idu, and one of the most active volcanoes in Japan, is very interesting, whether regarded geologically or geophysically.

The geology of this volcano has been studied by O. E. Naumann,[1] T. Wada,[2] J. Milne,[3] N. Yamazaki,[4] N. Fukuchi,[5] very thoroughly by S. Tsuboi[6] in 1900; and, recently, petrographically by H. Tsuya[7] in his study of the Huzi volcanic chain.

S. Nakamura[8] and others have studied it from the geophysical standpoint. F. Omori,[9] who made a thorough, detailed investigation, seismologically and geophysically, during the active period of 1911∼14, reported in detail the complete process of this eruption of the Hawaiian type.

One of the present writers, in the course of geophysical studies of volcano Asama, found, in collaboration with T. Minakami,[10] that it is possible to predict the explosive Vulcan type eruption of the volcano.

1) O. E. NAUMANN, *Zeitschr. d. Deutschen. Geol. Gesell.*, **29** (1877), 364.

2) T. WADA, "*Gakugei Sirin.*", **1**, No. 1, 1877.

3) J. MILNE, *Geological Magazine*, Series II. Vol. 1. No. 5. 1877; *Transact. seism. soc. Japan.*, IX, Part II. 1887.

4) N. YAMAZAKI, *Rep. Earthq. Inv. Comm.*, No. 9 (1899), 33.

5) N. FUKUCHI, *Journ. Geogr. Tokyo*, **14** (1902), No. 161 and 162; *Rep. Earthq. Inv. Comm.*, (1906), No. 53, p. 87.

6) S. TSUBOI, *Journ. Coll. Sci. Imp. Univ. Tokyo.*, **43** (1936), Art. 6.

7) H. TSUYA, *Bull. Earthq. Res. Inst.*, **15** (1937), 1.

8) S. NAKAMURA, and others. *Proc. Tokyo. Math. Soc.*, **4** (108), p. 293. *Journ. Geogr. Soc. Tokyo*, **20** Nos. 238∼239 pp. 682 and 786 (1908).

9) OMORI, *Rep. Earthq. Inv. Comm.*, No. 81, (1915).

10) T. MINAKAMI, *Bull. Earthq. Res. Inst.*, **13** (1935), 318; 629; 790. R. TAKAHASI, *Bull. Earthq. Res. Inst.*, **11** (1933), 25.

The main object of the present study of volcano Mihara is to enable comparisons of these two volcanoes of different types, and obtain data on which to base future studies of the volcano.

Past activities of volcano Mihara have been reported in detail by S. Nakamura,[11] but they are never frequent. The most recent was that during the epoch 1911~14, when molten lava, now called Taisyô Lava, filled the crater almost to the lowest brim and solidified there, so that the topography of the crater changed completely.

After this eruption, there has been no marked activity; only incessant rumblings, vapour emissions, occasional volcanic earthquakes, and ash precipitation, besides the gradual changes in the topography of the crater. Since it is consequently impossible to make observations of phenomena directly related to the eruption, such as we do at the Asama Volcano Observatory, we must be content with studies of the phenomena just mentioned as well as with the various geophysical surveys as data for the study of future eruptions.

In these respects we have so far made the following surveys. Since it is obvious that marked magnetic disturbances occur at the time of eruption of a volcano, as was reported by S. T. Nakamura and Y. Kato,[12] measurements have been made of the three el ments of terrestrial magnetism at 12 stations widely separated in Oosima, with the object of seeking some clue to the relation between volcanic activity and magnetism. This is one of the surveys. So far, the topography of the crater has been surveyed by a number of investigators,[13] the most recent being that made by S. Nakamura in 1924, since when, however, the crater pit has grown very large owing to parts of its wall falling from time to time.

In Asama, the crater floor rises considerably before an eruption—a phenomenon that is doubtless very conspicuous in volcanoes with basic lava like Mihara. Indeed, in the eruption of 1914, the molten lava poured out of the crater pit and filled the crater.[14] The depth of the present crater pit is therefore a measure of the activity of this volcano.

In these circumstances topographic surveys of the interior of the

---

11) *Rep. Earthq. Inv. Comm.*, No. 79, (1915), 38.

12) *Jap. Journ. Astr. Geophys.*, **12** (1934), 19.

13) S. Nakamura and others. *Rep. Earthq. Inv. Comm.*, No. 81.
J. Okamura, *Rep. Jap. Geol. Survey.*, **48**.
S. Tsuboi, *loc. cit.*
J. Kondo, *Rep. Earthq. Inv. Comm.*, No. 31.

14) F. Omori, *loc. cit.*

crater pit as well as the interior of the old crater were made. By repeating these measurements, it is hoped to obtain some clue to the relation of the topographic changes in the crater to other volcanic phenomena.

Magnetic Survey of Oosima.

In the case of the Nôbi earthquake of 1891, A. Tanakadate and H. Nagaoka[15] measured terrestrial magnetism with a view to detecting variations due to the earthquake. Since then, investigations in this direction have been neglected by seismologists, although magnetic surveys have regularly been made.

Recently S. T. Nakamura and Y. Kato,[16] with the aid of the Barrow type dip circle, observed in the eruption in 1929 of Komagatake, Hokkaido, abnormal variations in the inclination. In the eruption of Asama in July, 1935, T. Minakami,[17] at the Asama Volcano Observatory, observed marked variations in declination.

It is most probable therefore that similar variations in terrestrial magnetism will accompany future eruptions of Mihara. The magnetic elements may again vary with the volcanicity during ordinary times. In order to verify these assumptions, and also as data for future eruptions, terrestrial magnetism was measured at twelve stations, four of which

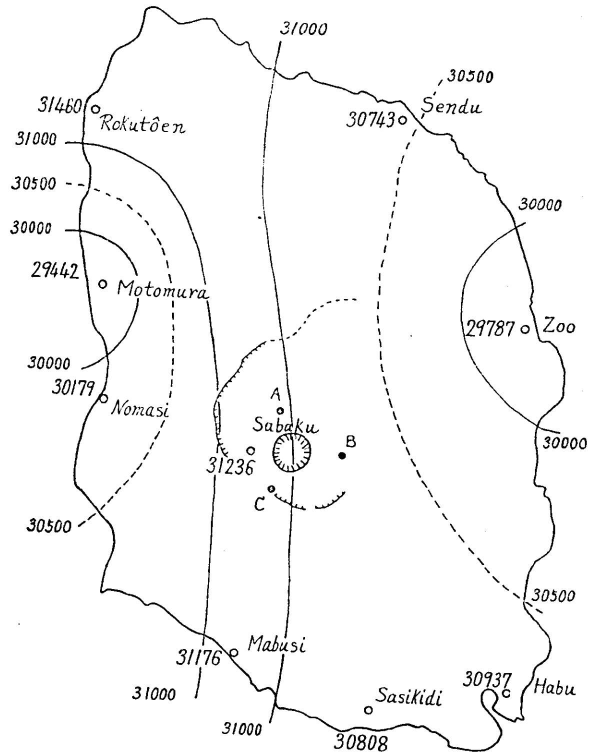


Fig. 1. Distribution of stations and the Horizontal Intensity. Unit. γ.

15) *Journ. Coll. Sci. Imp. Univ. Tokyo.*, Vol. 5 Art. 2.
16) Y. Kato, *loc. cit.*
17) T. Minakami, *loc. cit.*

were within the somma, the remaining eight around the volcano.

The stations were distributed as shown in Fig. 1. Eight stations were distributed almost equidistantly along the coast of Oosima, except for the S.E. side of the island, where the coast is very rugged. At Motomura and Mabusi, the points occupied by the Hydrographic Office of the Japanese Navy were reoccupied. The middle of the playground of the primary school, which is about 50 m north of the Habu station of the Hydrographic Office, was selected for our Habu station. As the Hydrographic Office station at Sendu was inconvenient for transporting the magnetometer, our measurements at Sendu were carried out at the Sendu Primary School, 1 km north of the former point. At stations A, B, C within the somma, only the inclination was observed.

Each station was marked by five pegs as shown schematically in Fig. 2. The central peg was driven into the ground on which the magnetometer was installed. The pegs marked E, W, N, and S were driven in at points 10 m apart from the central peg in the directions of magnetic E, W, N and S respectively. These auxiliary pegs serve for finding the station when the central peg is lost. Sketch-maps of these stations are given in Fig. 3, a—h.

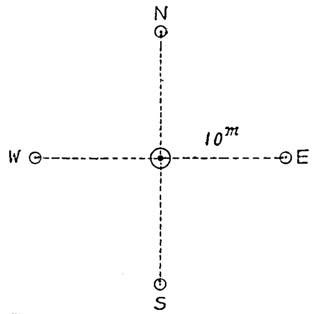


Fig. 2. The station mark.

For these measurements, a magnetometer of Hydrographic Office pattern[18] was used.

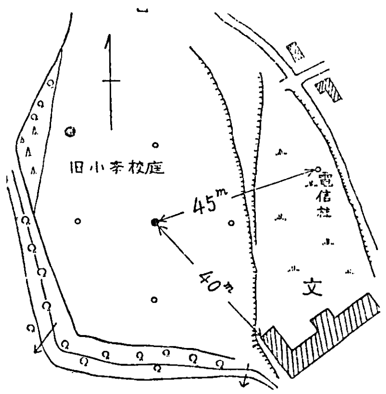


Fig. 3, a. Motomura.

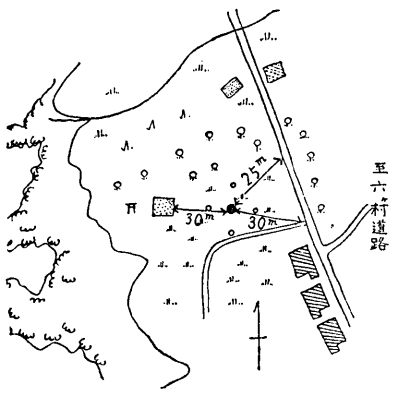


Fig. 3, b. Mabusi.

In this magnetometer of electromagnetic type, the horizontal intensity is

18) *Bull. Hydro. Office*, Vol. 8 (1937).

measured by the improved sine-method devised by A. Tanakadate, and the declination by making the axis of the Helmholtz coil of the

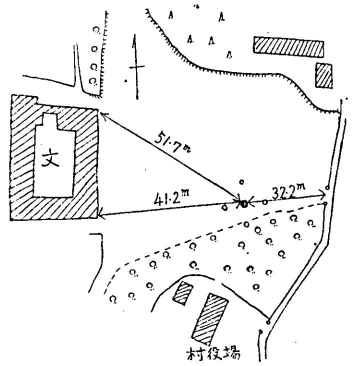


Fig. 3, c. Sasikidi.

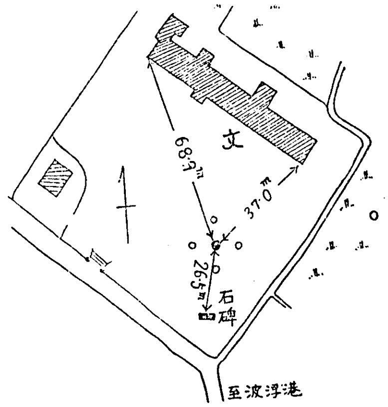


Fig. 3, d Habu.

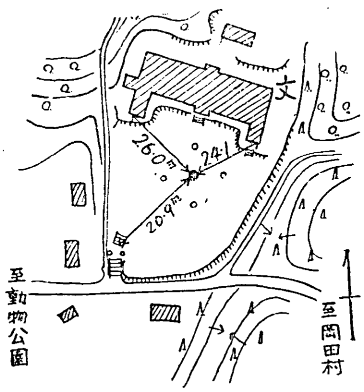


Fig. 3, e. Sendu.

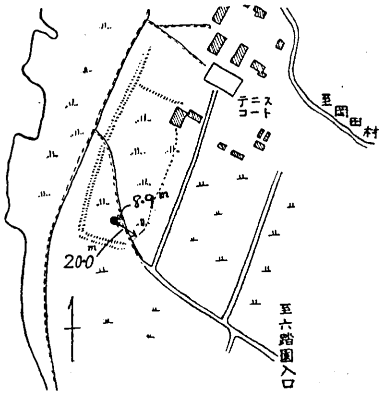


Fig. 3, f. Rokutôen.

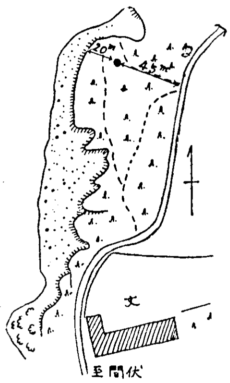


Fig. ?, g. Nomasi.

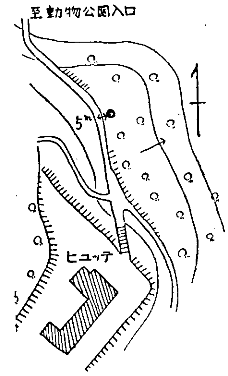


Fig. 3, h. Zoo.

magnetometer coincident with the direction of the field. Coincidence is established when a small magnet suspended at the center of the Helmholtz coil does not move even when the direction of the current in the coil is reversed. The accuracy of measurements obtained by us with this magnetometer was

$\Delta\delta = \pm 0{\cdot}1'$ in the declination,
$\Delta\theta = \pm 0{\cdot}1'$ in the inclination,
$\Delta H = \pm 1\gamma$ in the horizontal intensity.

At the stations of Motomura, Mabusi, and Habu, declination was measured every two hours for a day of 24 hours in order to eliminate the daily variation, while at the remaining five stations the mean of three measurements was adopted. It is obviously better to make 24-hour observations at all stations, but we decided on the schedule described above, because the time variation was expected to be much larger than the daily variation, and because of the limited time at our disposal for the survey.

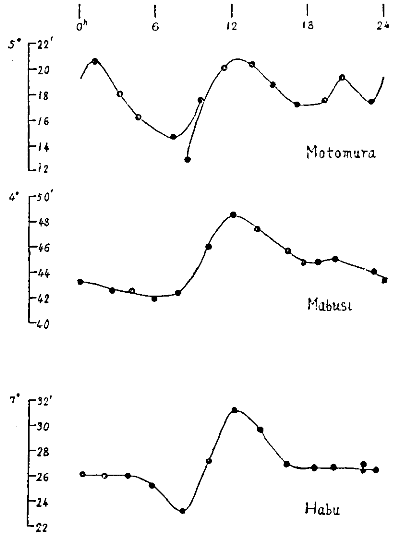
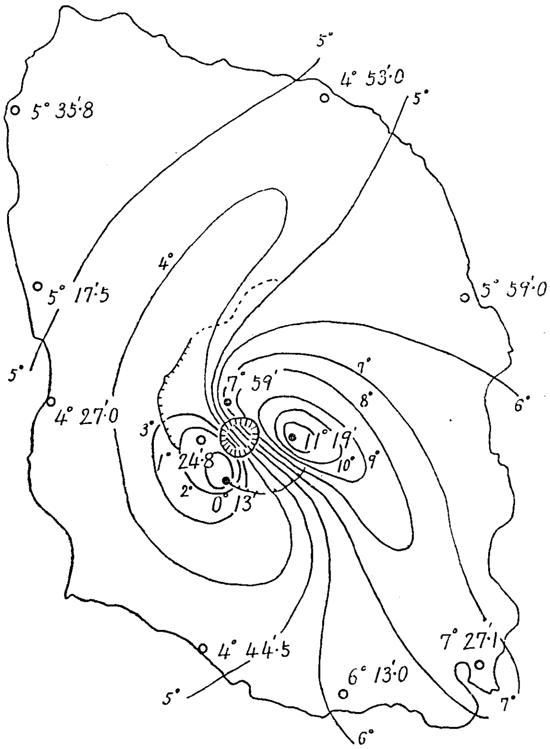


Fig. 4. The daily variations in declination.
Motomura: a small disturbance was observed at Kakioka betw. 16^h ~ 1^h.
Mabusi: slow variations.
Habu: calm.

As for the inclination and the horizontal intensity, our method of measurement was exactly the same as that adopted by the Hydrographic Office of the Japanese Navy, in which the mean of three measurements is taken for the value of the station in question. When inclination alone was measured, the magnetic meridian was determined by means of a striding declinator, with which the meridian is determined within 30′, while the uncertainty in the declination causes an error of only 0·1′ in the determined value of the inclination when the latter is 45°, so that the accuracy was quite sufficient. These measurements consisted of single observations.

The results of measurements taken at these 12 stations are given in Tables I~XII. At stations A, B, and C within the somma, bearings of three or four triangulation points either on the somma or on the parasitic cones were taken for determining the position of each station, from which measurements the astronomical meridian was also calculated, so that the magnetic declination was determined within an error of 20′. Although this is not sufficiently small for finding the variation in magnetism by repeated observations, it is good enough for determining the distribution of local anomaly in this volcanic island.

The values for the declination, inclination, and horizontal intensity thus obtained are graphically represented in Figs. 1, 5, and 6. It is interesting to note that the declination is very anomalous near the crater. Since, however, Oosima consists entirely of basaltic lava and ashes, the distribution of terrestrial magnetism may be very complicated, as is easily surmised from Nakamura's measurements[19] of the dip near Motomura. The contour lines shown in Figs. 1, 5 and 6 are therefore only provisional, having little geophysical meaning. Since the object of the present survey was to ascertain the time variation and not local anomalies, no increase was made in the number of stations. In case of necessity, the whole island could be covered with measurements, although of rather low accuracy, using the present stations as standards.



Fgi. 5. Distribution of the westerly declination.

Topographic Survey of the Crater.

Surveys and sketches made in the past. In 1907, S. Nakamura, T. Terada, and D. Ishitani,[20] and others surveyed for the first time the topography of the crater of Mihara. Since 1911, owing to the activi-

19) S. NAKAMURA, "*Zisin*", **6** (1934), 637.

20) *loc. cit.*

ties of the volcano, the appearance of the crater underwent rapid changes. These changes were sketched from time to time by Mr. Sato,[21] the village master of Motomura at that time. Another survey of the crater was made in 1913 by Okamura,[22] and a sketch map by Kondo,[23] both experts of the Imperial Japanese Geological Survey. After the activities ceased, S. Tsuboi,[24] in 1916, made a detailed sketch of the crater which, in 1924, S. Nakamura[25] and others resurveyed. Since then, no sketch or survey has been made for 12 years until the present survey was carried out in the autumn of 1936.

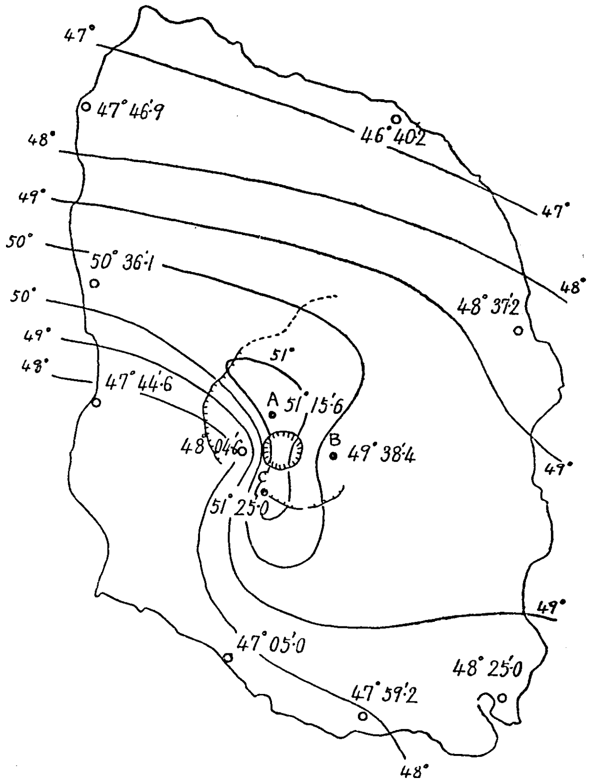


Fig. 6. Distribution of the inclination.

Method of survey and treatment of the results obtained. No marked change being observed either on the ridge or on the slope of the central cone, our survey was restricted to the bottom of the old crater and the interior of the present crater pit. The survey was accordingly divided into two parts; the one a topographic survey of the crater bottom by means of a plane table and a photographic theodolite, and the other a survey of the interior of the pit mainly by means of a sextant.

a) Topography of the old crater bottom. For various reasons, absolute determinations of the position, azimuth, and the height of the

21) SATO, *loc. cit.*
22) OKAMURA, *loc. cit.*
23) KONDO, *loc. cit.*
24) S. TSUOBI, *loc. cit.*
25) not yet published.

area in question as referred to triangulation points were not made, only relative values having been determined. Seeing that our survey is for changes in topography in the crater, absolute determinations could be dispensed with. All the heights were obtained on the assumption that the highest point of the central cone is 155·25 m above mean sea level.

The position of the base-line and its expansion net is shown in Fig. 7. The form of the expansion net is not as we could have wished,

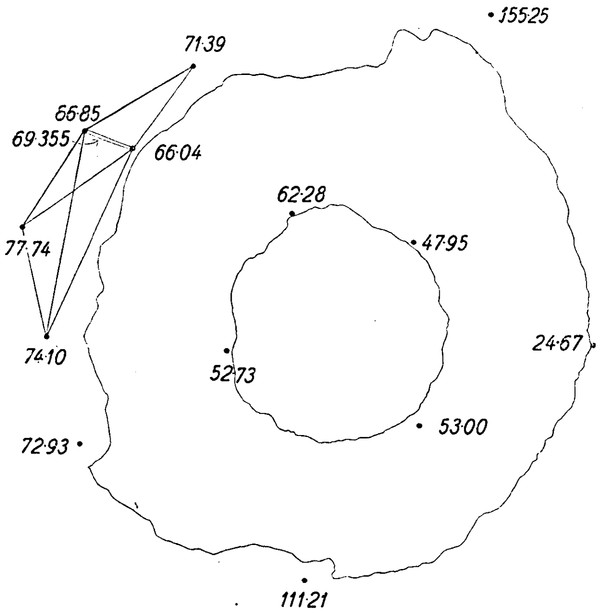


Fig. 7. The base-line, its expansion net, and the numerals show relative heights in meter.

but the topography prevented anything better. The length of base-line was measured with a stadia bar 1 m long and a micrometer theodolite included in the Zeiss photographic survey instrument. The expansion of the base-line and other trigonometric measurements were executed with the Wild theodolite. The trigonometric points for the plane table work were selected as shown in the same figure, namely 10 points on the ridge of the central cone, and 4 on the edge of the present crater pit.

Details of the topography were plotted on three field sheets in scale 1:1500. Owing to poor weather conditions, the cracks and fumaroles in the crater, and details of the wall of the old crater were not fully sketched but all other features on the bottom of the old crater were plotted within an error of 2 m. The results of the survey are shown in Fig. 8, Pl. XX.

b) Besides this plane table survey, a photographic survey was executed in parallel. Features of the crater were photographed from the ends of 3 base-lines with the Zeiss photographic survey camera. As plotting of the topography from the plates obtained is not yet completed, only a few of the photographs thus obtained are shown here (Figs. 9~12, Pl. XXI and XXII).

Survey of the interior of the present crater pit. The depth and other features of the interior of the present crater could be determined from measurements made from two or three fixed points on its edge. In favourable cases a transit theodolite could be used as was done by T. Minakami at Asama. At Mihara, however, the present crater is so deep compared with its diameter, and the edge so liable to give way, that the use of a theodolite is not practicable. In these circumstances, the method to be described was used.

Reference marks were set up at 4 points on the edge of the present crater, in three of which it was comparatively safe to approach the edge of it. From each of these three safe points a wooden frame-work projected over the crater to enable an observer at the end of the frame-work to look down into the crater, and thus, with a sextant, measure the angles subtended between each of the two reference points and a point in the interior of the crater. The positions of the reference marks, and the distance separating them were newly determined by means of the Wild theodolite and a 2 m stadia bar. The positions of the reference marks and the frame-works are shown in Figs. 13 and 14. Of the reference marks, *D* coincided with the trigonometric point used in the plane table work. Since each frame-work is from 5 to 6 m distant from its reference mark, the usual reduction for this eccentricity was made.

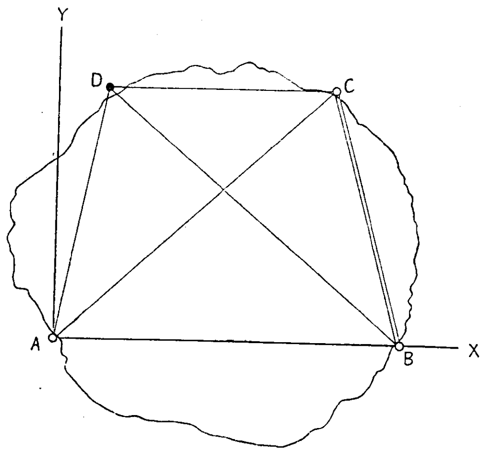


Fig. 13. Positions of reference marks.

From the angle thus observed, the positions of the marked points in the interior of the present crater were determined by the method of least squares. These points are referred to rectangular coordinates x, y, z, with the origin at A and the x axis towards AB.

At present, molten incandescent lava is seen in two openings in the bottom of the present crater. Although the shape of these openings vary from time to time, their mean positions remain unchanged. The coordinates of these openings in Nov., 1936, were as follows:

	Larger one	Smaller one
	m m	m m
x	$104{\cdot}6\pm1{\cdot}7$	$95{\cdot}1\pm1{\cdot}4$
y	$91{\cdot}7\pm1{\cdot}8$	$81.3\pm1{\cdot}3$
z	$-267{\cdot}7\pm3{\cdot}4$	$-289{\cdot}4\pm2{\cdot}7$

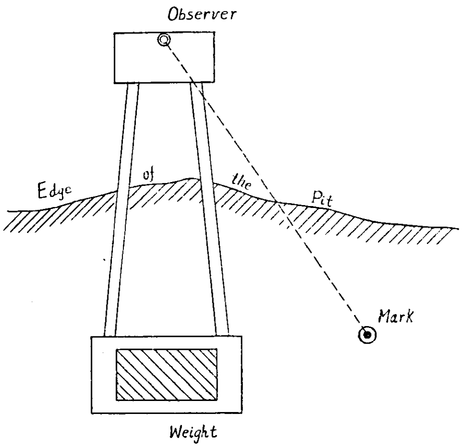


Fig. 14. Relative position of a reference mark and a framework.

The map of the interior of the pit in Fig. 8, is based on these determinations. In mapping, photographs and sketches of the interior of the present crater that were made simultaneously with the sextant work were consulted. According to these determinations, the present crater is almost conical in shape, with a vertex angle of 30°. Except in the northern part, its wall has a shelf showing the incessant breaking away of the pit wall. In Fig. 15 a, b, the sections of the present crater are shown.

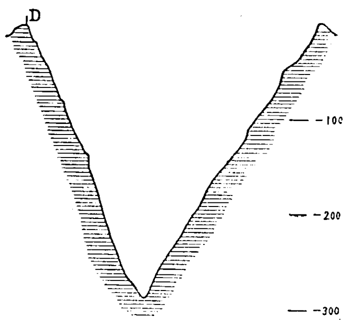


Fig. 15, a. Vertical section of the present crater. Unit: meter.

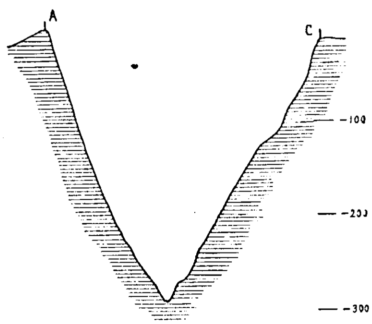


Fig. 15. b. Vertical section of the present crater. Unit: meter.

Changes in the topography of the crater up to the present. Upon comparing the results of the present survey with those of S. Nakamura made in 1924, we find that although there is no remarkable change in the central cone, except for small falls of the crater wall, the diameter of the present crater has greatly increased during the interval between 1924 and 1936, it being now 3 times larger in diameter and 10 times larger in area than when last surveyed. These

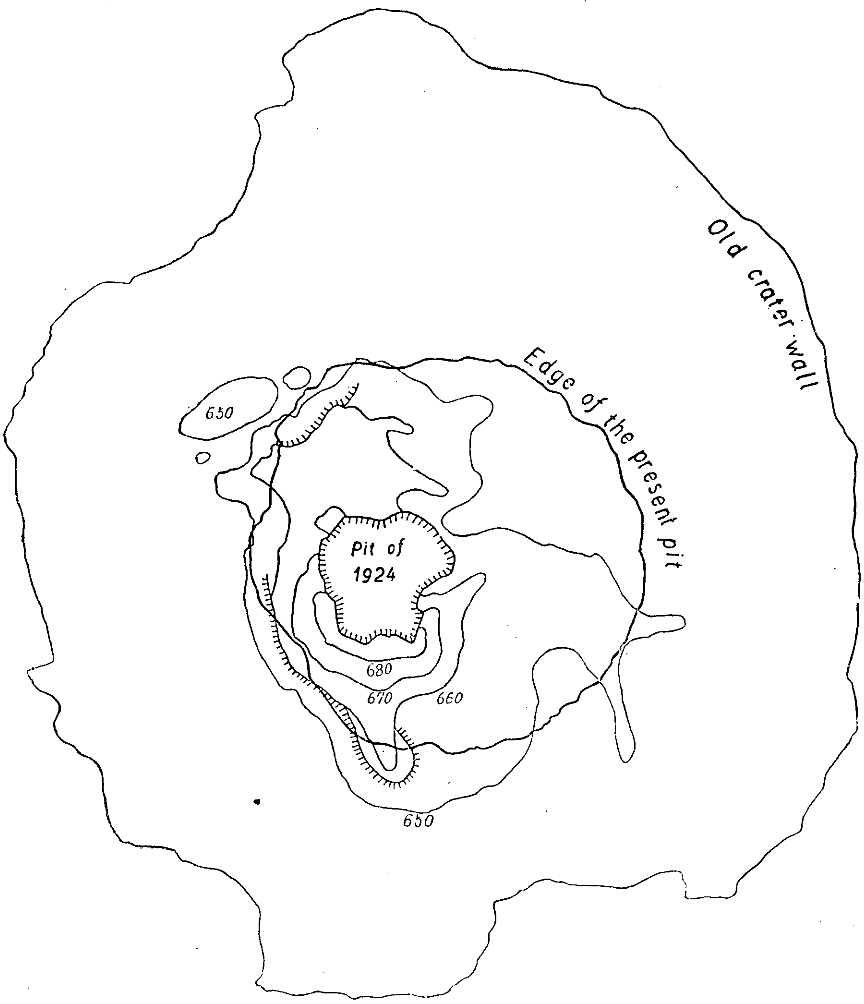


Fig. 16. Comparison of the results of the survey made in 1924 with those of the presnt one.

features are shown in Fig. 16. Fig. 17, a, b show the sections of the pit in vertical planes, one of which passes through the highest point of the central cone and the center of the present crater in 1923, and the other per-

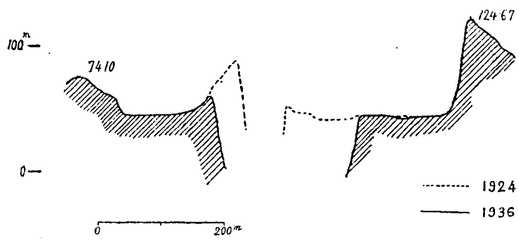


Fig. 17, a. Vertical section of the pit. Unit: meter.

pendicular to the former plane. As will be seen from this figure and Fig. 16, the collapse of the crater wall is much more marked on the east side than on the west.

As to the depth of the present crater, in the absence of any old data, it is not possible to make any observations regarding changes in it. It is reported however that, Mr. Iwata of the Yomiuri Newspaper staff succeeded in 1933 in descending to a depth of 1250 syaku (379 m) from which data it is possible to estimate that the present crater, which was more than 400 m deep at that time, has become shallower by more than 100 m in four years.

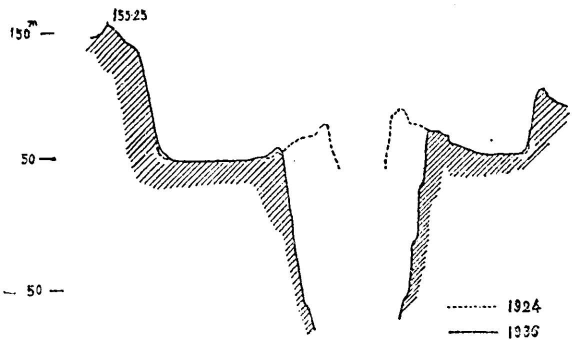


Fig. 17, b. Vertical section of the pit.
Unit: meter.

In conclusion, we wish to express our hearty thanks to the Hattori Hôkôkai, with the aid of whose grant the present surveys were made; and to the Hydrographic Office of the Japanese Navy who kindly placed their magnetometer at our disposal. Our thanks are also due to Professor M. Ishimoto, the director of our Institute, for his interest and encouragements thoughout the present work.

Appendix 1.

From the astronomical observation made for the determination of the true meridian, the latitudes of stations were also calculated. These calculated values of latitude seem to show that there are deviations of the plumb-line of the order of 30″ at all our stations, though the theodolite used was very inadequate for such accurate measurements, the smallest division of its vertical circle being 1′.

Appendix 2.

On Dec. 27, 1936, a strong earthquake occurred in the neighbourhood of Niizima, an volcanic island at 50 km SW of Oosima. In connection with the study of this earthquake, dip measurements were repeated at our stations of Motomura, Nomasi, and Mabusi, with the same instrument. The observed values are shown in Table XIII. Compared with the results of the former observation, no anomalous

Table XIII.

Station	Date and Time		Dip	
		h m	°	′
Motomura	Jan. 24.	9 18	50	38·9
,,	,,	9 48	50	37·8
,,	,,	10 10	50	37·9
Nomasi	,,	13 46	47	44·5
Mabusi	,,	15 04	47	05·4

variation is recognized from the present data, because the variation in dip of the magnitude of 1∼2 minutes must be considered to be within the range of daily and secular variations.

Lists of Magnetic Observations.

Table I. Station, Motomura.

Lat. = 34° 45′·1 Long. = 139° 21′·3 Sept., 1936.

Declination.

Date	Time	δ	Date	Time	δ
	h m	° ′		h m	° ′
9	8 36	5 12·8 W	9	20 45	5 19·3 W
9	8 57	5 18·1	9	23 02	5 17·4
9	11 24	5 20·1	10	1 06	5 17·0
9	13 41	5 20·2	10	3 06	5 18·0
9	15 21	5 18·7	10	4 52	5 16·3
9	17 07	5 17·1	10	7 40	5 14·7
9	19 20	5 17·5	10	9 34	5 17·6

Mean = 5° 17′·5 W

Dip.

Date	Time	θ
	h m	° ′
9	9 46	50 36·2
9	10 00	50 36·8
9	16 08	50 35·3
10	9 48	50 36·3

Mean = 50° 36′·1

Horizontal Intensity.

Date	Time	H
	h m	γ
9	9 28	29435
9	15 49	29457
10	8 11	29435

Mean = 29442 γ

Table II. Station, Nomasi.

Lat. = 34° 34.′ Long. = 139° 21.′4 Sept., 1936.

Declination.

Date	Time	δ
	h m	° ′
11	6 56	4 26·5 W
11	8 54	4 27·4

Mean = 4° 27.′0 W

Dip.

Date	Time	θ
	h m	° ′
11	9 58	47 44·6

Horizontal Intensity.

Date	Time	H
	h m	γ
11	7 32	30125
11	9 20	30206
11	9 42	30206

Mean = 30179 γ

Table III. Station, Mabusi.

Lat. = 34° 41.′4 Long. = 139° 23.′1 Sept., 1936.

Declination.

Date	Time	δ	Date	Time	δ
	h m	° ′		h m	° ′
11	17 44	4 44·7 W	12	7 52	4 42·3 W
11	20 03	4 45·0	12	10 08	4 46·0
11	22 16	4 44·0	12	12 08	4 48·5
12	0 00	4 43·2	12	13 54	4 47·4
12	2 25	4 42·5	12	16 07	4 45·6
12	4 05	4 42·5	12	18 36	4 44·8
12	5 55	4 41·8			

Mean = 4° 44.′5 W

(*to be continued*)

Table III. *(continued)*

Dip.

Date	Time	θ
11	$20^{h}\ 39^{m}$	$47^{\circ}\ 05{\cdot}5'$
12	10 50	47 05·4
12	17 13	47 04·2

Mean $=47^{\circ}\ 05{\cdot}'0$

Horizontal Intensity.

Date	Time	H
11	$18^{h}\ 36^{m}$	31200^{γ}
12	8 30	31162
12	9 20	31164
12	16 42	31189

Mean $=31176\ \gamma$

Table IV. Station, Sasikidi.

Lat. $=34^{\circ}\ 40{\cdot}'9$ Long. $=139^{\circ}\ 24{\cdot}'8$ Sept., 1936.

Declination.

Date	Time	δ
13	$15^{h}\ 05^{m}$	$6^{\circ}\ 13{\cdot}8'$ W
13	16 59	6 12·3

Mean $=6^{\circ}\ 13{\cdot}'0$ W

Dip.

Date	Time	θ
13	$15^{h}\ 54^{m}$	$47^{\circ}\ 58{\cdot}8'$
13	16 34	47 59·6

Mean $=47^{\circ}\ 59{\cdot}'2$

Horizontal Intensity.

Date	Time	H
13	$15^{h}\ 30^{m}$	30808^{γ}
13	17 22	30808

Mean $=30808\ \gamma$

Table V. Station, Habu.

Lat. = 34° 41′·1 Long. = 139° 25·′4 Sept., 1936.

Declination.

Date	Time	δ	Date	Time	δ
	h m	° ′		h m	° ′
16	22 26	7 26·9 W	17	8 16	7 23·6 W
16	23 33	7 26·9	17	10 07	7 27·6
17	0 15	7 26·6	17	12 13	7 31·6
17	2 00	7 26·4	17	14 08	7 29·7
17	3 59	7 26·4	17	16 28	7 26·9
17	5 50	7 25·7	17	20 05	7 26·8

Mean = 7° 27·′1 W

Dip.

Date	Time	θ
	h m	° ′
17	9 23	48 25·0
17	15 24	48 24·4
17	19 30	48 25·6

Mean = 48° 25·′0

Horizontal Intensity.

Date	Time	θ
	h m	γ
16	23 06	30944
17	8 43	30913
17	15 00	30961
17	19 03	30939

Mean = 30937 γ

Table VI. Station, Zoo.

Lat. = 34° 45·′5 Long. = 139° 26·′2 Sept., 1936.

Declination.

Date	Time	δ
	h m	° ′
18	17 20	5 59·0 W

(to be continued)

Table VI. (*continued*)

Dip.

Date	Time	θ
18	18ʰ 13ᵐ	48° 37′·2

Horizontal Intensity.

Date	Time	H
18	17ʰ 48ᵐ	29787γ

Table VII. Station, Sendu.

Lat.=34° 47′·0 Long.=139° 24′·9 Sept., 1936.

Declination.

Date	Time	δ
19	19ʰ 08ᵐ	4° 53′·0 W
19	19 50	4 53·2
22	23 04	4 52·8

Mean=4° 53′·0 W

Dip.

Date	Time	θ
19	16ʰ 52ᵐ	46° 39′·4
19	21 39	46 40·6
22	23 56	46 40·6

Mean=46° 40′·2

Horizontal Intensity.

Date	Time	H
19	16ʰ 30ᵐ	30753γ
19	20 18	30738
19	20 31	30739
22	23 29	30741

Mean=30743γ

Table VIII. Station, Rokutôen.

Lat. = 34° 46.′7 Long. = 139° 23.′1 Sept., 1936.

Declination.

Date	Time	δ
	h m	° ′
23	17 38	5 36·5 W
23	19 38	5 35·2

Mean = 5° 35.′8 W

Dip.

Date	Time	θ
	h m	° ′
23	20 04	47 46·4
23	23 00	47 47·4

Mean = 47° 46.′9

Horizontal Intensity.

Date	Time	H
	h m	γ
23	18 14	31469
23	23 31	31452

Mean = 31460 γ

Table IX. Station, Sabaku.

Lat. = 34° 43.′5 Long. = 139° 23.′1 Sept., 1936.

Declination.

Date	Time	δ
	h m	° ′
24	21 54	1 24·8 W

Dip.

Date	Time	θ
	h m	° ′
24	21 58	48 04·6

(to be continued)

Table IX. (*continued*)

Horizontal Intensity.

Date	Time	H
24	21h 26m	31236γ

Bearing.

Mark	V.C.	R	V.C.	L
Gosinkatyaya. Flag-pole	330°	23′·3	150°	21′·6
Kagamihata △ (Highest pt.)	345	55·1	165	54·8
Kakotyaya. Sign-post	61	44·1	241	41·8
Mihara shrine. N. edge of roof	94	34·9	274	30·3
Kasso-dai. Flag-pole	163	06·3	343	03·7

Table X. Station A, (Kawadiri).

Sept. 1936.

Bearing.

Mark	V.C.	R	V.C.	L
Gosinkatyaya monument	298°	16′·0	118°	13′·8
Kagamihata △	316	30·8	136	28·0
N. end of somma	27	42.0	202	40·6
Highest pt. of central cone	140	14·2	320	11·0

Magnetic Observation.

Date	Time	Read. of Magnetic Meridian	θ	δ
25	14h 45m	176° 58′·0	51° 15′·6	7° 59′ W

Table XI. Station B, (Tutuisi).

Sept. 1936.

Bearing.

Mark	V.C.	R	V.C.	L
N. end of somma	350°	55′·2	170°	59′·8
Itonasi △	8	26·2	188	24·4
Siroisi △	168	27·4	348	25·4

(*to be continued*)

Table XI. *(continued)*

Magnetic Observation.

Date	Time	Read of Magnetic Meridian	θ	δ
25	15h 42m	165° 38′·0	49° 38′·4	11° 19′ W

Table XII. Station C, (Akazawa).

Sept. 1936.

Bearing.

Mark	V.C.	R	V.C.	L
Siroisi △	155°	21′·8	335°	20′·0
Hutatune pt.	234	34·8	54	33·4
Kassodai. Flag-pole	347	23·8	167	21·6
Mihara △	353	59·6	178	57·4

Magnetic Observation.

Date	Time	Read. of Magnetic Meridian	θ	δ
25	16h 45m	234° 14′·0	51° 25′·0	0° 13′ W

26. 伊豆大島三原火山の地球物理學的研究
火口の地形測量及大島磁氣測定

地震研究所 高橋龍太郎
永田武

伊豆大島三原火山は我國の活火山の一つであつて，その地質學的，地球物理學的研究は多くの人々によつて行はれて來た．筆者等は三原火山の研究の一部として，先づ火口附近の地形測量，火口底の深度測定等を行ひ，現在迄の火口の變化を知ると同時に，今後の變化の記錄を容易ならしめた．次に大島全島にわたる地磁氣測定を行ひ，この測定を繰返す事により將來火山活動に伴ふ地磁氣の變動を見出さんとするものである．三原火山は淺間火山に比べて，やゝ性質を異にする火山であるから，兩火山の地球物理學的特性の對比は興味深く，その爲に現在，三原山にても火山微動，地電流等の常時觀測が行はれてゐる．

之等の研究は凡て，服部報公會の補助によつて施行されたものであつて，同會に對して深く感謝の意を表す．

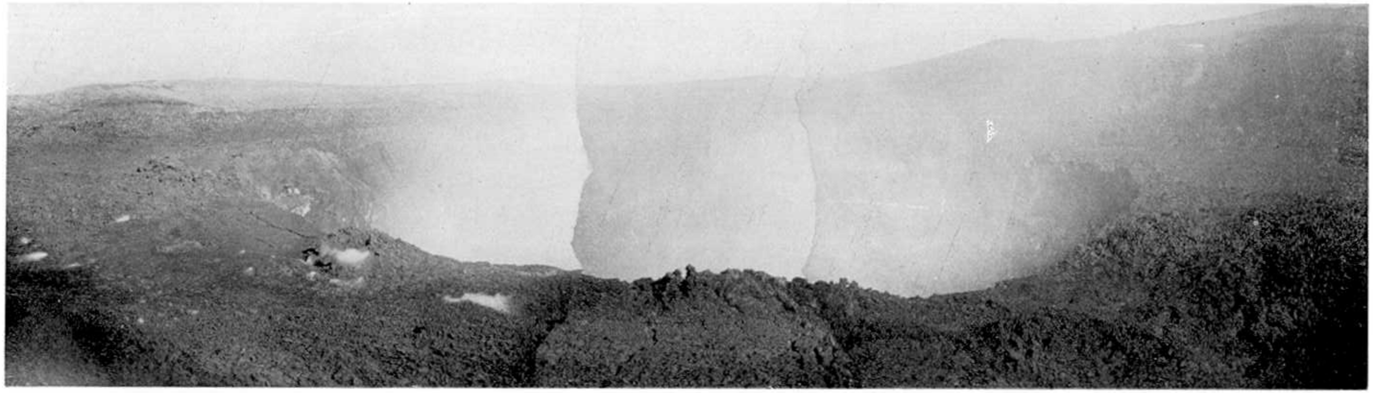


Fig. 9. General View of the Crater as seen from the SSW Ridge of the Old Crater Wall.

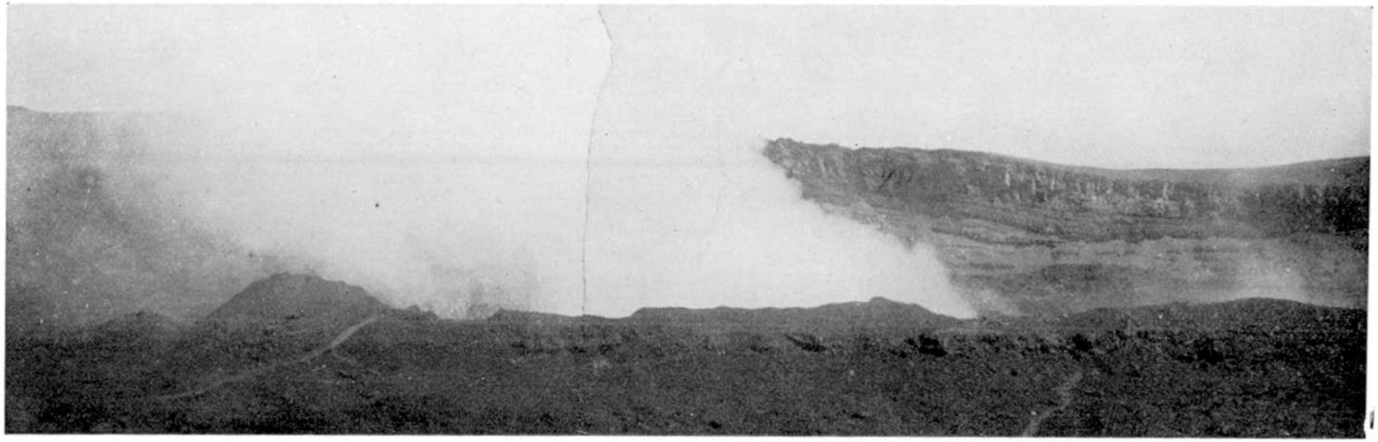


Fig. 10. The same as seen from Kakô-tyaya (crater cottage) on the NW Ridge of the Old Crater Wall.

（震研彙報 第十五號 圖版 高橋・永田）

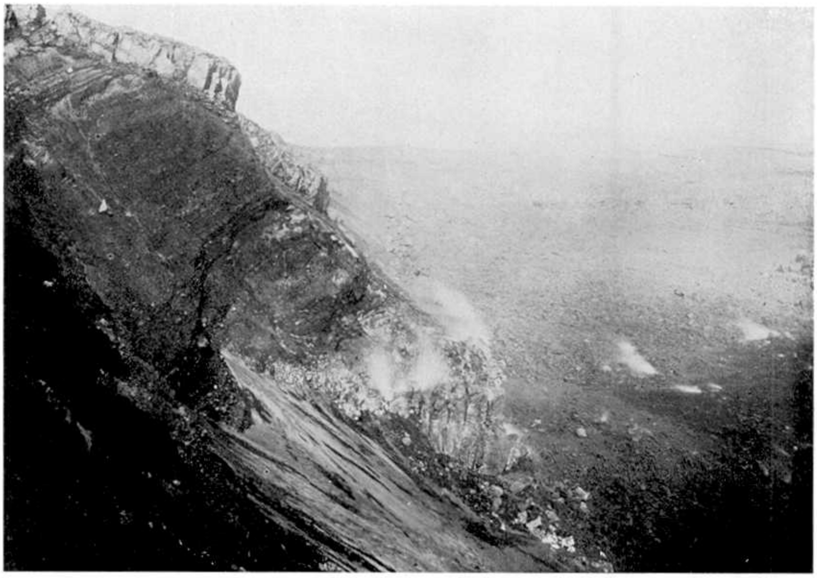


Fig. 11. A Part of the Old Crater Wall.

Fig. 12. General Features of the Old Crater Bottom.

Fig. 18, a. Motomura.

Fig. 18, b. Sendu.

Fig. 18, c. Mabusi.

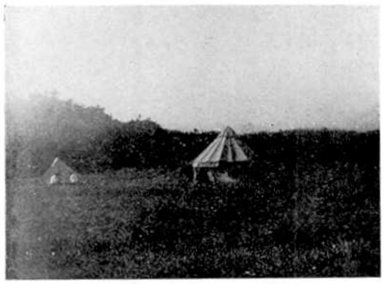


Fig. 18, d. Rokutôen.

Fig. 18, e. Sasikidi.

Fig. 18, f. Sabaku.

Fig. 18. Magnetic survey stations.

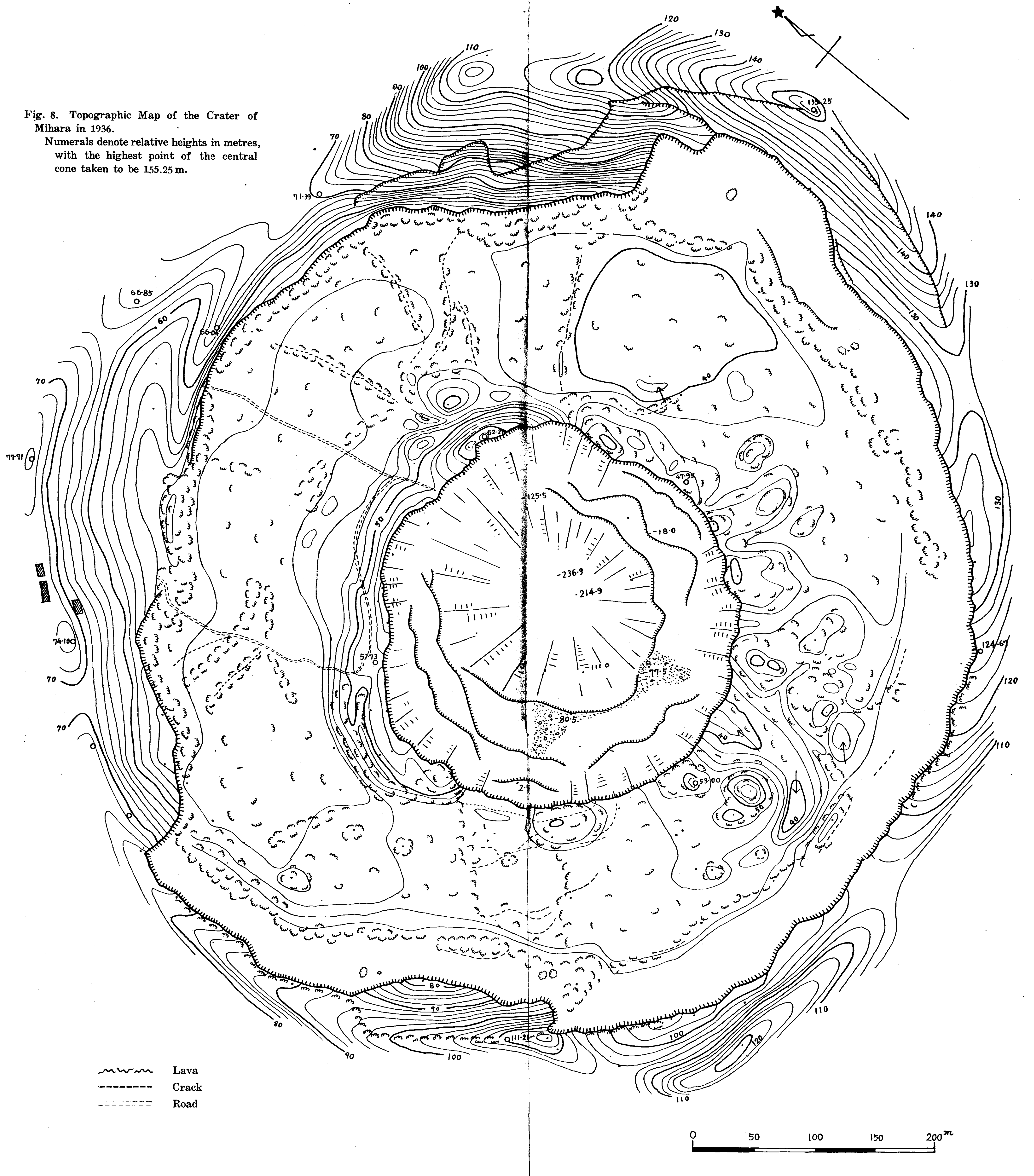


Fig. 8. Topographic Map of the Crater of Mihara in 1936.
Numerals denote relative heights in metres, with the highest point of the central cone taken to be 155.25 m.

(震研彙報 第十五號 圖版 高橋・永田)