CHAPTER III. SUPPLEMENTARY NOTES ON THE SAKURA-JIMA ERUPTION OF 1914.

19. Median Furrow. (Supplement to §§ 52 to 54, No. 3, of this Volume.) The formation of the *median furrow* (figs. 44 and 46) along the middle axis of the course of the *2nd stage* lava outflow AB, is due partly to the flowing down in lateral direction and partly to the contraction of the surface crust portion in the same direction (fig. 43). The result is the formation of a curved V-shaped canal *C'* along the median line *C* (fig. 44). The existence of the median furrow may be taken as being limited to lava streams flowing on a free unbounded area. In case of the confinement, or the flow, within a valley space *ab*, the cracks *C*, formed in consequence of the contraction, are necessarily narrow (fig. 45). Figs. 47 and 48 give the general and detail views of the median furrows of the lava streams at Yunohama (湯之濱) near the buried village of Arimra. In the case of fig. 48, the mouth breadth of the canal was 46 feet, and the vertical depth about 33 feet. (See fig. 46.)

Diagrams illustrating the Formation of the Median Furrow.
ACB ; A'C'B'...Cross section of a lava stream.

Fig. 43.

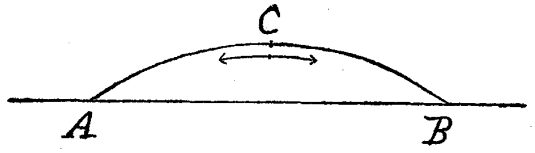


Fig. 44.

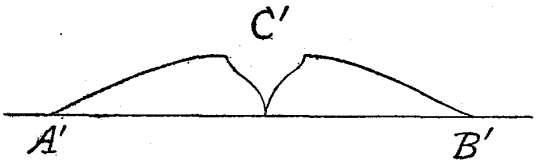
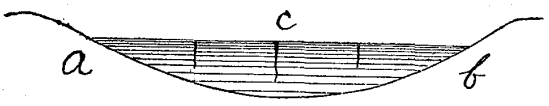


Fig. 45.



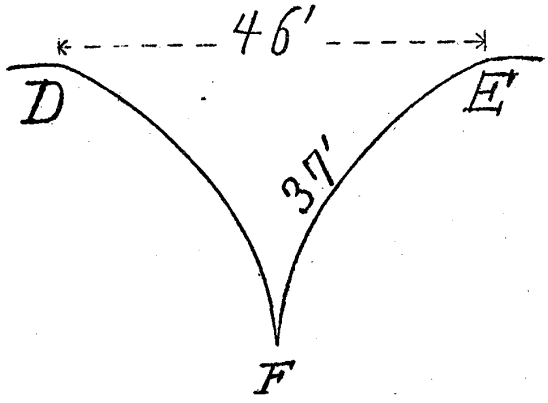


Fig. 46. Section of a Median Furrow.

20. Lava Islets. The new lava islets described in No. 3 of this Volume, are, in form, much similar to, but different in the formation process from, the median furrow. These islets have also invariably each a " cleavage canal," or a curved V-shaped axial depression, sometimes intersected by secondary transverse cracks ; the result being in many cases the formation of a miniature lake or pond occupying the central area. An islet of this type, with one of its ends partly covered by the

lava stream of a later date, is found at the coast near the side of the buried village of Arimra, and has been named Arimra-Kojima (有村小嶋). (See the photograph, fig. 53.) The maximum width is 50 feet and the length about 450 feet. Figs. 49 to 54 illustrate the other lava islets formed off the new coast at the S. E. and the N. E. parts of the Sakura-jima, already described or referred to in p. p. 261—266.

Some of the differences between the *cleavage canal* and the *median furrow* are the following: the former is of sub-acqueous formation and more nearly horizontal, is composed of homogeneous massive material, is uniform in density, and is devoid of the reddish oxidation, characterizing the sub-aerial formation of the latter.

21. Nabe-yama Crack Ridge. Fig. 55 gives a general view from the west of the "canal", or eruption crack, formed across the Nabe-yama,* and figs. 56 and 57 enlarged views of the top ridge nearly in the E.-W. direction which is ashy and covered with lava blocks of various size and beyond which is laid the deep eastern branch of the crack. The length of the top ridge is 197 feet, and the height of the lava layer forming cliffs or "gate walls" on both sides of the canal is 50 feet (=15 metres). The north "gate wall" is dark red in colour, being much oxidized as the lava cascade which flowed along the N. W. flank of Nabe-yama. The south "gate wall" presented an apparently smooth surface, thin violet in colour, exhibiting no reddish oxidation effect; probably in consequence of the breaking off of the front surface of the lava layer. When seen on Oct. 13, 1916, the north "gate wall" was not fuming, but the roof area of the south "gate wall" was whitened with sublimates and was fuming considerably.

22. Ash and Lave Accumulation around the Craterlets. The inner exposed side of the peripheral wall of the craterlet No. 1 on the western slope of the Minami-dake shows very clearly the stratification of ashes, pumice and the solid lava layer. The rim of the craterlet, formed at the depressed portion lying to the north of a ridge connecting the parasitic cone of Hikinohira with the main central peaks of the island, is highest on the southern side, the sectional formation being as is indicated in fig. 58. The surface portion, 4.65 metres in thickness, is composed of several layers of ashes, pumice, and broken lava fragments, and represents the accumulation of the volcanic ejection during the 9 days following the active lava outflow stage, and ending with Jan. 22nd, when the craterlet in question became practically extinct. The underlying

*) A good general view of the same crack taken from the east is given n Pl. LVIII of this Volume.

Sakura-jima. 1914–1915.

Median Furrow of the 2nd-Stage Lava Flow. (F. Omori, phot.)

Fig. 47. A Lava Stream End, showing the Median Furrow. (Oct. 1916.)

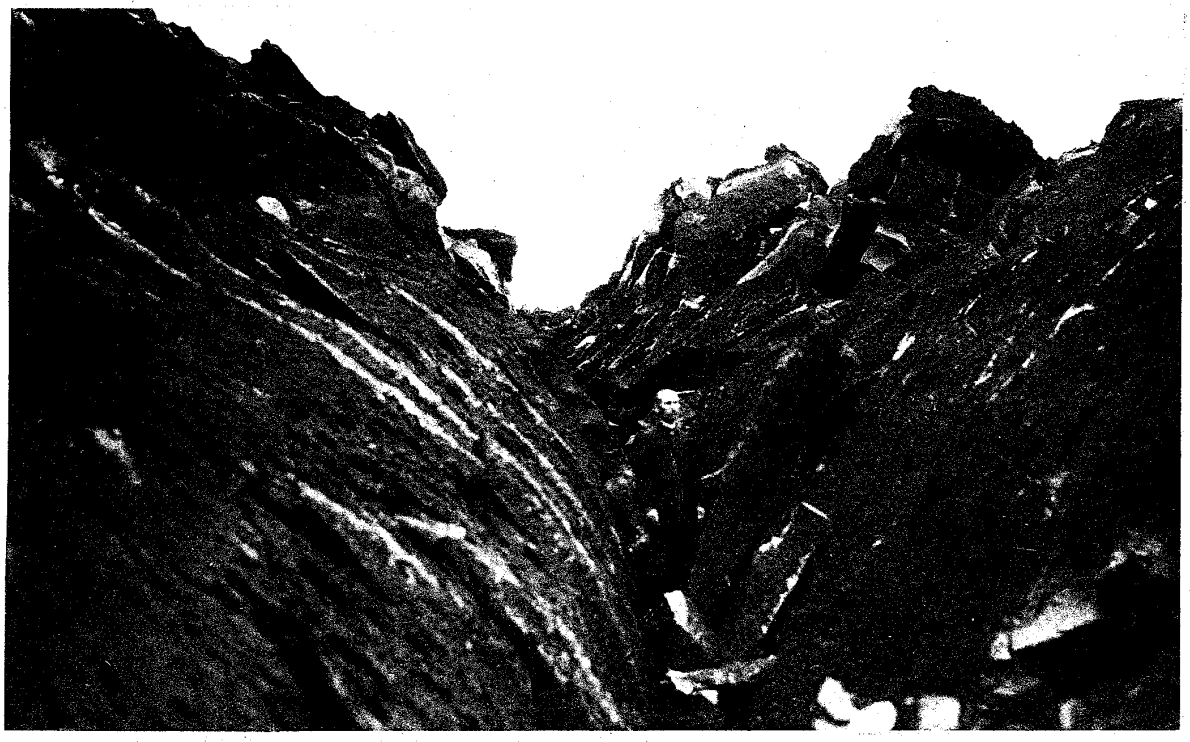


Fig. 48. An enlarged view of the V-shaped Median Furrow near the End of the Arimra-saki Lava Stream. (Oct. 1916.)

The New Ushine-Oshima Lava Islets, formed off the N.E. Coast of Sakura-jima.

(F. Omori, phot.)

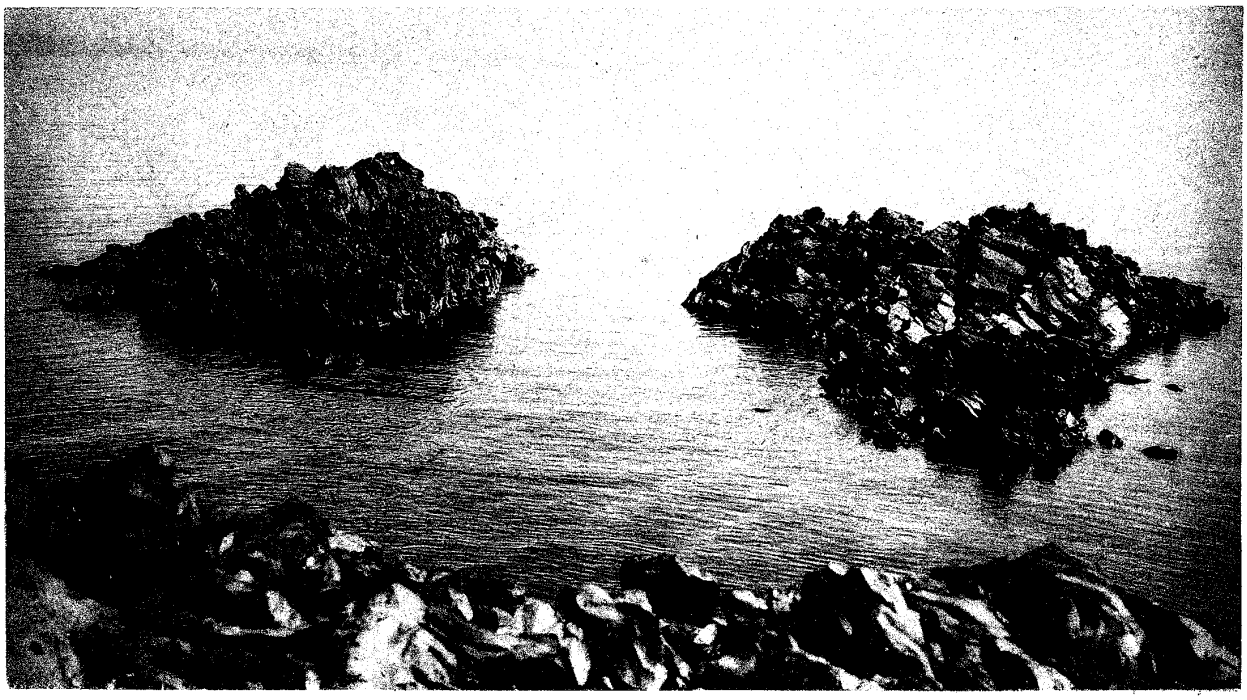


Fig. 49. View of the Two Small Islets and the Central Canal. (Oct. 1916.)

Fig. 50. General view of the group, taken from the top of Sakkabira. (Oct. 1916.)

Sakura-jima Eruption of 1914.

New Lava Islets on the S. E. Coast of Sakura-jima. (F. Omori, phot.)

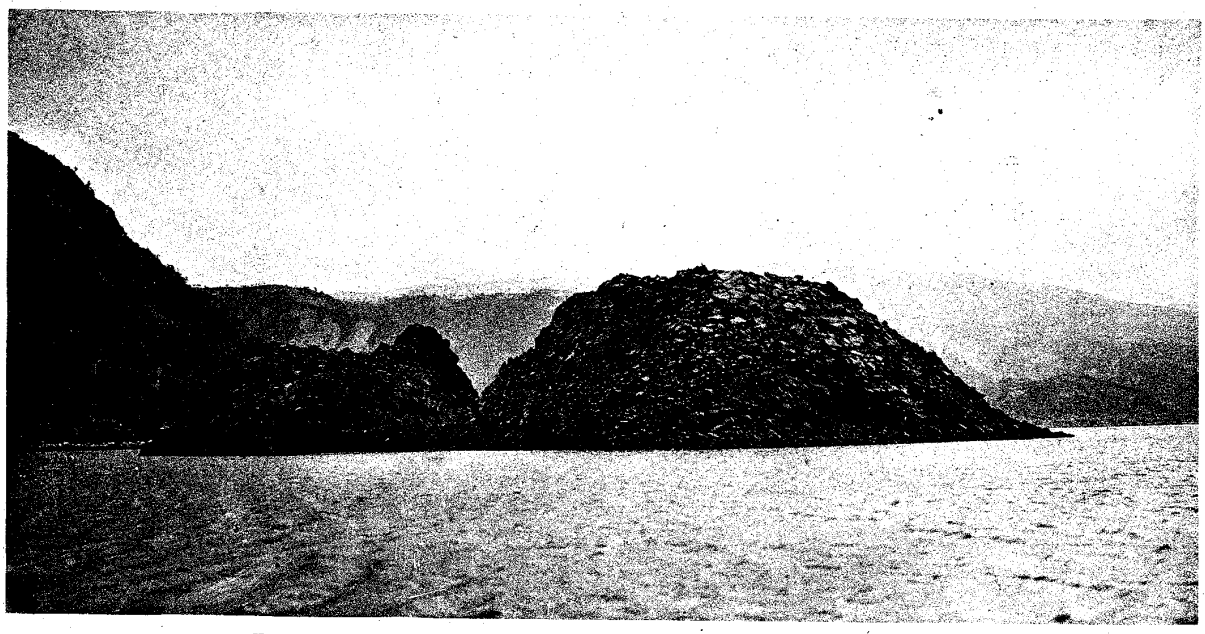


Fig. 51. Arimra-jima, showing the V-shaped Central canal. (May 1918.)

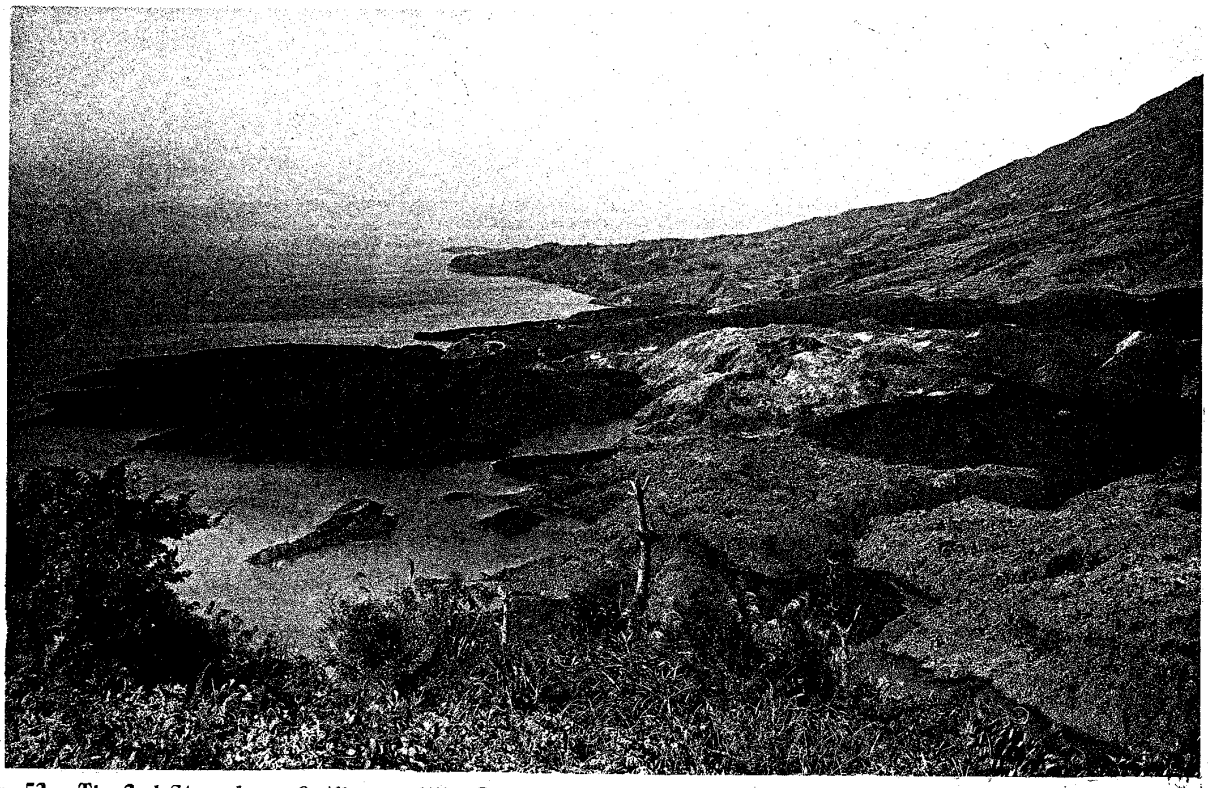


Fig. 52. The 2nd-Stage Lava Outflow and the Group of the New Lava Islats. Arimra-jima at the lefthand side. (Oct. 1916.)

Pond filling the Central Canal of Lava Islet. (F. Omori, phot.)

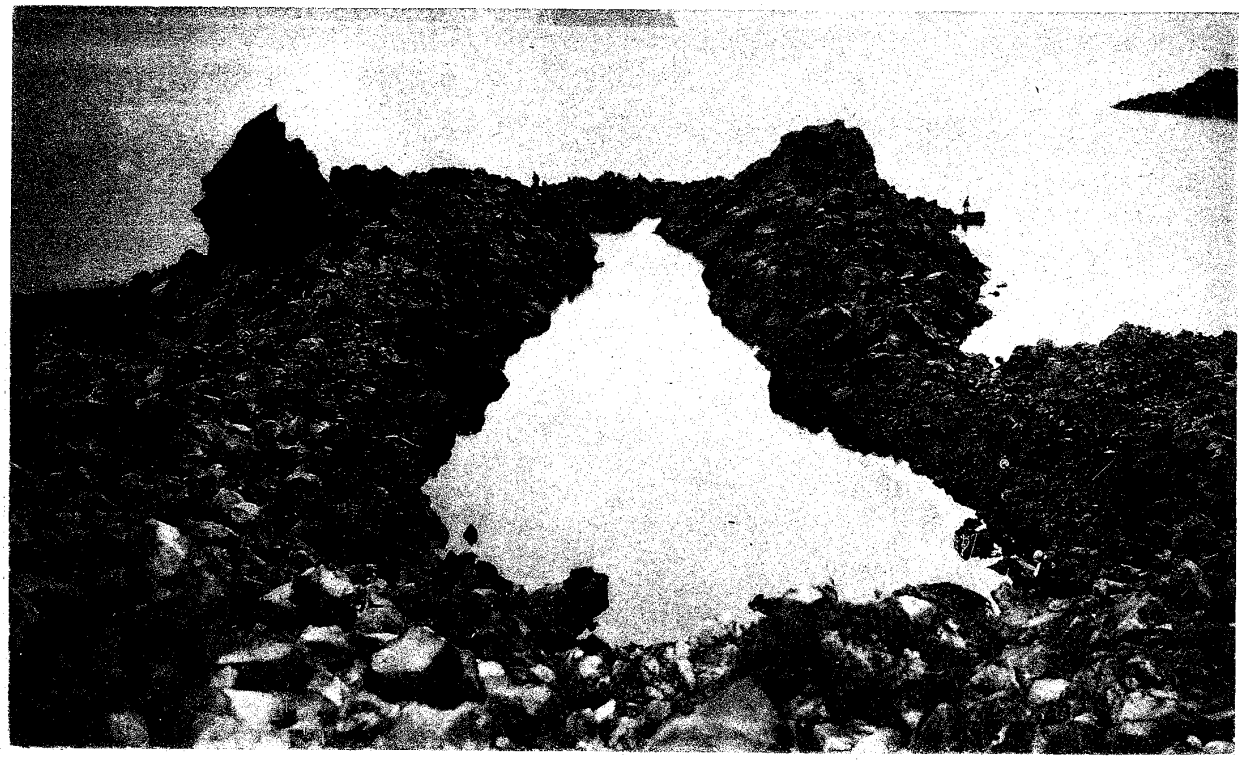


Fig. 53. An Islet adjoining the Coast of Arimra. (May 1918.)

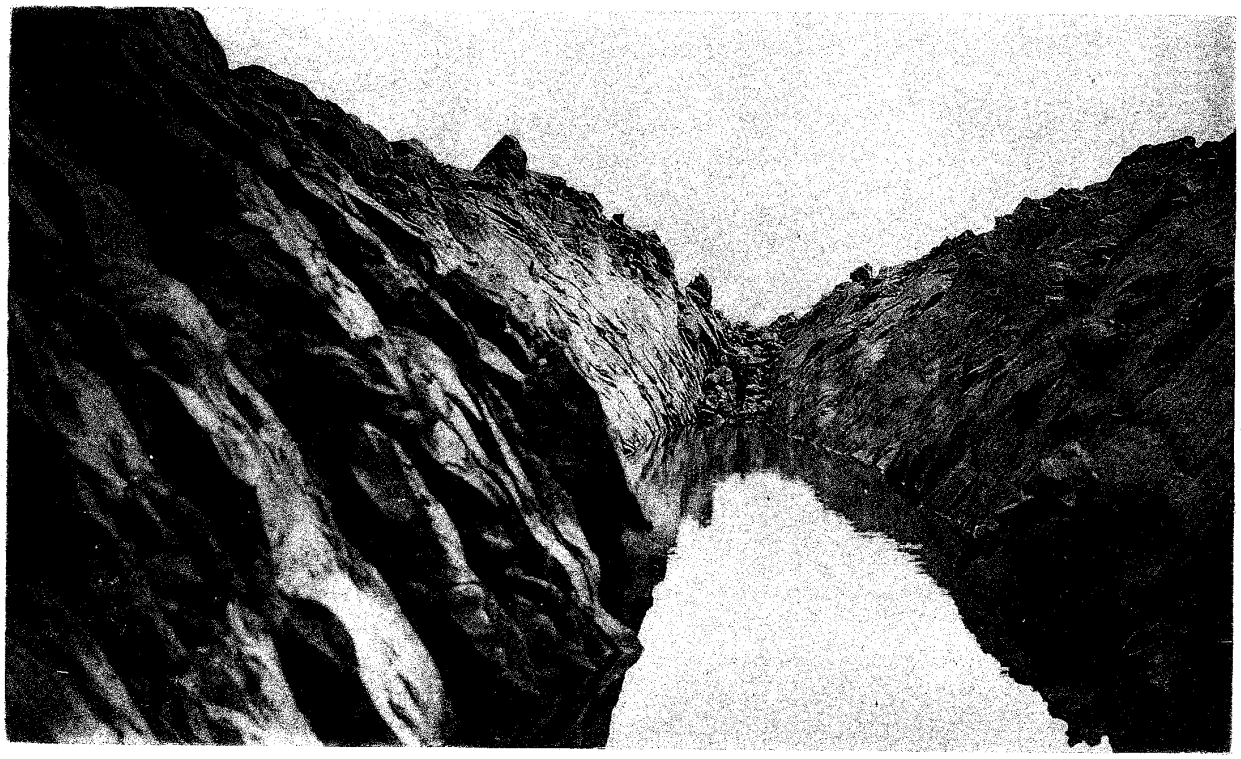


Fig. 54. Arimra-jima. (Oct. 1916.)

Sakura-jima Eruption of 1914.

Nabe-yama Eruption Crack Line. (F. Omori, phot.)

Fig. 55. General View of the Nabe-yama Crack from West. (Oct. 1916.)

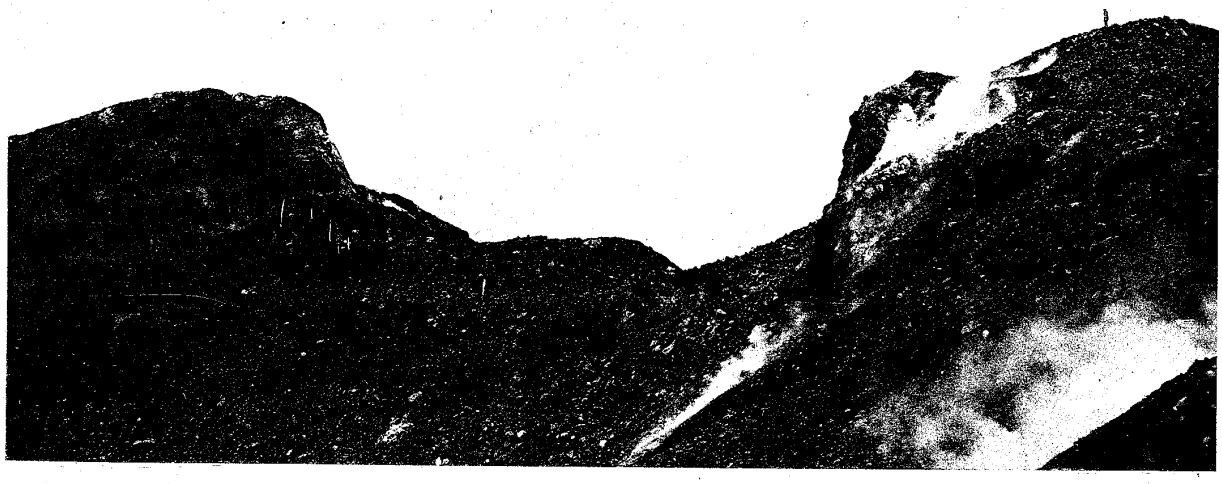


Fig. 56. The Top Transverse Ridge of the Crack. (Oct. 1916.)

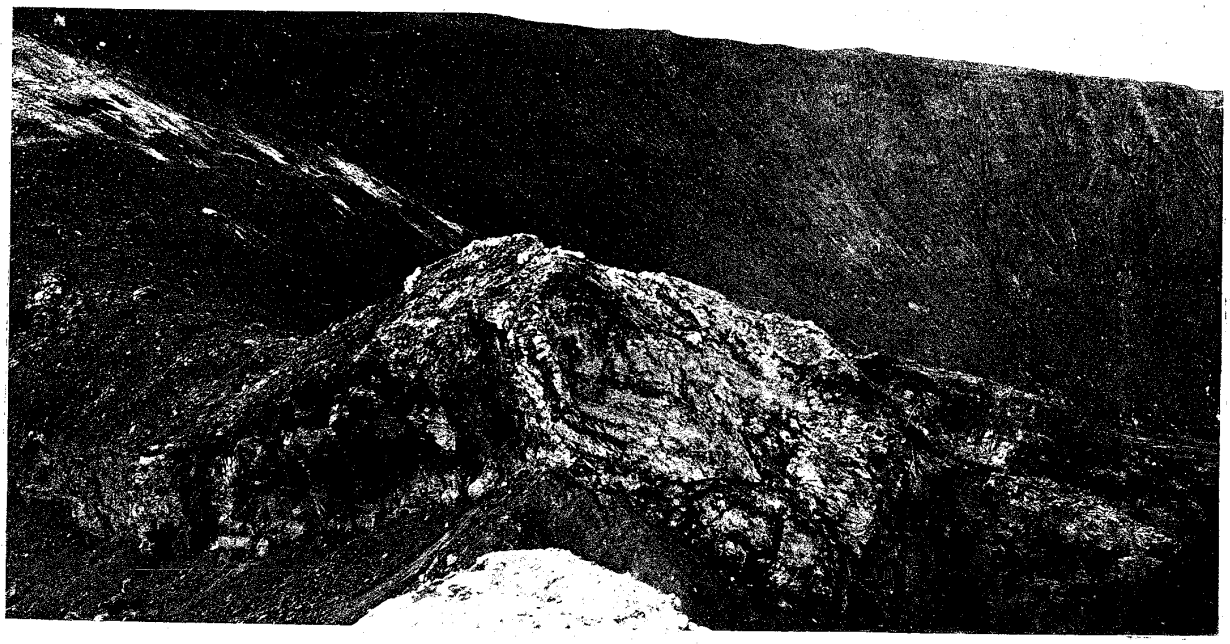
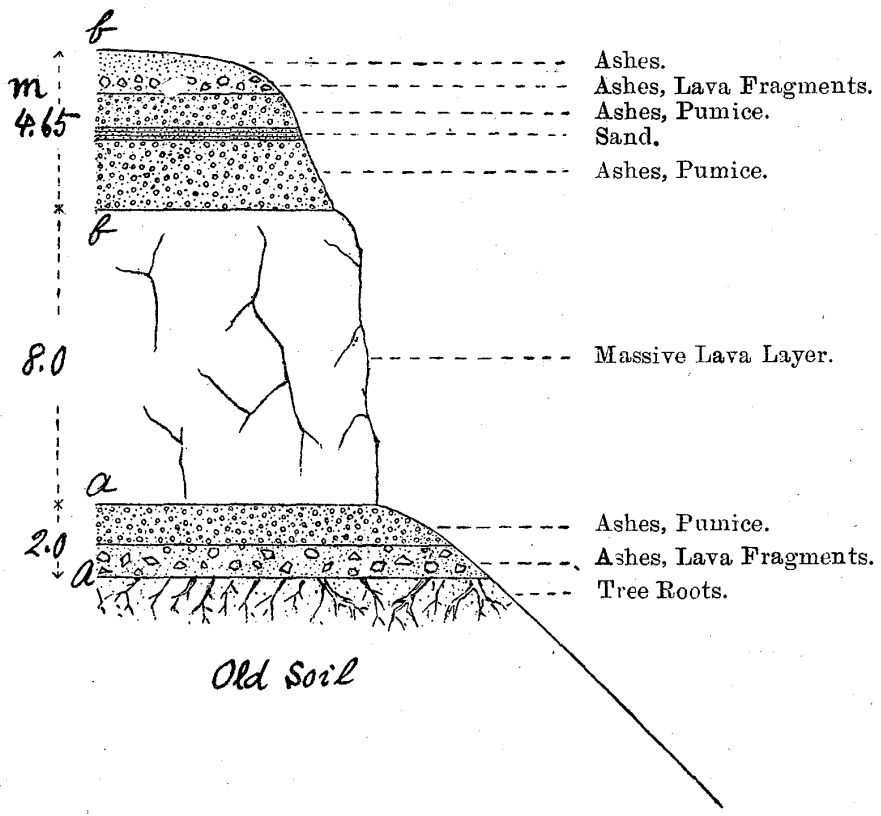


Fig. 57. The Cliff Edge of the Lava Layer on the S. Side. (Oct. 1916.)

layer of massive rock is 8.35 metres in thickness and indicates the result of the lave overflow from the craterlet on the night of Jan. 13th (1914). Beneath this there are for the thickness of 2.0 metres two layers of loose formation, which represent the explosive products given out prior to the lava outflow; the upper being a mixture of ashes and pumice, and the lower containing angular lava pieces. So much, altogether 13.0 m. in depth, is the result of the eruption, the old natural black soil beneath containing many new dead tree roots which were not charred. (See fig. 59.) These roots belonged

Fig. 58. Section of the S. Wall of the W. Craterlet No. I.
Showing the Accumulation of the various Volcanic Materials.



to trees smashed by the volcanic ejection or broken off by the volcanic winds. Some were the roots of wild roses, 2 cm. thick, or of the Japanese pines, 7 cm. thick. On the west side of the craterlet, the original soil is shown to the thickness of 2 metres at the foot of the wall formed by the new solid lava layer, which rests on the layers of pumice and rock fragments also about 2 m. thick. The thickness of the massive lava layer reaches the maximum amount of 20 metres toward the north where the craterlet rim is lowest. At the S.W. corner of the wall, the lava thickness is 11.3 metres. The actual

place of explosion, on the bottom of the craterlet No. 1, is some 490 or 500 m. above sea-level, being only slightly higher than the highest craterlet, or the "chimney," (p. 183), on the eastern side of the island. The top of the Hikinohira parasitic cone which has not evidently been overflooded by the sheet lava from the western craterlet No. 1, may be supposed to be covered by pumice and ashes to a depth of $4.65+2.0 = 6.65$ m. or some 7 metres, this being the sum of the amount of accumulation of the volcanic ejectaejecta before and after the lava outflow above mentioned.

East No. 1 *Craterlet.* The surface accumulation of the volcanic débris was about 10 metres at the highest western part of the rim, increased to about 20 metres at the lower portions of the latter. Fumaroles and incrustations were found only along or above the boundary line between the above mentioned surface débris and the underlying massive lava layer.

East No. 2 *Craterlet.* The west end, or higher, wall of the craterlet rim is narrow, and sharply cut, being about 50 metres in height. The surface accumulation of débris is about 10 m. in thickness. The exposed faces of the large lava brocks underlying the débris are smooth and more or less rounded as if struck and rubbed by the explosion materials ejected after the outflow of the lava. When seen in May 1918, the bottom was filled with sand, while several fumaroles were issuing from the débris layer.

In the cases of the two east craterlets Nos. 1 and 2, the massive lava wall is more than 30 metres in height, the underlying débris layer being not exposed at all. This shows that the thickness of the lava outflow was there considerable; especially, the lava from the No. 2 craterlet having overflowed up to the shoulder of the Nabe-yama with a thickness amounting to 100 m. at places.

23. Sea-level at Kagoshima. Table VII is supplementary to the §§ in Nos. 2 and 4 of this Volume, which relate to the apparent sea-level changes in the bay of Kagoshima before and after the Sakura-jima eruption of 1914, and indicates the mean sea-level and the greatest springs in the harbour of Kagoshima during the different months between Jan. 1920 and June 1922; the mean monthly sea-level heights at the nearest tide gauge station of Hososhima (province of Hyuga) during the two years 1920 and 1921 being also given, for the sake of comparison. In Table VIII are given the annual mean heights of sea-level at Kagoshima and Hososhima.

As will be seen from the graphical representation in fig. 64, the course of variation at Kagoshima in the mean height of sea level from year to year is not much different from that at Hososhima, which is about 135 km. distant from the Sakura-jima volcano. Thus the difference between the mean sea-

level height in 1915–1916 and that in 1917–1921 was practically identical at Kagoshima and Hososhima, being 0.083 metre at the former place and 0.082 metre at the latter place.

Now the subsidence of the ground about Sakura-jima and the Inner Kagoshima Bay attained the maximum limit at the end of 1914, followed since

Table VII. Mean and Highest Monthly Sea-level at the Kagoshima Harbour, Compared with the Mean Monthly Sea-level at the Tide Gauge Station of Hososhima, 1920–1922.*

Month.	Kagoshima Harbour.						Hososhima.*	
	Mean Monthly Sea-level.			Highest Monthly Sea-level.			Mean Monthly Sea-level.	
	1920	1921	1922	1920	1921	1922	1920	1921
	shaku	shaku	shaku	shaku	shaku	shaku	(−) metre	(−) metre
I.	6.41	6.43	6.243	11.55	11.35	11.50	2.788	2.785
II.	6.49	6.45	6.785	11.60	11.20	11.85	2.765	2.759
III.	6.38	6.70	6.727	11.30	12.15	11.95	2.757	2.770
V.	6.39	6.86	6.938	11.5	11.55	11.95	2.760	2.698
V.	6.80	6.92	7.032	11.5	11.50	11.80	2.572	2.627
VI.	6.86	7.08	7.344	11.7	11.70	12.10	2.589	2.549
VII.	7.36	7.48	7.503	12.4	12.05	12.65	2.521	2.508
VIII.	7.49	7.60	7.762	12.1	12.70	13.20	2.508	2.462
IX.	7.10	7.59	7.738	12.9	12.55	12.90	2.480	2.524
X.	7.40	7.50		12.35	12.50		2.500	2.497
XI.	6.98	6.52		11.9	11.50		2.626	2.715
XII.	6.77	6.53		11.4	11.60		2.657	2.718
Mean.	6.87	6.97		11.85	11.86		2.627	2.634

* The height is given in *shaku* (= 0.994 English foot.)

then, by a slow recovery, or upheaval, whose amount was maximum and =0.168 m. at the coast of Osaki-hama about 10 km. to the north of Kagoshima, but only about 0.0045 m. at Ogawa-machi, the strand street of the latter city. Thus it is to be assumed that the sea-level height at the harbour of Kagoshima is since 1916 subject to no marked disturbance. The present mean sea-level at the latter place is about 1.82 *shaku* = 55 cm. higher than in 1903–1905. This agrees fairly well with the result of the leveling surveys, as the bench-

Table VIII. Yearly Highest and Mean Sea-level Heights at Kagoshima Harbour, Compared with the Yearly Mean Sea-level at Hososhima, 1914–1921.

Year.	Kagoshima Harbour.				Hososhima.*	
	Mean Highest Sea-level.	Mean Annual Sea-level.	Reduced to 1915. Mean Highest Sea-level.	Reduced to 1915. Mean Annual Sea-level.	Mean Annual Sea-level	*Do.* (Height referred to 1915.)
	Before the Sakura-jima Eruption of 1914.					
	shaku	shaku	m.	m.	m.	m.
1903–1905	10.51	5.51	−0.494	−0.552	2.541	+0.013
	After the Sakura-jima Eruption of 1914.					
	shaku	shaku	m.	m.	m.	m.
1914	12.06	——	−0.024	——	2.584	−0.030
1915	12.14	7.33	0.000	0.000	2.554	0.000
1916	12.07	7.19	−0.021	−0.043	2.550	+0.004
1917	11.90	6.93	−0.073	−0.121	2.650	−0.096
1918	11.99	7.02	−0.046	−0.094	2.658	−0.104
1919	12.21	7.13	+0.021	−0.061	2.601	−0.047
1920	11.85	6.87	−0.088	−0.139	2.627	−0.073
1921	11.86	6.97	−0.085	−0.109	2.634	−0.080
1922						

* For the Kagoshima harbour, the sea-level *height* is expressed in *shaku* (=0.994 English foot). For the Hososhima station, the sea-level is indicated in the distance below a fixed point in the tide gauge room, so that a greater figure corresponds to a deeper or lower level of the sea-surface.

Sakura-jima Eruption of 1914.

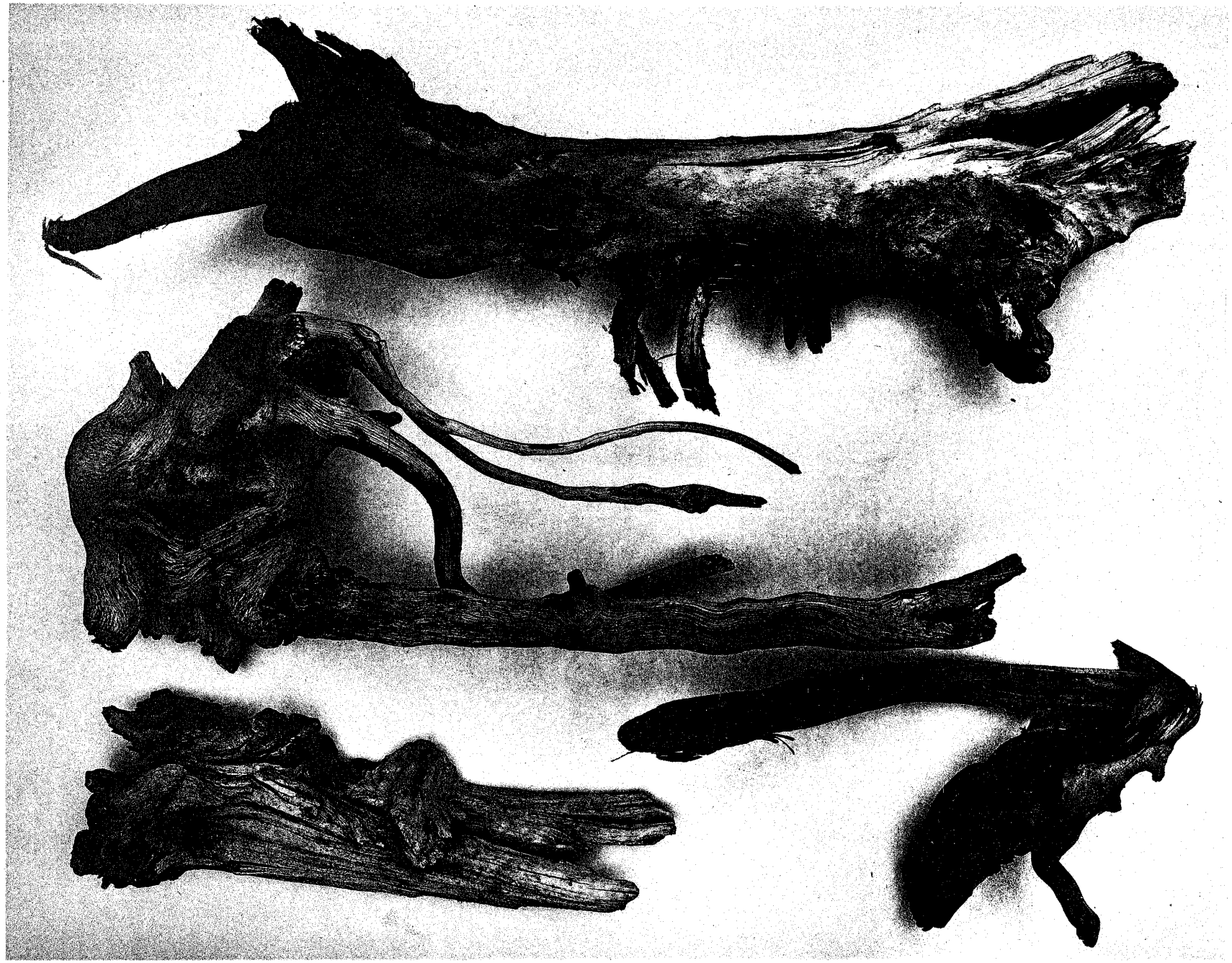


Fig. 59. Uncharred Tree Roots buried under the Ashes, Pumice and Lava Layers. (Natural Size.)

Sakura-jima Eruption of 1914. (F. Omori, phot.)

Fig. 60. Scene at Krokami, in the E. Part of Sakura-jima. The Gate Posts of the Miyabara Elementary School very nearly buried by Pumice and Ashes. (The man is sitting on one of the gate posts.)

Fig. 61. Scene before the Prefectural Office, on the morning of Jan. 17th, 1914, when there was a slight ash-precipitation for the first time in the city of Kagoshima.

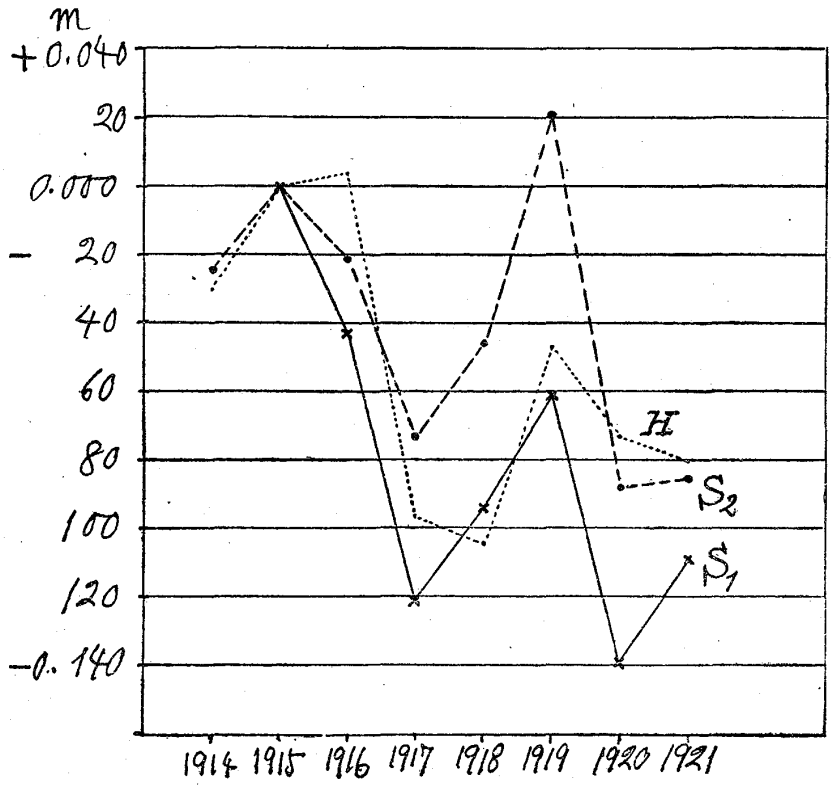
Sakura-jima Eruption of 1914. (F. Omori, phot.)

Fig. 62. A Deep Crack (depth=5 m.), formed across the layer of the new volcanic débris on the 460 m.-Hill, near the Lava Source on the West Side. (Oct. 1916.)

Fig. 63. The New Lava Coast, in the locality where the 102-metre Asahi-yama Hill had existed. (Oct. 1916.)

mark No. 2469 at Ogawa-machi (Kagoshima) was 0.407 metre lower just after the eruption, in June 1914, than in the year 1892, while the elevation of the ground during the 22 years between the latter date and the year of the eruption (1914) must have been some 0.15 metre, giving the resultant depression of ground of about 0.407 m + 0.15 m = 0.557 m. at the harbour.

Fig. 64. Variation of the Mean Annual Sea-level Height, referred to 1915.



S_1 .....Mean Sea-level at Kagoshima.
S_2 .....Mean Annual Value of the High Tide Level at Kagoshima.
H .....Mean Sea-level at Hososhima.

24. Casualty and Loss of Property. The amount of mortality involved in the great volcanic eruption and the strong earthquake on Jan. 12, 1914, was amazingly small. The inhabitants of Sakura-jima were brought, by means of steamers, mortor-boats, and other craft, safely to the city of Kagoshima and other places on the coast of the provinces of Satsuma and Osumi, there having been only two cases of death and 27 cases of missing out of the whole island population of over 21,000. Of the 16 earthquake victims relating to the Kagoshima district, excluding Sakura-jima, about a dozen were killed at a place called Tenjin-ga-seto, $2\frac{1}{2}$ km. to the s.w. of the city, by the fall of a cliff of loose formation on the road side where a group of the fugitives were resting.

Tables IX and X are the official statements of the different items of the damage caused by the volcanic and seismic convulsions. The amount of the loss of property was estimated at the time at a little less than 40 million yen, as follows :—

	yen
Kagoshima City....	963,007
Kagoshima District.	7,244,257
Ibski ,, ...	35,676
Hioki ,, ...	55,587
Izumi ,, ...	1,188
Isa ,, ...	22,924
Aira ,, ...	8,998,060
Soö ,, ...	14,751,904
Kimotski ,, ...	5,088,855
Total.	**37,161,458**

Damage to	Total.	Sakura-jima only.
	yen.	yen.
Cultivated Field, etc.	28,980,536	4,704,750
Road, Bridge, etc.	209,559	——
Dwelling Houses, etc.	2,258,188	1,072,287
Agriculture.	2,217,041	933,150
Sericulture.	318,251	——
Private Forest.	1,982,091	371,077
State Forest.	377,572	11,030
Live Stock.	754,487	80,126
Acquatic Product.	63,733	33,784
Sum.	37,161,458	7,206,204

Table IX. List of the Seismic and Volcanic Damage in Kagoshima Prefecture Caused by the Sakura-jima Outburst of 1914.

Seism. and Volcanic Damage. \ City or District.		Kagoshima City.	Kagoshima District. (including Sakura-jima)	Ibsuki District.	Aira District.	Soo District.	Kimotsuki District.	SUM.
Casuality.	Killed.	13	18	—	—	—	4	35
	Wounded.	96	25	—	—	—	—	121
	Missing.	—	27	—	—	—	—	27
Domestic Animals killed.		—	2,875	—	—	1	9	2,885
Number of Dwelling Houses.	Burnt (volc. erupt.)	—	2,066	—	—	—	1	2,067
	Totally collapsed (eqke.)	29	28	1	10	—	45	113
	Half collapsed „	117	38	1	6	2	70	234
	Damaged „	9,405	1,222	1	1	4	915	11,548
	Buried under pumice and ashes.	—	59	—	—	9	1,568	1,636
Number of Other Buildings.	Burnt (volc. erupt.)	—	1,790	—	—	—	—	1,790
	Totally collapsed (eqke.)	94	62	2	45	—	46	249
	Partially collapsed „	182	28	1	15	2	99	327
	Damaged „	1,058	58	—	25	—	—	1,141
	Buried under pumice and ashes.	—	22	—	—	21	1,478	1,521
Roads.	Covered by ashes (Number of places).	—	14	4	105	48	28	199
	Do., total length, in *cho.**	—	273	32	4,305	1,682	2,812	9,104
	Damaged (number of places).	20	70	—	—	—	—	90
	Do., total length, in *cho.**	7.5	17	—	—	—	—	42.5
	Embankment broken down or damaged (number of places).	—	3	—	—	—	—	3
	Do. (total length).	—	198′	—	—	—	—	198′

* 1 *cho*=360 *shaku*=109 metres nearly.

Table IX. List of the Seismic and Volcanic Damage in Kagoshima Prefecture Caused by the Sakura-jima Outburst of 1914. (*Cont.*)

Seism. and Volcanic Damage. \ City or District.		Kagoshima City.	Kagoshima District. (including Sakura-jima.)	Ibsuki District.	Aira District.	Soö District.	Kimotsuki District.	SUM.
Miscellaneous Damage.	Bridges damaged.	10	4	—	3	—	—	17
	Old wooden water work pipes damaged.	43	—	—	—	—	—	43
	Ishigaki, damaged.	466	1,763	—	4	—	—	2,233
	Telegraph posts overthrown.	—	4	—	—	—	—	4
	Boats lost or damaged.	35	23	—	—	—	1	59
	Landslips.	10	32	4	10	—	2	58
Cultivated Fields, Forest, etc., covered by ashes or buried under lava.		*tan.*	*tan.*		*tan.*	*tan.*	*tan.*	*tan.**
	Paddy field covered by ashes.	1,825	5	—	59,301	46,381	51,788	159,300
	Field covered by ashes.	1,036	9,079	—	131,779	207,896	202,744	552,535
	Do. buried under lava.	—	7,432	—	—	—	—	7,432
	House ground, covered by shes.	4,162	916	—	18,437	15,317	14,001	52,833
	Do. buried under lava.	—	742	—	—	—	—	742
	Forest and waste land covered by ashes.	1,132	24,218	—	344,549	176,869	327,446	874,214
	Do. buried under lava.	—	4,398	—	—	—	—	4,398
	Miscellaneous grounds, covered by ashes.	205	20	—	1,876	31	1,434	3,566
	Do. buried under lava.	—	12,574	—	—	—	—	12,574

* 1 *tan* = 300 *tsubo* = 10,667 sq. ft. = 992 sq. m.

Table X. Seismic and Volcanic Damage in Sakura-jima and at the Opposite Coast of Osumi.

Seismic and Volcanic Damage. \ Village.		Kagoshima District. (Sakura-jima).		Kimotski District.		SUM.
		Nishi-Sakura-jima-mra.	Higashi-Sakura-jima-mra.	Ushine-mra.	Mobiki-mra.	
Casualty.	Killed.	1	1	4	—	6
	Wounded.	9	—	—	—	9
	Missing.	4	23	—	—	27
Domestic Animals killed.		2,500	373	8	1	2,882
Number of the Dwelling Houses.	Burnt (volc. erupt.)	1,419	644	1	—	2,064
	Totally collapsed (eqke.)	21	3	35	10	69
	Partially collapsed „	16	10	20	50	96
	Damaged.	654	517	5	—	1,176
	Buried under ashes and pumice, or under lava.	9	50	759	628	1,446
Number of other Buildings.	Burnt (volc. erupt.)	1,260	530	—	—	1,790
	Totally collapsed (eqke.)	16	25	21	25	87
	Partially collapsed (eqke.)	17	5	19	80	121
	Damaged.	38	16	1	—	55
	Buried under ashes and pumice, or under lava.	10	12	699	610	1,331
Cultivated Fields, Forests, etc.	Buried under lava. (area.)	*cho.* 30	*cho.* 54	—	—	*cho.* 84
	Buried under ashes. (area.)	60	126	*cho* 726	*cho.* 720	1,632