

CHAPTER VII. BAROGRAPH OBSERVATION AT FRUSATO OF THE SAKURA-JIMA AFTER-EXPLOSIONS.

104. *Open barograph record of Sakura-jima explosions.*

The observation of the air disturbances caused by the Sakura-jima after-explosions was carried on at Frusato on the 12th to 15th, Feb., 1914, by means of a Richard's barograph adapted to the smoked paper registration in the same way as had been tried in 1913 at the Yuno-taira seismological station on the Asama-yama*. In this way, well defined open time-scale barograms were obtained on Feb. 14th and 15th as follows:

- (i) Feb. 14th, 1914, at 11. 58. 45 A.M.
- (ii) „ „ „ „ 1. 30. 53 P.M.
- (iii) „ „ „ „ 10. 40. 53 P.M.
- (iv) „ 15th, „ „ 0. 41. 34 A.M.

The explosions on these occasions proceeded from the craterlet No. 2 on the eastern, or Nabe-yama, side of the Sakura-jima, which was then in full activity. The source of disturbance was situated 3500 metres to the N. 35° E. of the observing place at Frusato. The magnified diagrams are reproduced in figs. 30, 31 and 31.

105. *After-eruption of Feb. 14th, 1914, at 11.58.45 A.M.* The barometric disturbance was small and composed of an increase of 0.87 mm. (duration=about 0.44 sec.) and the counter change of 1.06 mm. (duration=about 1.1 sec.); the pressure being gradually brought back to the original height in the course of the next 3.6 sec. Total duration=15 sec.

* See the Bulletin, Vol. VII, No. I.

106. After-eruption of Feb. 14th, 1914, at 1.30.53 P.M. The principal oscillation of the barometric disturbance was 2.1 sec. in period and consisted of a sudden pressure increase of 2.6 mm., followed by the counter change of 3.5 mm.; resulting in the reduction of the pressure by the amount of 0.8 mm. below the equilibrium condition. The next displacement of 0.85 mm. practically brought the disturbance to end, the three first movements together lasting 3.1 sec. For the subsequent 17 sec., there were very small traces of air vibrations of $T=3.5$ sec., mixed with those of about half period. Total duration=20 sec.

This barometric disturbance was produced by an outburst from the Nabe-yama craterlet, whose earthquake motion was tromometrically observed at Frusato, as described next.

Tromometer diagram. The earthquake motion, whose preliminary portion was confused by micro-tremors, began at 1.30.44 P.M. or 9 sec. before the arrival of the barometric disturbance. The 1st displacement was 0.038 mm. (duration=1.34 sec.) directed toward the crater. The co-existing transverse motion of 0.016 mm. is to be regarded as belonging to the micro-tremors. The counter, or outward, longitudinal motion of 0.085 mm. (duration=1.9 sec.) corresponded approximately to the two transverse displacements of 0.050 and 0.112 mm. which together formed a vibration of $T=2.45$ sec. The next vibration, of $T=2.67$ sec., was composed of the following two displacements. (1), 0.138 mm. toward the crater, 0.144 mm. toward the S.E. (absolute maximum in the transverse component); resultant $2a=0.20$ mm. toward the E. (2), 0.066 mm. away from the crater, 0.091 mm. toward the N.W.; resultant $2a=0.113$ mm. toward $W.9^{\circ}N$. The motion continued large further for 7.9 sec. in the longitudinal and for 4.0 sec. in the transverse component; the absolute maximum vibration in the former direction.

being $2a$ = about 0.204 mm., T = 2.64 sec., which occurred 7.3 sec. after the commencement. From about 10.1 sec. after the same time moment there appeared, both in the longitudinal and the transverse components, quick vibrations of T = about 0.7 sec., max. $2a$ = 0.047 mm. in each direction. Total duration = 60 sec. approx.

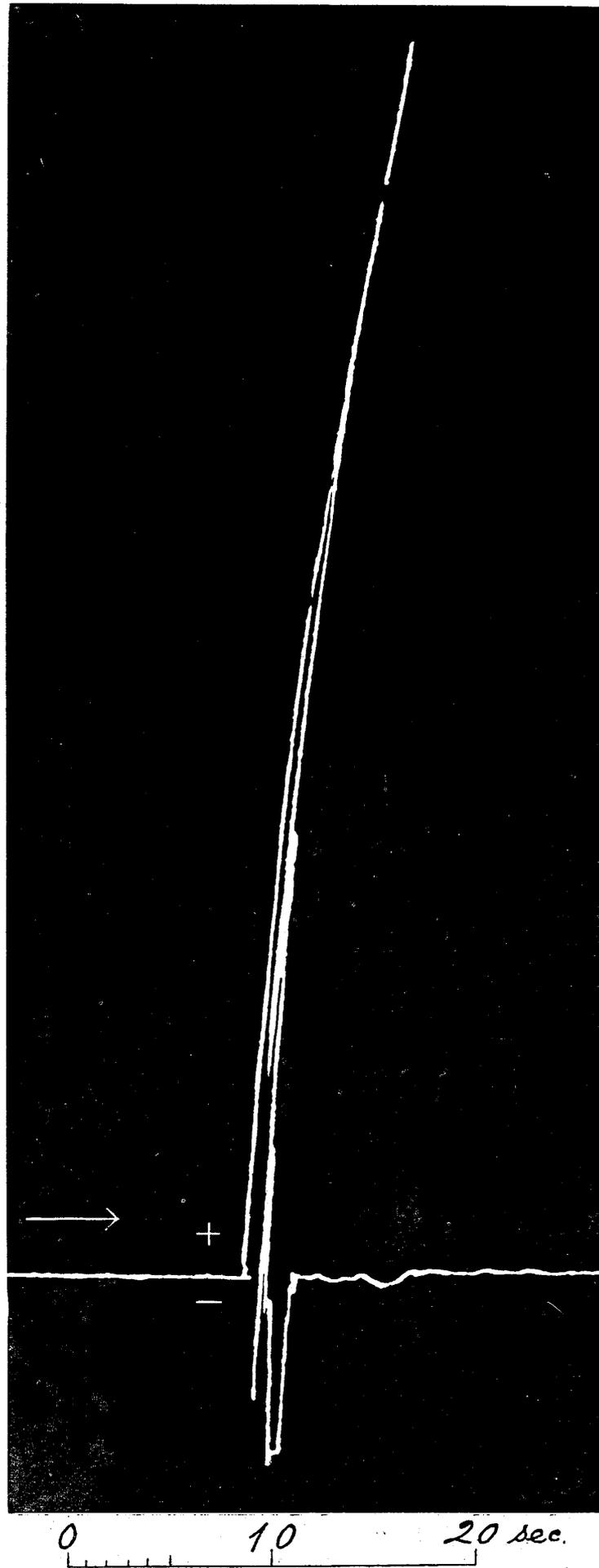
The *micro-pulsatory vibrations or micro-tremors*, which existed about the time of the after-eruption in question, were as follows:—

Longitudinal Component.	Transverse Component.
sec. 0.85 ($2a = 0.02$ mm.)	0.89 (max. $2a = 0.01$ mm.)
0.93	0.96
1.28 ($2a = 0.016$ mm.)	1.80 (max. $2a = 0.021$ mm.)
	1.90 („ = 0.013 „)
2.50	1.15 („ = 0.009 „)
2.30 ($2a = 0.036$ mm.)	2.20 („ = 0.022 „)
2.28	

107. After-eruption of Feb. 14th, 1914, at 10.40.53 P.M. The initial and principal vibration of the barometric disturbance was made up of an increase of 2.2 mm. (duration = about 0.59 sec.), followed by the counter change of 2.9 mm. (duration = about 1.3 sec.). The pressure was gradually restored to the original condition in the course of the next 3.9 sec., very slight movements continuing for further 8 sec. Total duration = 14 sec.

108. After-eruption of Feb. 15th, 1914, at 41.34 A.M. The barometric disturbance was comparatively large and began with a sudden pressure increase of 5.95 mm., about 0.45 sec. in duration. The counter motion of 6.85 mm. about 1.6 sec. in duration, was mixed up with the smaller and quicker vibrations about 0.45 sec. in period. The 3rd displacement of 0.9 mm. brought back the barometric pressure to the level before the disturbance, which so far lasted 2.8 sec. During the next 20 sec., there were very slight

Fig. 29. Barograph Observation at Frusato of the Sakura-jima After-eruption
on Feb. 15th, 1914, 0. 41. 34. A. M. Magnification = 28.



Open Time-scale Barograph Observation at Frusato of the Sakura-jima After-eruptions.

Magnification = 18.

Fig. 30.

Feb. 14th, 1914;

1. 30. 53. P. M.

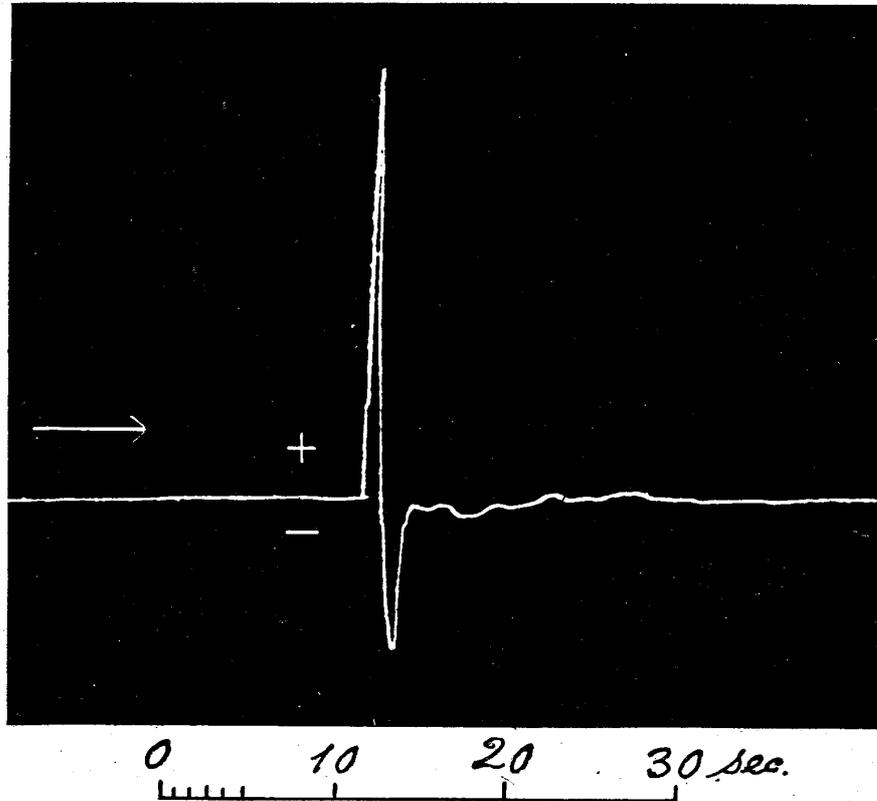
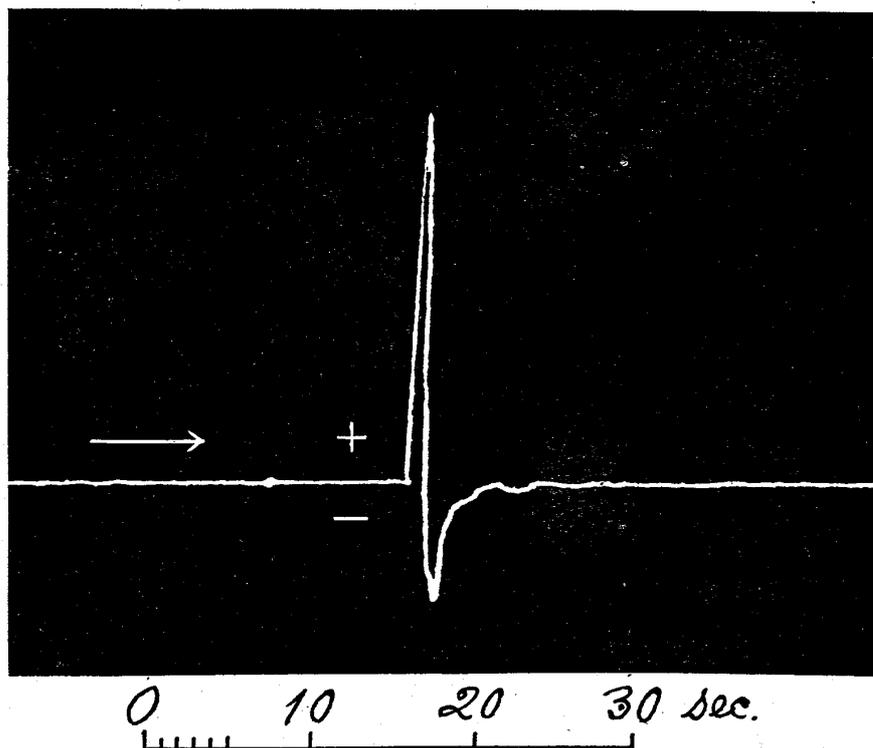


Fig. 31.

Feb. 14th, 1914;

10. 40. 53. P. M.



traces of $T=2.1$ sec. (?) mixed with quicker ones. Total duration = 23 sec.

TABLE XXVIII. BAROGRAPH OBSERVATION OF THE SAKURA-JIMA AFTER-ERUPTIONS AT FRUSATO, COMPARED TO THAT OF THE ASAMA-YAMA EXPLOSIONS OBSERVED AT YUNO-TAIRA.

Date.	Time of Occurrence.	Principal Barometric Oscillation.		Duration of			
		1st Displ.: Pressure Increase.	2nd Displ.: Pressure Decrease.	1st Displ.	2nd Displ.	Princ. Portion.	Total Disturbance.
Sakura-jima.							
Feb. 14, 1914.	11.58.45 A.M.	0.87 mm.	1.06 mm.	0.44 sec.	1.10 sec.	3.6 sec.	15. sec.
„	1.30.53 P.M.	2.6	3.5	(2.1 sec.)		3.1	20
„	10.40.53 P.M.	2.2	2.9	0.59	1.3	3.9	14
Feb. 15, 1914.	0.41.34 A.M.	5.95	6.85	0.45	1.6	2.8	23
Mean				0.49 sec.	1.3 sec.	3.4 sec.	18 sec.
Asama-yama.							
Aug. 12, 1913.	7. 45 P.M.	2.3 mm.	3.2 mm.	(2.7 sec.)			7.1 sec.
„	10. 20 P.M.	>11 mm.	>13 mm.				
May 5, 1914.	0. 33 A.M.	6.4	7.0	(2.3 „)			12.3 „

109. Summary. The barometric effect of the explosion consisted in each case mainly in the production of a single compressional oscillation, whose average period was 1.9 sec., and which was composed of the 1st displacement, or the pressure increase, and the 2nd displacement, or the pressure decrease. The latter was greater than the former in the mean ratio of 1.3 to 1. (See Table XXVIII.) Further, the semi-periods or durations corresponding to the two displacements were unequal, the respective average values being 0.49 sec. and 1.3 sec. The duration of the 1st pressure

increase may probably be taken as giving approximately the duration of the explosive action at the craterlet itself, the strong detonative outburst thus lasting about $\frac{1}{2}$ sec. The duration of the 2nd displacement or pressure decrease, =1.3 sec., may be taken as indicating the time length of the continuance of the powerful inrush of the air which immediately set in after the termination of the eruption. The general nature of the barometric disturbance caused by the Sakura-jima outbursts was quite similar to that in the case of the Asama-yama explosions observed in 1913.

Tokyo. April, 1920.