

GROUP V.—*Earthquakes which originated off the southern coast of Honshiu (Main Island).*

Eqike No. 99. March 7th 1899; 9h 55m 29s a.m.

Total duration = $1\frac{1}{2}$ h.

This was a large earthquake, whose total land area of disturbance was about 240,000 square km. and whose origin was situated off the south-eastern coast of the province of Kii, at about long. $136^{\circ} 26'$ E and lat. $33^{\circ} 45'$ N. The shock was most strongly felt in the middle and southern parts of the province of Yamato and in the eastern part of the province of Kii, where, amongst others, numerous land-slips took place, killing a few and wounding a great many people. In the city of Osaka some brick buildings were damaged and a few small chimneys were broken.

Observations at Meteorological Observatories :—

Nagoya	9h 54m 35s a.m.	Strong.	Motion quick and accompanied by vertical movements; houses shaken.
Gifu	9. 54. 49	„	
Kobe	9. 54. 50	„	Pendulum clocks stopped.
Kyoto	9. 55. 1	„	Accompanied by vertical motion; pendulum clocks stopped.
Tokushima ..	9. 55. 46	„	
Tsu	9. 56. 28	„	Accompanied by vertical motion; pendulum clocks stopped; followed by after-shocks.

Osaka	.. ..	9h 56m 36s a.m.	Strong.	{ Motion quick, accompanied by vertical movements; li- quids overflowed.
Hikone	.. ..	10. 0. 0	„	{ Motion quick, accompanied by vertical movements; houses shaken.
Hamamatsu	.. ..	9. 54. 40	Rather strong.	{ Pendulum clocks stopped; followed by after-shocks.
Sakai (in Hoki)		9. 55. 18	Strong.	Houses shaken.
Yagi	.. ..	9. 57. 47	„	{ Motion quick; vertical mo- tion strongly felt; walls cracked.
Wajima	.. ..	9. 58. 10	„	Houses shaken.
Wakayama	.. ..	10. 5. 0	„	Pendulum clocks stopped.
Tadotsu	.. ..	9. 57. 35	Rather strong.	{ Accompanied by vertical motion and earthquake sound; pendulum clocks stopped.
Fukui	.. ..	9. 54. 0	Weak.	{ Motion quick; accompanied by vertical motion; pen- dulum clocks stopped.
Yokohama	.. ..	9. 54. 58	„	Duration long.
Nagatsuro	.. ..	9. 54. 30	„	Houses shaken.
Fushiki	.. ..	9. 55. 0	„	
Kofu	.. ..	9. 55. 31	„	{ Motion quick; accompanied by vertical movements; houses shaken.
Kochi	.. ..	9. 57. 44	„	Doors shaken.
Iida	.. ..	9. 53. 24	„	{ Motion quick; accompanied by vertical movements; houses shaken.

Okayama	..	10h 0m 50s a.m.	Weak.	{ Motion quick; accompanied by vertical movements; pendulum clocks stopped.
Matsumoto	..	9. 54. 51	„	Duration long.
Nagano	..	9. 55. 1	„	
Kumagae	..	9. 55. 36	„	Motion gentle.
Kanazawa	..	9. 57. 0	„	Pendulum clocks stopped.
Hiroshima	..	9. 59. 0	„	Motion gentle.
Oita	..	9. 59. 20	„	Doors shaken.
Numazu	..	9. 52. 48	„	Pendulum clocks stopped.
Kure	..	9. 55. 26	Slight.	Motion gentle.
Tokyo	..	9. 55. 29	„	„
Mito	..	9. 56. 20	„	{ Only instrumentally re- gistered.
Mayebashi	..	9. 56. 25	„	Motion gentle.
Choshi	..	9. 56. 41	„	„
Izugahara	..	9. 57. 0	„	„
Kagoshima	..	9. 59. 0	„	„
Oshima	..	9. 59. 11	„	„
Shiwonomisaki	10.	0. 15	„	{ Motion quick, accompanied by vertical motion.
Fukuoka	..	9. 57. 13	„	
Saga	..	10. 0. 0	Weak.	Duration long.
Matsuyama	..	10. 0. 30	Slight.	
Kumamoto	..	10. 1. 26	„	Duration long.
Hamamatsu	..	10. 1. 20	„	„

(EW component).

The earthquake began with a displacement of 0,2 mm towards E, the counter motion being 0,45 mm towards W. The second and third undulations were as follows:—

(2nd wave.) 1st displacement 0,7 mm towards E, counter displacement 1,85 mm towards W; period 13,7 sec.

(3rd wave.) 1st displacement 3,65 mm towards E, counter displacement 4,15 mm towards W ; period 17,8s.

These three undulations together occupied 45,7s and may be taken as the P.T. Then larger and quicker motion began to appear, the first three vibrations giving an average period of 9,4s. Then the max. 2a of 15,9 mm, (period 9,4s) took place. The subsequent motion was much smaller, and complex owing to the appearance of slow undulations of an average period of 33s. Superposed on these latter there were vibrations of an average period of 7,5s. The P.P. lasted for 6m 44s.

The E.P. The average period, deduced from 8 successive groups of 50 vibrations, was as follows :—

6,5s	(at the commencement)	}	(General mean)
7,0			
7,9			
8,0			
8,5			
9,0			
8,8			
8,7	(towards the end)		
			8,0s.

For two minutes at the commencement of the earthquake there were also traces of quick small vibrations, whose principal average period was about 2,3s.

(NS component).

The NS component diagram was imperfect as the earthquake took place during the change of the record-receiver.

Eqke No. 100. March 7th 1899 ; 3h 42m 50s p.m.

Duration = 9m.

Observations at Meteorological Observatories :—

Tsu	3h 40m 25s p.m.	Weak.	} Accompanied by vertical motion.

Yagi.. ..	3h 48m 37s p.m.	Weak.	{ Accompanied by vertical motion ; houses shaken.
Hikone ..	3. 15. 5	Slight.	
Wakayama.	3. 40. 20	"	{ Accompanied by vertical motion.
Sakai ..	3. 40. 49	"	
Kofu ..	3. 40. 58	"	
Hamamatsu	3. 41. 0	"	Motion quick.
Kyoto ..	3. 41. 29	"	
Nagoya ..	3. 41. 30	"	Motion gentle.
Matsumoto.	3. 41. 38	"	
Nagano ..	3. 41. 54	"	
Tadotsu ..	3. 44. 17	"	Motion gentle.
Fushiki ..	3. 48. 37	"	"
Tokushima.	3. 4. 0	"	

The P.T. lasted for 1m.21s. During the first 24s, which may probably be taken as the 1st P.T., the motion was very small. During the remainder of this epoch, the motion consisted of vibrations of an average period of 6,4s, superposed with quicker ones of an average period of 2,6s, which latter waves became more prominent towards the end.

The P.P. began with the maximum group of vibrations of an average period of 7,0s, superposed with small quick vibrations of an average period of 2,6s. The max. 2a was 0,09 mm in the EW and 0,07 mm in the NS component.

The E.P. was obscured by P.O.

P.O. The average period, measured 3 hours after the earthquake, was 6,4s.

Eqke No. 119. April 6th 1899; 8h 30m 22s a.m.

Total duration=about 19m.

This was a small earthquake at some distance and was felt as a slight shock throughout a rather large area, which extends from the province of

Rikuzen on the north to the provinces of Echizen, Bizen and Sanuki on the south-west.

Observations at Meteorological Observatories:—

Gifu	..	..	8h 25m 1s a.m.	Slight.	
Yagi	..	..	8. 25. 30	„	
Okayama	..	..	8. 27. 00	„	
Wakayama	..	..	8. 27. 50	„	Motion gentle.
Tsu	..	..	8. 28. 17	„	Duration long.
Fukui	..	..	8. 28. 57	„	
Fukushima	..	..	8. 29. 19	„	
Tadotsu	..	..	8. 29. 24	„	
Osaka	..	..	8. 29. 32	„	Motion gentle.
Maebashi	..	..	8. 30. 3	„	
Yokohama	..	..	8. 30. 8	„	Motion gentle.
Kumagae	..	..	8. 30. 12	„	
Nagano	..	..	8. 30. 20	„	
Tokyo	..	..	8. 30. 22	„	
Mito	..	..	8. 30. 25	„	
Kofu	..	..	8. 30. 58	„	Motion gentle.
Kobe	..	..	8. 33. 00	„	
Ishinomaki	..	..	8. 33. 6	„	{ Accompanied by sound ; li- quids overflowed.
Choshi	..	..	8. 33. 8	„	
Utsunomiya	..	..	8. 42. 00	„	

The P.T., whose duration was 49s in the EW and 46s in the NS component, consisted of vibrations of an average period of 7,7s; the maximum motion of 0,2 mm in the EW and 0,14 mm in the NS direction occurring at the very beginning of the earthquake. There were also traces of quick small vibrations of an average period of 2,2s, whose max. 2a was 0,25 mm in each component.

The P.P., whose duration was 7¼m, began with the max. (abs.) 2a of 0,42 mm in the EW and 0,32 mm in the NS component, with a period of

9,1s. After about 1m there appeared well defined waves of an average period of 7,8s, whose greatest motion was 0,35 mm in the EW and 0,29 mm in the NS component.—In the earlier part of this epoch the motion was superposed with small quick vibrations of an average period of 2,6s.

The E.P. was confused by P.O.
