

GROUP IV.—*Earthquakes which originated off the coasts of the provinces of Hitachi and Iwaki.*

Eqke No. 3. July 15th 1898; 5h 10m 22s a.m.

Total duration = 6m.

Observations at Meteorological Observatories:—

Mito	5h 8m 34s a.m.	Slight.	Motion quick.
Fukushima	5. 9. 45	„	Motion gentle.
Choshi	5. 9. 53	„	
Tokyo	5. 10. 44	„	
Kumagae	5. 10. 48	„	
Maebashi	5. 10. 55	„	
Utsunomiya	5. 11. 0	„	Motion gentle.
Kofu	5. 12. 47	„	

The P.T., whose duration was 19s, consisted of vibrations of an average period of 1,2s, superposed with very quick small waves.

The P.P., whose duration was 21s, consisted essentially of vibrations of an average period of about 1,1s. The max. 2a was 0,16 mm in the EW and 0,20 mm in the NS component.

The E.P. The average period was 2,7s.

Eqke No. 20. August 22nd 1898; 11h 31m 53s p.m.

Total duration = 6m 20s.

Observations at Meteorological Observatories:—

Nagano	11h 13m 41s p.m.	Slight.	
Fukushima	11. 37. 49	„	Motion gentle.
Utsunomiya	11. 40. 0	„	
Maebashi	11. 40. 8	„	Motion gentle.

Kumagae	11h 40m 14s p.m.	Slight.
Tokyo	11. 10. 33	„
Mito	11. 41. 5	„
Kofu	11. 41. 20	„
Miyako	11. 41. 21	„
Ishinomaki.. .. .	11. 41. 50	„

The P.T. lasted for 17s.

The P.P. consisted essentially of quick waves of an average period of 1,0s, superposed on slower ones of an average period of 3,0s. The max. 2a was 0,05 mm in the EW and 0,04 mm in the NS component.

In the E.P. the average period was 2,9s.

Eqke No. 20. August 23rd 1898; 11h 42m 53s a.m.

Total duration = 3m 24s.

This earthquake was observed at no meteorological observatory, but seems to have originated at the same place as the following earthquake, No. 21. The motion was very small.

The average period, measured towards the end, was 2,0s.

Eqke No. 21. August 23rd 1898; 11h 47m 17s a.m.

Total duration = 8m.

Observations at Meteorological Observatories:—

Fukushima	11h 46m 25s a.m.	Slight.	
Mito	11. 46. 32	„	
Kumagae	11. 46. 42	„	
Utsunomiya	11. 47. 42	„	Motion gentle.
Tokyo	11. 47. 59	„	
Maebashi	11. 51. 0	„	

The P.T. lasted for 17s.

The P.P., whose duration was 49s, began with quick vibrations. 39s later there appeared well defined larger waves, whose average period was

3,6s and whose max. 2a of 0,04 mm in each component occurred at 56s from the commencement of the earthquake.

The E.P. The average period was 3,3s.

Eqke No. 32. September 16th 1898; 8h 32m 40s a.m.

Total duration = 12m.

Observations at Meteorological Observatories:—

Mito	8h 32m 25s a.m.	Weak.	{ Motion quick; houses shaken.
Matsumoto	8. 30. 59	Slight.	
Choshi	8. 31. 50	„	
Utsunomiya .. .	8. 32. 10	„	Motion gentle.
Ishinomaki .. .	8. 32. 10	„	
Maebashi	8. 32. 21	„	Motion gentle.
Kumagae	8. 32. 34	„	„
Tokyo	8. 32. 42	„	
Fukushima .. .	8. 32. 50	„	
Yokohama	8. 32. 51	„	Motion gentle.

The P.T. lasted for 16s.

The P.P. consisted of quick vibrations superposed on slower undulations. The max. 2a was 0,3 mm in each component.

The E.P. The average period was 3,8s.

Eqke No. 37. September 27th 1898; 10h 19m 52s a.m.

Total duration = 16m.

Observations at Meteorological Observatories:—

Tokyo	10h 19m 59s a.m.	Slight.	
Mito	10. 20. 51	„	Motion gentle.
Kumagae	10. 39. 20 (?)	„	

The P.T. was not well defined. During the first 58s, however, the motion consisted of small quick vibrations, superposed on waves of an

average period of about 3,0s. The max. 2a was 0,04 mm in the EW and 0,02 mm in the NS component. Towards the end the average period was 5,7s.

Eqke No. 39. September 28th 1898; 7h 53m 40s a.m.

Total duration = 9m.

Observations at Meteorological Observatories :—

Mito 7h 54m 22s a.m. Slight.

The P.T. lasted for about 30s.

The P.P. consisted of very small vibrations (period about 0,8s) superposed on well defined ones of an average period of 2,2s. The max. 2a was very small in each component.

The E.P. The average period was 3,8s.

Eqke No. 63. November 28th 1898; 10h 56m 10s p.m.

The motion was very small.

Observations at Meteorological Observatories :—

Mito 10h 55m 0s p.m. Slight. Motion quick.

Tokyo 10. 56. 10 „

Fukushima 10. 56. 30 „

Eqke No. 92. February 22nd, 1899; 8h 2m 18s a.m.

Total duration = 16m.

Observations at Meteorological Observatories :—

Maebashi 7h 1m 56s a.m. Slight.

Tokyo 8. 2. 38 „

Utsunomiya 8. 3. 0 „ Motion gentle.

Choshi 8. 2. 10 Rather strong. { Motion quick; doors
shaken.

Mito 8. 3. 44 Weak.

Kumagae 8. 2. 57 Slight.

Nagano 8. 3. 2 „

Fukushima 8. 3. 45 „ Houses shaken.

(EW component).

The P.T., whose duration was 14s, consisted of small vibrations. The max. 2a was 0,05 mm.

The P.P., whose duration was 3m 50s, began with slower waves of an average period of 4,0s, the first motion being 0,2 mm. 21s later there appeared 5 well defined larger vibrations which together lasted for 16,4s and had an average period of 3,3s; the 2nd motion having the max. 2a of 0,65 mm. For the next 2m 5s, the motion was smaller, but the average period was nearly the same as before, namely 3,2s. During the remainder of this epoch, the predominating average period was 6,7s. The quick and small superposed movements continued till 1m 57s after the commencement of the earthquake.

The E.P. The motion consisted at first of vibrations of an average period of 3,4s superposed more or less distinctly on slower ones of an average period of 6,7s. Towards the end the average period was 4,2s.

(NS component).

Here the 1st and 2nd P.T.'s may be distinguished.

The 1st P.T. lasted for 12,8s.

The 2nd P.T. lasted for 8s.

The P.P. began with slow vibrations of an average period of 4,0s, whose 3rd vibration had the max. 2a of 0,45 mm.

P.O. There existed well pronounced slow P.O., whose max. 2a was 0,06 mm in each component. The average period, measured immediately before the earthquake, was 7,3s.

Eqke No. 109. March 22nd 1899; 8h 22m 2s p.m.

Total duration=about 5m.

Observations at Meteorological Observatories :—

Ishinomaki	8h 14m 33s p.m.	Slight.	
Fukushima	8. 15. 10	„	Houses shaken.
Mito	8. 15. 14	„	Motion gentle.
Tokyo	8. 15. 37	„	

Yokohama	8h 16m 1s p.m.	Slight,
Utsunomiya	8. 16. 13	„
Yokosuka	8. 23. 19	„

This was a small shock, the diagram showing only traces of minute quick vibrations.

Eqke No. 115. March 26th 1899; 6h 46m 45s a.m.

Total duration=15m.

Observations at Meteorological Observatories :—

Fukushima	6h 47m 55s a.m.	Weak.	Houses shaken.
Mito	6. 46. 37	„	Motion quick.
Yokohama	6. 46. 48	„	Motion gentle.
Tokyo	6. 46. 53	„	Motion quick.
Kumagae	6. 41. 31	Slight.	
Nagoya	6. 44. 8	„	
Kofu	6. 45. 15	„	Motion gentle.
Yokosuka	6. 45. 50	„	
Yamagata	6. 45. 52	„	Doors shaken.
Hikone	6. 46. 37	„	
Choshi	6. 46. 50	„	Motion gentle.
Mayebashi	6. 46. 54	„	{ Accompanied by verti- cal motion.
Utsunomiya	6. 47. 10	„	Motion gentle.
Akita	6. 47. 20	„	Duration long.
Miyako	6. 49. 2	„	
Ishinomaki	6. 51. 42	„	Houses shaken.

The P.T., whose duration was 16s, consisted of small quick vibrations.

The P.P., whose duration was about 4m, began with two well defined slow vibrations, whose average period was 8,5s and whose 2a was 0,6 mm in each component. These were superposed with quick small movements

(0,3 mm in each component) which ceased to exist at 1m 45s after the commencement of the earthquake. Then there appeared a new groups of 10 large well defined vibrations, which together lasted for 1m 0s and had an average period of 6,0s; the max. 2a being 0,6 mm in the EW and 0,3 mm in the NS component. For the next 1m 21s, there were 25 quicker vibrations of an average period of 3,2s; the max. 2a being 0,32 mm in the EW and 0,25 mm in the NS component.

The E.P. The motion consisted of regular vibrations, whose average period was about 7,0s. The end was confused by P.O.

P.O. P.O. existed both on the 25th and 26th. The amplitude remained nearly constant, on the whole; the period was however gradually lengthened with time. The max. 2a was 0,15 mm in each component. The average period was as follows:—

7,3s (on the 26th, morning);
4,9 („, 25th, „).

Eqke No. 123. April 15th 1899; 0h 40m 26s a.m.

Total duration=7m.

Observations at Meteorological Observatories:—

Mito	0h 41m 17s a.m.	Slight.
Tokyo	0. 41. 45	„
Choshi	0. 59. 11 (?)	„

The P.T. lasted for 1m 2s.

The P.P. consisted for the first 38s of small quick vibrations superposed on waves of an average period of 4,8s. Then followed the group of the most active vibrations of an average period of 3,4s; the max. 2a being 0,04 mm in the EW and 0,05 mm in the NS component.

The E.P. Towards the end the average period was 3,4s.

P.O. There existed very slight traces of P.O. The average period, measured on the morning of the 14th, was 3,7s.

Eqke No. 174. August 1st 1899; 9h 39m 57s a.m.

Total duration=6m.

Observations at Meteorological Observatories :—

Mito	9h 39m 0s a.m.	Weak.	} Accompanied by vertical motion; houses shaken.
Kumagae	9. 38. 0	Slight.	
Utsunomiya	9. 38. 30	„	„
Maebashi	9. 38. 53	„	Motion gentle.
Tokyo	9. 38. 55	„	
Yokohama	9. 38. 56	„	Motion quick.
Fukushima	9. 39. 10	„	

The P.T. lasted for 7s.

The P.P., whose duration was 65s, consisted of small quick vibrations, the motion commencing with the max. 2a of 0,15 mm in the EW and 0,13 mm in the NS component. In the former component the amplitude remained nearly constant for about 25s; but in the NS component there was a second max. 2a of 0,17 mm at 6s after the first maximum.

Eqke No. 175. August 3rd 1899; 1h 34m 52s a.m.

Total duration = 10m.

Observations at Meteorological Observatories :—

Mito	1h 34m 46s a.m.	Weak.	} Motion quick; accompanied by vertical movements; houses shaken.
Matsuyama	1. 31. 30	Slight.	
Matsumoto	1. 32. 18	„	
Miyako	1. 34. 9	„	
Maebashi	1. 35. 1	„	Motion gentle.
Tokyo	1. 35. 5	„	
Yokohama	1. 35. 11	„	
Fukushima	1. 35. 14	„	} Motion quick; doors shaken.
Kumagae	1. 35. 18	„	
Utsunomiya	1. 35. 38	„	„
Choshi	1. 40. 26	„	

The P.T. lasted for 17s. In the NS component the amplitude remained nearly uniform. But in the EW component there was an abrupt increase of amplitude at 8s from the commencement.

The P.P., whose duration was 45s, consisted of small quick vibrations; the max. 2a being 0,18 mm in the EW and 0,14 mm in the NS component.

The E.P. At first the motion consisted of vibrations of an average period of 2,8s, superposed on traces of slower ones. Towards the end the vibrations were regular and had an average period of 5,0s.

Eqke No. 178. August 5th 1899; 9h 18m 53s a.m.

Total duration = 8m.

Observations at Meteorological Observatories:—

Mito.. .. .	9h 18m 43s a.m.	Weak.	} Motion quick; accompanied by vertical movements; houses shaken.
Utsunomiya .. .	9. 19. 0	„	
Ishinomaki .. .	9. 12. 40 (?)	Slight.	Motion quick.
Choshi	9. 18. 26	„	Motion gentle.
Fukushima .. .	9. 18. 53	„	
Kumagae	9. 19. 1	„	
Tokyo	9. 19. 19	„	

The P.T., whose duration was 26s, consisted of small quick vibrations.

The P.P., whose duration was 40s, began with the max. 2a of 0,1 mm in the EW and 0,05 mm in the NS component. The period was very short.

The E.P. The average period was 3,3s, there being also traces of still quicker vibrations.

P.O. The max. 2a was very short. The average period was 6,6s.

Eqke No. 183. August 13th 1899; 8h 0m 2s p.m.

Total duration = 4m.

Observations at Meteorological Observatories :—

Tokyo	8h 0m 16s p.m.	Slight.	
Mito	8. 0. 56	Weak.	} Motion quick; houses shaken.
Fukushima	8. 1. 36	Slight.	

(NS component).

The P.T. lasted for 15s.

The P.P. began with a well defined motion towards S; the counter displacement (max.) being 0,07 mm, directed towards N.

The EW component diagram was obscured by the superposition of lines.

Eqke No. 204. September 27th 1899; 1h 57m 39s a.m.

Total duration = 4m 30s.

Observations at Meteorological Observatories :—

Utsunomiya	1h 57m 20s a.m.	Weak.	Motion gentle.
Mito	1. 57. 35	„	} Motion quick; accompanied by vertical movements; houses shaken.
Choshi	1. 57. 43	Slight.	
Ishinomaki	1. 57. 59	„	

The P.T. lasted for 7s.

The P.P., whose duration was 20s, consisted of quick vibrations. The max. 2a was 0,15 mm in the EW and 0,08 mm in the NS component.

Eqke No. 209. October 3rd 1899; 6h 28m 3s p.m.

Total duration = about 6m.

Observations at Meteorological Observatories :—

Fukushima	6h 27m 19s p.m.	Slight.	Houses shaken.
Mito	6. 27. 38	„	Doors shaken.
Tokyo	6. 28. 19	„	
Utsunomiya	6. 28. 30	„	Motion gentle.

The P.T. lasted for about 6s.

The P.P. consisted of very small quick vibrations. The max. 2a was 0,04 mm in the EW and 0,03 mm in the NS component and occurred towards the end of this epoch.

The E.P. The average period was about 3,3s.

Eqke No. 215. October 10th 1899; 6h 47m 26s p.m.

Total duration=3m.

Observations at Meteorological Observatories :—

Mito	6h 47m 17s p.m.	Weak.	Duration long.
Utsunomiya	6. 47. 23	„	Motion quick.
Tokyo	6. 47. 43	Slight	
Kumagae	6. 47. 49	„	Motion quick.
Fukushima	6. 51. 18	„	Houses shaken.

The P.T., whose duration was 23s, consisted of very small quick vibrations.

The P.P., whose duration was 25s, began with a motion directed towards NE; the counter displacement (max.) being 0,12 mm towards W and 0,14 mm towards S. The average period of the most active vibrations was about 6,5s, there being also traces of small quicker ones. In the EW component the amplitude remained nearly constant. But in the NS component, there were three distinct maximum groups of vibrations with nearly an equal range of motion, of which the two last began respectively at 4,7s and 7,3s after the first.

The E.P. The average period was 1,9s.

Eqke No. 242. December 20th 1899; 10h 46m 29s a.m.

Total duration=13m.

Observations at Meteorological Observatories :—

Mito	10h 46m 45s a.m.	Weak.	{ Accompanied by vertical motion; houses shaken.
Yokohama	..	10. 48. 6	„	Motion quick.
Ishinomaki	..	10. 46. 5	Slight.	
Kumagae	..	10. 47. 15	„	
Kofu	10. 47. 37	„	Motion gentle.
Tokyo	10. 47. 52	„	Motion quick.
Maebashi	..	10. 49. 1	„	
Fukushima	..	10. 42. 25	„	Houses shaken.
Miyako	..	10. 48. 27	„	
Akita	10. 57. 45	„	

The P.T., whose duration was 24s, consisted of small quick vibrations.

The P.P. began with two small vibrations. The 3rd vibration was the maximum (abs.), its 2a being 0,17 mm in the EW and 0,44 mm in the NS component. The motion was quick-perioded during the first 1m 35s, the average period being 1,5s.

The E.P. Towards the end the average period was 4,1s.

Eqke No. 246. December 31st 1899; 9h 40m 17s a.m.

Total duration = 3½m.

Observations at Meteorological Observatories :—

Maebashi	9h 40m 4s a.m.	Slight.	
Utsunomiya	..	9. 40. 6	„	
Kofu	9. 40. 28	„	Motion gentle.
Ishinomaki	..	9. 41. 28	„	Duration short.
Iida	9. 46. 20	„	„ „
Fukushima	..	9. 50. 14	„	Motion gentle.

The duration of the P.T. was uncertain, on account of the existence of P.O.

(NS component).

The P.P. began with the max. 2a of 0,3 mm.

The EW component diagram was lost, as the earthquake took place during the change of the record-receiver.

P.O. The P.O., whose max. $2a$ was 0,2 mm in each component, was active on the 30th, but lessened very much before the occurrence of the earthquake. The average period was 5,0s.