

12. *A Note on the Results of the Repeated Precise
Levellings across the Itô Earthquake Area.*

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(Read March 17, 1931.—Received March 20, 1931.)

Since February of 1930, an abnormally abundant number of weak earthquakes have taken place in a region near Itô on the east coast of the Idu Peninsula. This seismic activity lasted till the end of May of the same year. There were irregular fluctuations in the daily numbers of the earthquakes during this period. Generally speaking, however, there were two conspicuous maxima in them, the one in the middle of March and the other in the middle of May. The Itô earthquakes which were recorded during this period by a seismograph at Misaki, some 50 km. ENE of Ito, were no less than 6,000 in number. This rather unusual seismic activity seemed to have quited down until the middle of November of the same year when there happened to occur another earthquake swarm. According to the seismometric observations by N. Nasu of our Institute, most of these earthquakes originated from a region some 10 km. N of Itô and it would seem that this seismic activity was an apparently independent one from that of the former Itô earthquake swarms. On Nov. 26th, 1930, on the other hand, a destructive earthquake occurred in the northern part of the Idu Peninsula. The causal relations between these three seismic activities are not yet clear.

With the hope of obtaining, if possible, some information regarding the change of land levels connected with these seismic activities, precise levellings have been carried out three times in 1930 along the eastern coast of the peninsula across the Itô seismic area by the Land Survey Department of the Imperial Army. The levelling route measured was from B. M. 9328 to B. M. 9344 and is shown in Fig. 1. The results of

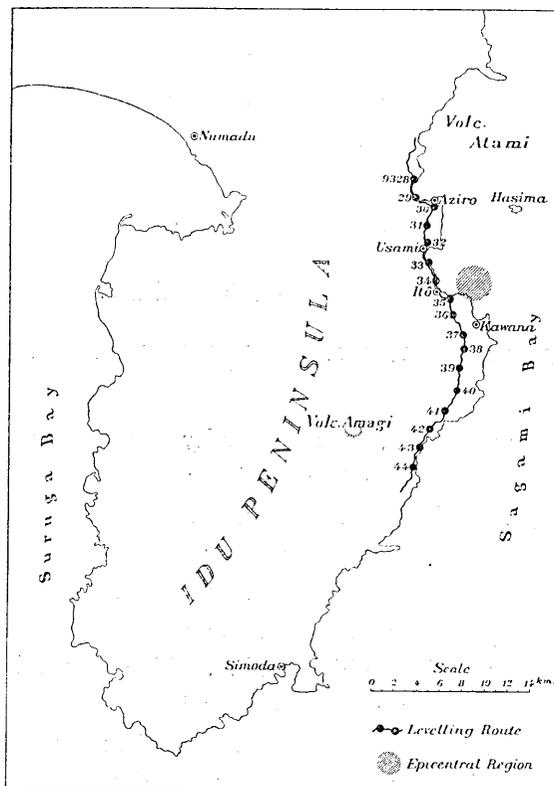


Fig. 1.

these measurements, when combined with former levellings of 1903 and 1923, indicate the mode of successive changes of land levels in the region now in question. These five measurements will be referred to as I, II, III, IV and V in chronological order. The time of the respective measurements are as follows :

I	1903	
II	1923	← Kwantô Earthquake
III	1930 April	Itô Earthquake Swarms
IV	1930 November	
V	1930 December	← Idu Earthquake

The changes of heights of bench marks between successive two surveys are shown in Table I. These values have already been published elsewhere.¹⁾

Table I.

B. M.	II-I	III-II	IV-III	VI-V
9328	assumed to be stationary	—	—	—
9329	mm. — 23.6	mm. — 3.6	mm. + 6.3	mm. — 21.6
9330	+ 97.6	— 4.9	+ 5.6	+ 9.1
9331	+ 67.1	— 10.5	+ 21.5	+ 17.4
9332	+ 61.6	+ 1.7	+ 35.6	+ 26.9
9333	+ 41.1	+ 10.6	+ 59.4	+ 27.2
9334	—	+ 33.9	+ 81.0	+ 25.0
9335	+ 2.8	+ 72.6	+ 102.3	+ 13.6
9336	0	+ 93.8	+ 118.1	+ 6.8
9337	— 19.5	+ 96.9	+ 122.1	+ 4.3
9338	— 34.4	+ 74.8	+ 88.1	— 2.5
9339	— 59.8	+ 47.5	+ 56.1	— 0.7
9340	— 53.5	+ 21.5	+ 31.8	— 4.5
9341	— 48.2	+ 5.7	+ 6.0	— 8.0
9342	— 42.2	— 7.3	— 11.5	— 8.0
9343	— 31.1	— 11.8	— 17.8	— 10.1
9344	— 24.7	— 26.5	— 21.4	— 14.5

1) *Bull. Earthq. Res. Inst.*, 8 (1930), 375.EARTHQUAKE RESEARCH INSTITUTE, *Proc. Imp. Acad.*, 6 (1930), 399.

The successive changes of heights of the bench marks are graphically shown in Fig. 2. The remarkable upheaval of B.M. 9337 between

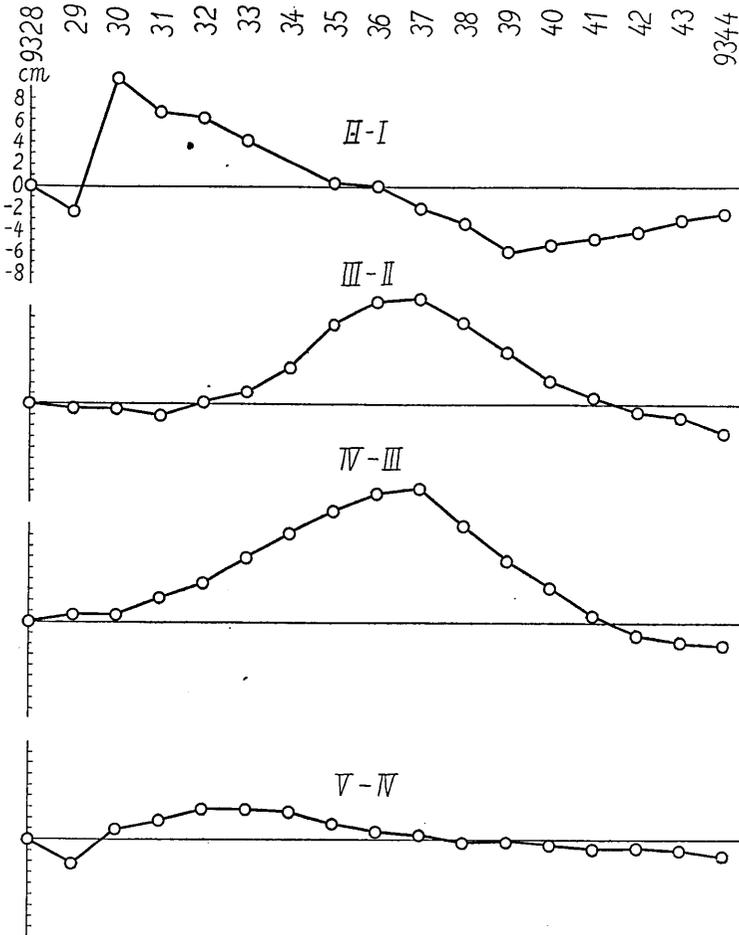


Fig. 2.

II and III, III and IV is at once apparent, and this is no doubt connected with the occurrence of the Itô earthquake swarms. The curves III-II and IV-III are remarkably similar in their forms and thus it is clear that a movement of the same mode was taking place in this district during these two periods. But if we compare the two curves in some detail, there is found a little difference between them. The

chief difference is one in the curvatures of the curves in the northern part of the curves. It is concave upward in the curve III-II while it is convex upward in the curve IV-III. How these two curves are similar in one part and is not similar in the other is to be seen in Fig. 3 in which

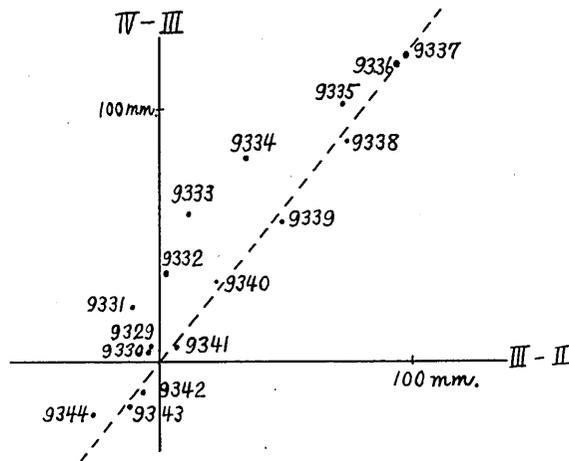


Fig. 3.

the vertical displacements of the bench marks in the period III-II are taken in abscissa and those in the period IV-III in ordinate. If the curves are exactly similar in their forms, the points in the figure should have to lie on one straight line passing the origin of the axes. In our case, we have points 9335, 9334, 9333, 9332, 9331, 9330, 9329 which do not lie on this straight line. These points correspond to the vertical movements of the bench marks on the northern part of the levelling route. On the other hand, in the southern part of the route, the similarity of the two curves is almost exact. The maximum elevations in these curves are 96.9 mm and 122.1 mm respectively, the ratio between them being approximately 0.8. For the purpose of making distinct the difference of the two curves, the values in curve III-II were divided by 0.8 and subtracted from the corresponding values of curve IV-III.

Table II.

IV-III	(III-II) ÷ 0.8	Dif.
mm 0.0	mm 0.0	mm 0.0
+ 6.3	- 4.5	+ 10.8
+ 5.6	- 6.1	+ 11.7
+ 21.6	- 13.1	+ 34.7
+ 35.6	+ 2.1	+ 33.5
+ 59.4	+ 13.2	+ 46.2
+ 81.0	+ 42.4	+ 38.6
+ 102.3	+ 90.8	+ 11.5
+ 118.1	+ 117.2	+ 0.9
+ 122.1	+ 121.0	+ 1.1
+ 88.1	+ 93.6	- 5.5
+ 56.1	+ 59.4	- 3.3
+ 31.8	+ 26.9	+ 4.9
+ 6.0	+ 7.1	- 1.1
- 11.5	- 9.1	- 2.4
- 17.8	- 14.8	- 3.0
- 21.4	- 33.1	+ 11.7

The curve Dif. in Fig. 4 was obtained in this way.

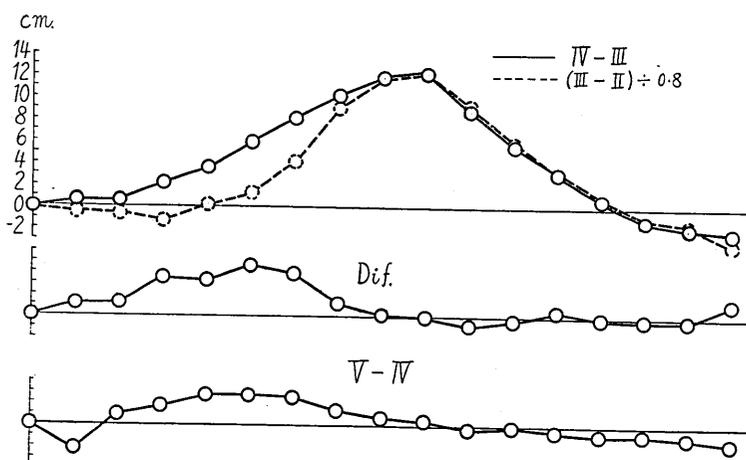


Fig. 4.

The difference is largest at the B. M. 9333. When the curve of difference is compared with the curve V-IV, the similarity in their forms is at once apparent. From these facts, it is naturally concluded that in the interval of the levelling III and IV, two different kinds of level changes took place simultaneously, the one similar to that between III and II and the other similar to that between IV-V. The successive upheavals of the B. M. 9337 and 9333 are thus shown in the following table.

Table III.

	B. M. 9337		B. M. 9333	
	mm	inte- grated		
II	96.9	96.9	—	—
III	122.1	219.0	46.2	46.2
IV	4.3	223.3	27.2	73.4
V				

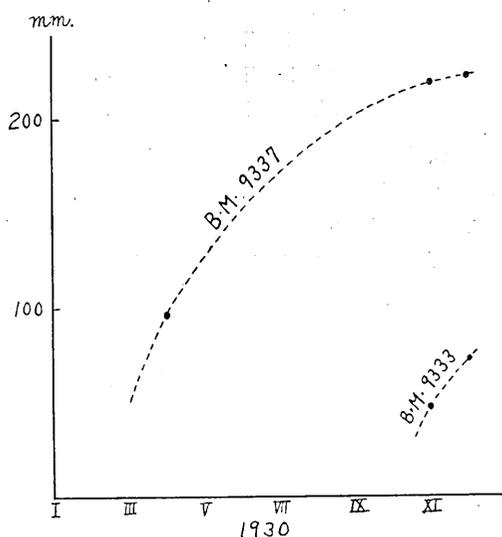


Fig. 5.

These changes in the rate of upheaval of these bench marks are in good accordance with the variation of the recent seismic activities. As was described before, the Itô earthquake swarms began to display their activities from February of 1930 and they seemed to have become apparently dormant at the end of May. On the other hand, another swarm of earthquakes occurred N of Itô in November of 1930. The different location of the seismic active centres and the rate of the upheaval of the respective bench marks seem to be in a close correlation with each other.

In conclusion, the writer wishes to express his sincere thanks to Professor T. TERADA for his interests in this work.

12. 伊東地方の水準測量の結果に就いて

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伊豆半島の東海岸に沿つて行はれた水準測量は、既に五回にも達したが、此の小論文は夫等の結果に就いて二三の考察を加へたものである。今

1903年	に行はれたもの	I
1923年	ク	II
1930年	四月ク	III
1930年	十一月ク	IV
1930年	十二月ク	V

とすると、(III-II)と(IV-III)とが形がよく似て居る。それで(III-II)に適當な常数を乗じて(IV-III)と極大値を揃へて、其の差を見ると、之が又(V-IV)と形が大變よく似る。それでIIIとIVとの間には二つの型の違つた地殻變動が同時に行はれ居たと看做し得る。之等の事實は伊東地方に發生して居た群生地震の勢力の消長と、よく調和する様に見える。