Preliminary Note on the Formosa Earthquake of March 17, 1906.

By

F. Omori, Sc. D.,

Member of the Imperial Earthquake Investigation Committee.

1. ***Introduction.*** The Island of Formosa is preëminently an earthquake country and has been visited within the last 2 years between April 1904 and April 1906, by no less than 4 destructive shocks. From the time of Teiseikō, a Chinese general who occupied the island in the middle of the 17th century at the downfall of the Min dynasty, there were, up to 1906, eighteen severe earthquakes, as follows.

NO.	DATE.	LOCALITY.	REMARKS.
1	Jan. 21, 1655.	Tainan.	
2	———, 1660.	,,	
3	Nov. 1, 1720.	,,	
4	Jan. 5, 1721.	,, ...	Many people killed; mud and water ejected. Shocks continued for more than 10 days.
5	Jan. 27, 1736.	Tainan, Kagi, Shōka ...	Many people killed. The weather was fine.
6	Dec. —, 1776.	Kagi.....	Great many people killed.
7	July 20, 1792.	Kagi.....	Fires broke out after the earthquake, more than 100 people killed.
8	July —, 1815.	Giran.	
	Oct. —, 1815.	Tansui.	
10	———, 1816.	Giran	Houses destroyed. The ground was cracked, and in some places convulsed.
11	Nov. —, 1840.	Toroku.....	Houses destroyed. Landslips took place.

NO.	DATE.	LOCALITY.	REMARKS.
12	June 6, 1862.	Tainan, Kagi, Shōka...	This was a very great earthquake, and in Kagi more than 1000 persons were killed. The mount Daisen was much cracked.
13	Dec. 18, 1867.	Keelung	Great destruction in the harbour of Keelung, where several hundreds of people were drowned by the sea waves. Enormous landslips took place.
14	June 7, 1901.	Giran.	
15	April 24, 1904.	Toroku to Banshoryō...	3 persons killed, 13 wounded.
16	Nov. 6, 1904.	Toroku, Kagi, Ensuikō.	145 „ „ , 148 „ .
17	March 17, 1906.	Kagi, Toroku.....	1266 „ „ , 2476 „ .
18	April 14, 1906.	Kagi, Ensuikō.....	15 „ „ , 87 „ .

Of the 18 earthquakes given in the above table, 13 originated in the south-western part of the island, namely, in the Prefectures of Toroku, Kagi, Ensuikō, and Tainan. The 5 other earthquakes shook the north-eastern part of the island, their origins being submarine.

In the *Reports* (Japanese) *of the Imperial Earthquake Investigation Committee*, No. 54, the present author, who visited Formosa in Nov. 1904, has given a full account of the two destructive earthquakes of that year, together with the results of the seismographical measurements made at the different observatories in the island.

EARTHQUAKE OF MARCH 17, 1906.

2. *Damage.* The earthquake of March 17, 1906, at $6^h\ 42^m\ 30^s$ A.M.,* was the severest which shook Formosa in recent times, being even more destructive than the well-known great shock of June 6, 1862. The numbers of the houses damaged and the casualties were as follows :—

* Given in 2nd Normal Japan Time, or that of longitude 120° E of Greenwich.

Number of dwelling houses totally destroyed	7,284
,, ,, ,, ,, partially ,, ...	30,021
,, ,, persons killed	1,266
,, ,, ,, wounded	2,476

As far as the loss of life is concerned, this earthquake was, among the recent Japan shocks, only second to the great Mino-Owari catastrophe of 1891.

Immediately after the earthquake of March 17, 1906, I proceeded again to Formosa and was able, amongst other things, to compare the seismic effects on this occasion with those in Nov. 1904. One specially interesting feature in this earthquake was the formation of remarkable faults, which are described in § 4.

The heavy amount of the casualties was, in a great measure, due to the weakness of the native dwelling houses, which mostly have no capacity of resisting earthquake shocks, being built of *dokaku*, or sun-dried mud blocks of dimensions $22 \times 33 \times 9\frac{1}{2}$ cm., loosely cemented with a mortar of mud, at best mixed with a small quantity of lime. The consequence of such a bad method of construction, joined to the heaviness of the roof, is that the native houses are, at the occurrence of a violent shock, at once shattered to pieces, leaving little time for the people to escape. The easiness with which the *dokaku* houses are overthrown may be seen from the fact that the town of Dabyō was almost entirely levelled to the ground with the exception of the Sub-Prefectural Office, a brick one-story building with a two-story tower, which suffered no severe damage except some cracks in walls and the falling down of part of the roof tiles. Framed timber structures resist earthquake shocks infinitely better than the *dokaku* houses, but they are generally exposed, when old, to a great danger from the ravages of white ants, which literally eat up the wood.

Fig. 9 shows the ruined condition of a native temple, Masobyō, in the town of Shinkō, the destruction of the building being very complete. Fig. 8 gives a view after the earthquake of the Sub-Prefectural Office in the same town, a wooden structure with plastered walls, which was very severely damaged, due mainly to the vibration of the front tower, but was not overthrown to the ground.

3. *Isoseismals.* The earthquake was felt all over the Island, the three isoseismal lines in Fig. 1 (Pl. XVI) giving approximate boundaries of the areas defined as follows :—

(1) *Area of violent motion*, in which the damage was considerable.

(2) *Area of severe motion*, in which occurred more or less such damage as landslips, cracks of the ground, partial or total destruction of a few buildings, etc.

(3) *Area of moderate motion*, in which the shock was moderately strong, so that some furnitures were overthrown, pendulum clocks were stopped, etc.

Different from usual cases of seismic disturbances in Formosa the longer axes of the isoseismal areas, especially, Nos. 1 and 2, are not parallel to the length of the Island, evidently due to the fact that the fault and the epifocal zone was oblique to the latter.

The area (1) of violent motion was about 50^{km} in length, from the vicinity of the town of Baishikō on the east to the city of Shinkō on the west, and about 30^{km} in width from the vicinity of the city of Kagi on the south to that of the village of Tarimu on the north. From the limited extension of the area of the severe motion, it may be inferred at once that the earthquake centre was not deep below the surface, as was in fact indicated by the formation of the faults.

4. *Faults.* (See Pl. XVII.) The main fault line is most

markedly shown at its eastern end, where it crosses the road leading from the town of Taihorin to Baishikō, at about 1^{km} from the latter town. The fault runs here in the direction of N 75° E and S 75° W, the south side being depressed 6 feet and relatively sheared 6 feet westwards. Fig. 5 gives a general view of the fault, the left-hand (south) side being depressed in such a way that it curves down toward the plane of discontinuity. Fig. 4 shows how the road was cut off and displaced at its intersection with the fault. The small village of Bishō, under which the fault passed, was completely destroyed. The western continuation of the fault passes across a hill spur and appears again to the south of the village of Kaigenkō, at about 1^{km} from Bishō. The fault then runs in a mean direction of N 75° E to S 75° W and crosses the river Sanjōkei, at 5^{km} from Kaigenkō and about 1^{km} to the SW of the village of Maenryō, producing a 4 feet dislocation of the river bed. Then it becomes nearly SW in direction and passes between the villages of Tensanshikiaku and Kasanshikiaku, meeting finally to the south of the latter the branch fault of Chinsekiryō. This second fault starts at about half a kilometre to the west of the village last named, on the top of a gently sloping hill of hard clay, and manifested itself first as a remarkable deep crack of 2 feet width, the depth ascertained with a bamboo stick being 11 feet. (See Fig. 6.) This fault is nearly in the E W direction and its western continuation passes through cultivated grounds, cutting at right angles a series of potato field ridges, which latter suffered a relative horizontal displacement amounting to the interval between two successive ridges, so that each of the latter became, after the earthquake, contiguous to its former neighbour. The fault then runs through the puddy fields, to the north of the village of Tōseiko, finally reaching the city of Dabyō, beyond which the disturbance

of the ground ceases to be apparent. The railroad, which runs in an N–S direction was much damaged between Dabyō and Kagi, especially at its intersection with the fault, 8 rails being considerably bent and a number of rail joints torn apart. The length of the main, or Baishikō, fault is about 11^{km}, while that of the branch, or Chinsekiryō, fault is a little over 4^{km}, the whole length between the Dabyō and Baishiko ends being $13\frac{1}{2}^{km}$.

As stated before, at the eastern extremity of the main fault the south-side was depressed and sheared westwards. But, along the whole rest of the fault the relation was reversed, and the depression was invariably on the north (or NNW) side, the shear being always eastwards. The maximum amount of the eastward shear was 8 feet and occurred at the village of Kaigenkō ; while the maximum northward depression of 4 feet occurred at the last named place, and also at and near the crossing of the fault with the Sanjōkei river. Along the Chinsekiryō fault, the depression was also always on the north side, and the shear, whose maximum amount was 5 feet, was eastwards. In this case, the vertical dislocation was slight and less than 1 foot, being often indicated only by a gradual depression which caused the waters in the puddy fields to be collected on one side of the line of disturbance, leaving the other side dry.

To the west of Dabyō there was no surface manifestation of tectonic disturbances. But it seems probable that there exists an underground continuation of the fault for about 12^{km} in the direction of west slightly south, as far as the vicinity of the city of Shinkō. Along the zone about this imaginary fault, which is marked in Pl. XVIII by a dotted line, there was an ejection of large quantity of sand and water. Especially, in the vicinity of the villages of Tanshiken and Saikōseki, the ejected sand reached a thickness of

more than two feet and covered wide areas sometimes half a kilometre or more in width. (See Fig. 7.) The enormity of water ejection in these places may be judged from the fact that the police authorities, who tried to rescue people from under the ruined houses, were in some instances prevented from immediately approaching the latter, owing to the large quantity of mud water which flooded the surrounding grounds. The total length of the fault between Baishikō on the east and Tanshiken on the west is $25\frac{1}{2}^{km}$.

5. *Relation to the Faults of the Direction of (Vibratory) Motion.* Fig. 3 (Pl. XVIII.) indicates the general course of the faults, the directions of the (vibratory) motion at the different places, and the boundary of the area of the severest shock. This latter area is slightly different from that bounded by the line (1) in Fig. 1, and includes those towns and villages, in each of which more than 50 dwelling houses were completely destroyed or more than 15 persons were killed.

The directions of motion at the different places in this meizoseismal area determined from overthrown bodies, were as follows :—

Kagi	Toward	ESE.
Shinkō	,,	ENE.
Suigiuseki	,,	SE.
Seiho	,,	E.
Dabyō	,,	E slightly S.
Baishiko	,,	SSE.

Thus it will be seen that the earthquake motion in the meizoseismal area was not perpendicular to the fault zone, but was, on the whole, directed from the western to the eastern end of the latter, in the same sense as the shear of the depressed side,

with the exception of the eastern extremity of the main fault. This seems to indicate that the tectonic disturbances were the result of the existence in this part of the earth's crust of a pressure or shearing forces in a driection nearly transverse to the longer axis of the island of Formosa, which finally produced the faults, such that the first shock or sudden movement of the ground was westwards, and the counter or greatest one eastwards. Probably both sides of the fault zone were displaced eastwards, the shear of the depressed side being the differential amount due to the greater eastward displacement of the latter.

The disturbances of the ground along the two faults above described were similar to those observed in other cases, the depression and the horizontal shear being generally combined. There were also the usual *secondary shear cracks*,* whose inclination to the course of the dislocation zone was on the average about 43°. At some places along the main fault there were marked forcing up of the ground, due to the coexistence of compression. On the other hand, the wide crack which appeared near Chinsekiryō, was the result of a tension or a tendency to tear ashunder the two sides of the fault plane.

6. *Probable Eastward Extension of the Fault.* The boundary of the meizoseismal area given in Pl. XVIII. is evidently not complete and represents only the western half, the eastern half including mountainous regions inhabited by the savages, whence we could get no earthquake reports. Thus it is extremely likely that the main fault did not end at the vicinity of Baishikō, but was continued eastwards amoung the mountains for a further distance of 20 or 25^{km}. This supposition consistently explains why the

* See the *Bulletin*, No. 1, p. 13.

depression and shear phenomena at the eastern end of the Dabyo-Baishiko fault zone were opposite to those along the rest of the latter. The fact was probably as follows :—the fault had an extension of about 50^{km} and its most central point was between Bishō and Kaigenkō, the amount of the disturbances being greatest near these two places ; further, along the western half of the zone in question the ground on the north side was depressed and sheared eastwards, while along the eastern half the ground on the south side was depressed and sheared westwards. (See the next Article.)

The most central point of the epifocal zone as sssumed above may probably be taken to be between the villages of Bishō and Kaigenko, say, at

$$\begin{cases} \textit{Longitude}, & 120^\circ\ 32'\ \text{E.} \\ \textit{Latitude}, & 23^\circ\ 35'\ \text{N.} \end{cases}$$

7. *Duration of the Preliminary Tremor.* The approximate position of the centre of the earthquake may also be inferred from the duration (y) of the preliminary tremor recorded by Omori Horizontal Pendulums at the different meteorological observatories in Formosa. The epicentral distance (x) in the following table have been calculated by the formula*

$$x^{km} = 7.27\ y^{sec} + 38^{km}.$$

Earthquake of March 17, 1906.

Place.	Duration of Prel. Tremor $=y$.	Epicentral Distance $=x$.
Taihoku	27.5 *sec.*	238 *km*
Taichu	9.0	104
Tainan	8.7	101
Hokoto	11.5	122

* The *Publications*, No 13.

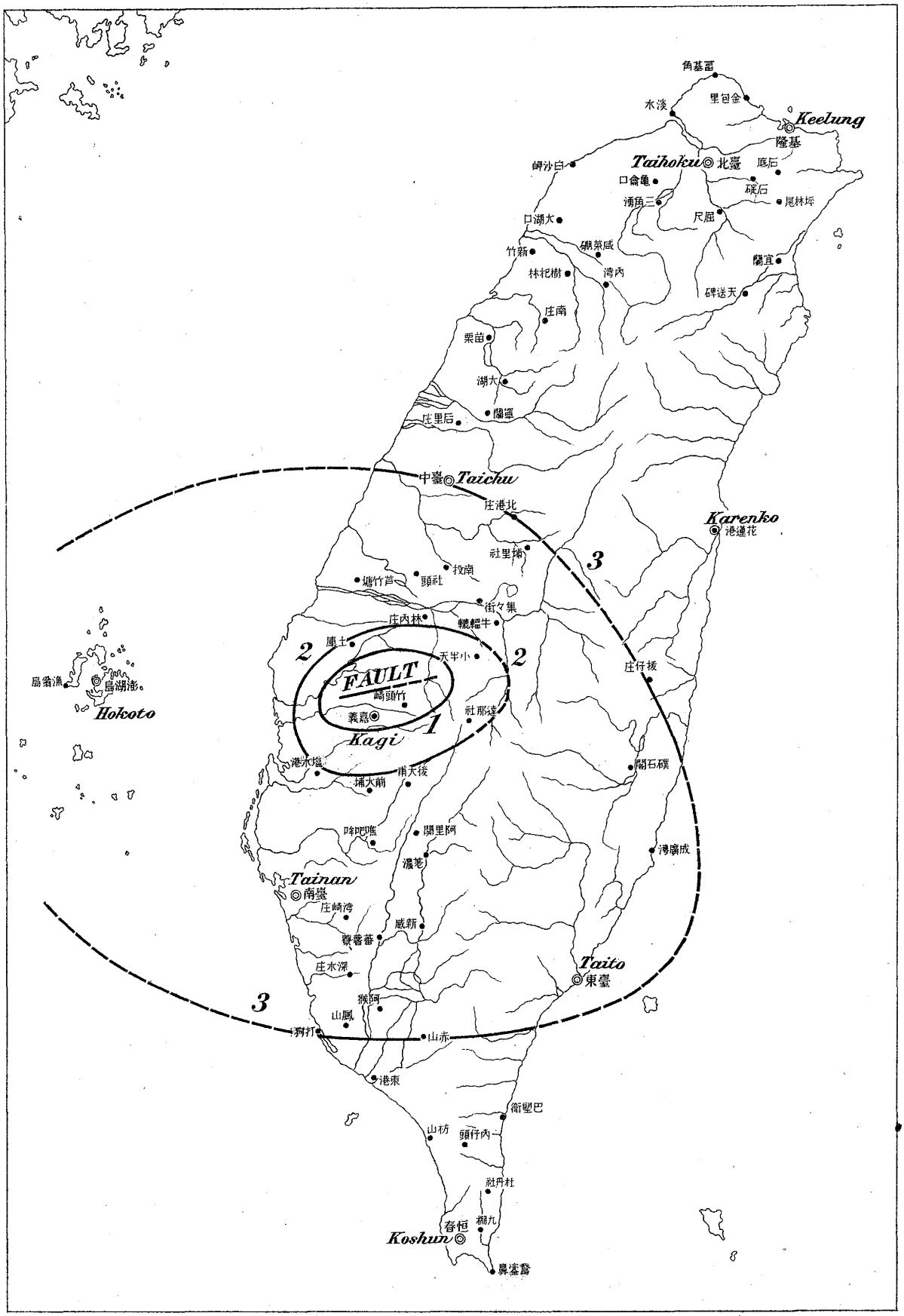
The circles drawn upon a map of Formosa about these four places with radii respectively equivalent to the calculated values of the epicentral distances enclose an area, whose centre roughly coincides with the region midway between the cities of Dabyō and Baishiko.

8. *The Two Severe Earthquakes in* 1904. The earthquake on the early morning of Nov. 6, 1904, at 4h 25m, caused a large amount of damage in the three prefectures of Toroku, Kagi, and Ensuiko, the casualties and the number of houses damaged being as follows.

Prefecture.	Casualties.		Number of Houses damaged.		
	Killed.	Wounded.	Totally destroyed.	Greatly damaged.	Slightly damaged.
Kagi	133	132	425	1021	1453
Toroku	10	16	62	60	517
Ensuiko	2	0	3	4	5
Sum	145	148	490	1085	1975

Thus the number of the killed was nearly equal to that of the wounded, which is much different from what is usually the case in which the number of the wounded much exceeds that of the killed. According to the above table, 1 person was killed for every 3.4 houses totally destroyed. This ratio is much smaller than what takes place in Japan proper: thus, for instance, in the great Mino-Owari earthquake of 1891, there was 1 person killed for every 11 houses totally destroyed. These peculialities in the Formosa earthquake are evidently due to the bad construction of the native houses in the island, as remarked in § 2. As can easily be demonstrated, a very bad material of construction, which possesses no tensile strength, has a very serious defect, namely, it causes

Fig. 1. Map Showing the Isoseismal Lines of the Earthquake of March 17, 1906.



◎..... Meteorological observatory.

●..... Station for Precipitation observation.

Fig. 2. Map. Showing the Actual Trace of the Baishikō and Chinsekiryō Faults.

(Towns, villages, rivers, and railroads only are shown.)

The red shade is the depressed side, the arrow indicating the direction of shear of the latter.
The figure in the shade gives the amount of depression, while that at the point of the arrow indicates the extent of shear.
The eastern continuation of the main Fault is lost among the mountains.

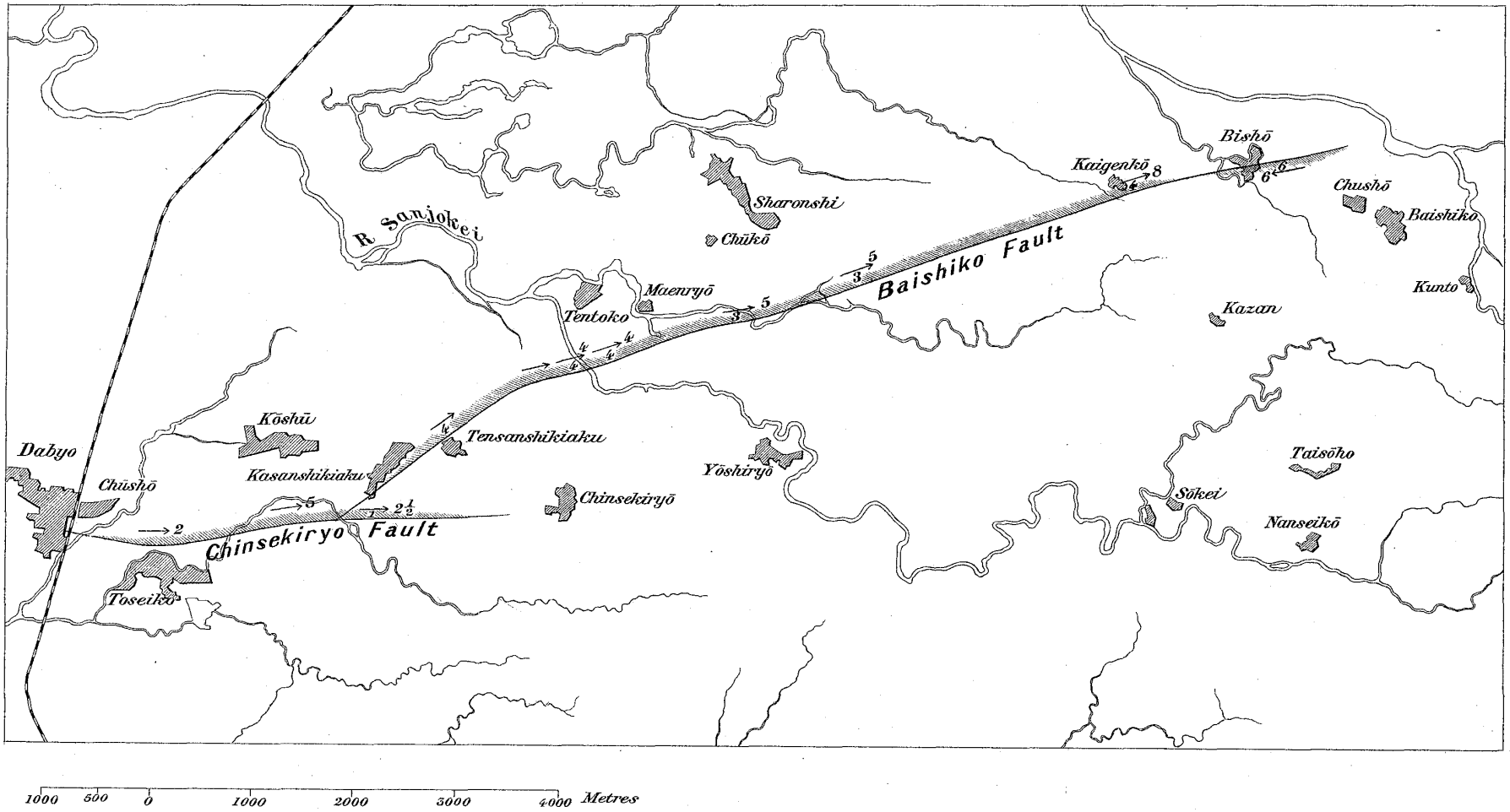
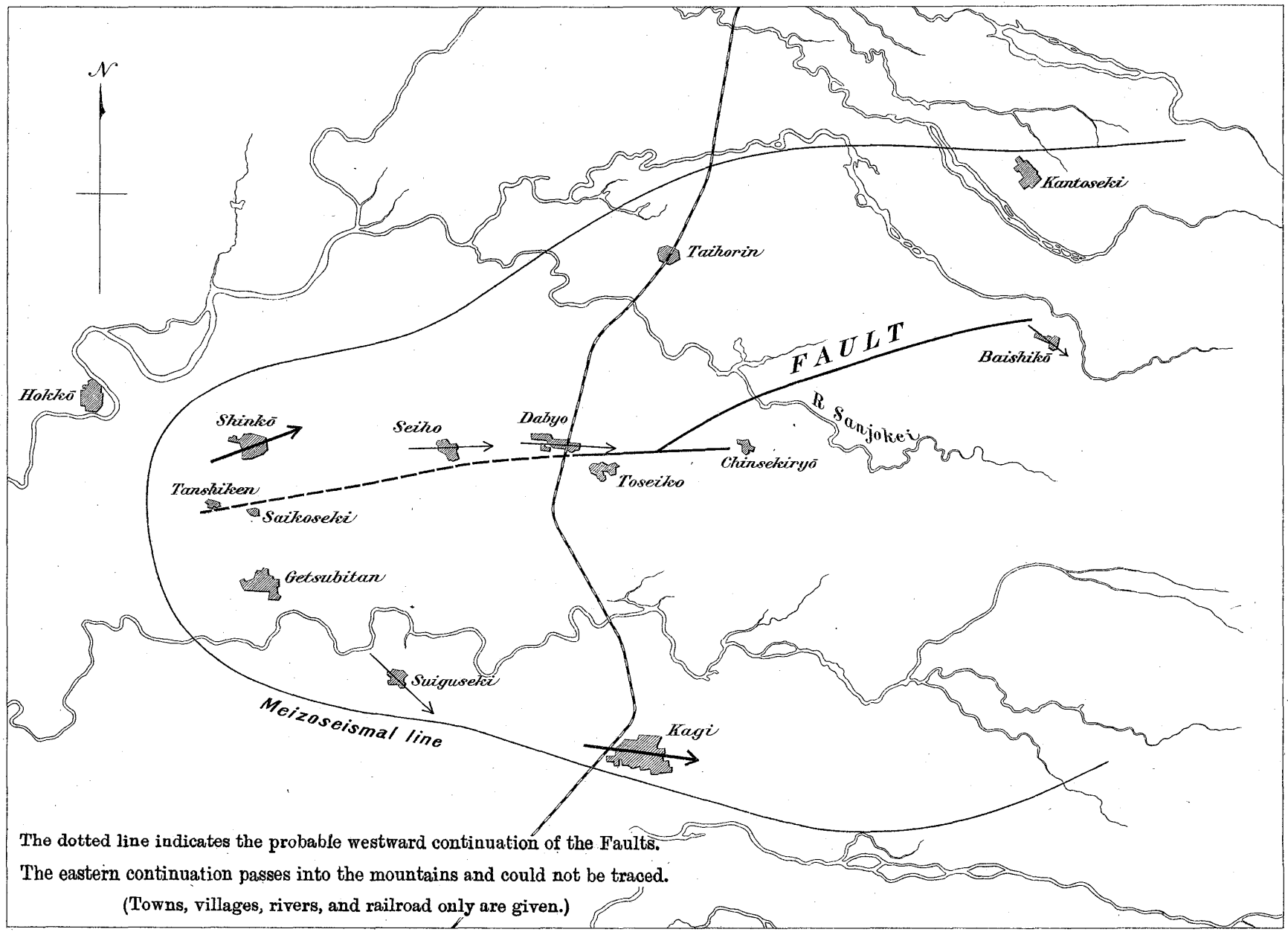


Fig. 3. Map Showing the Meizoseismal Line, the General Course of the Faults, and the Directions of Motion at the Different Places.



The dotted line indicates the probable westward continuation of the Faults.
The eastern continuation passes into the mountains and could not be traced.
(Towns, villages, rivers, and railroad only are given.)

The Baishikō Fault.

Fig. 4. Shear of the Taihorin-Baishikō Road; the foreground (southern side) sunk 6 feet and was displaced 6 feet westwards. (×) Mark the former continuation of the road.

Fig. 5. General view of the Fault from south-east. The left-hand (southern) side was depressed 6 feet, sloping down towards the fault line.

Fig. 6. Chinsekiryo Fault: a wide crack formed on a flat hill-top ground, the depth being more than 11 feet. A 2 ft. scale placed across the opening shows the width.

Fig. 7. Great Sand Eruption, near the village of Saikoseki. The cultivated fields were covered with sand to a depth of 2 feet.

Fig. 8. The New Sub-Prefectural Office Shinko, showing the effects of vibration of the front tower. The building was of wood, with plastered walls.

Fig. 9. The native Maso Temple, in the city of Shinko. The building was completely destroyed owing to bad masonry and weakness of wooden timbers on account of ravages of white ants.

the seismic stability of the wall to be nearly independent of the thickness; very thick walls of the Formosan *dokaku*, therefore, being thrown down by earthquake shocks quite as easily as thin ones. Had the same earthquake taken place in small towns of Japan proper the casualties would have been very slight. The intensity of motion in the most strongly shaken area was nearly half of that at Gifu or Ōgaki on the occasion of the Mino-Owari earthquake.

In Formosa there are also a large number of houses or cottages, built of bamboo, with very light roofs. These were of course not damaged by the earthquake. Wooden buildings in ordinary Japanese style also received no particular damage, except cracking of plastered walls and the disturbances of roof tiles.

The area of destructive motion was a narrow zone, whose length and breadth were about 57 and 23^{km} respectively. This zone, whose longer axis was in a NNE-SSW direction, stretched from the vicinity of the town of Toroku on the north to the vicinity of the village of Shin-eisho in the south ; the shock having been strongest in the district between the towns of Shinko and Kagi, at the middle of the area under consideration, or at about *lat.* 23°30′ N, and *long.* 120°26′ E.

The earthquake of April 24, 1904, at 2^{h} 39^{m} P.M. which also disturbed the south-western part of Formosa, was not so violent as that of Nov. 6, but its area of disturbance was much larger, and the zone of severe motion, whose length and breadth were 123 and 32^{km} respectively, ran in a NNE-SSW direction from the vicinity of the town of Toroku on the north to the vicinity of Banshoryo and Hozan on the south.

The position of the centre of each of the two earthquakes of April 24 and Nov. 6, 1904, may also be determined from the

duration of the preliminary tremor observed at the different places, the epicentral distance being calculated by the same formula as that given in § 7.

Earthquake of April 24, 1904.

Place.	Duration of Prel. Tremor=y.	Epicentral Distance=x.
Taihoku	28.7 *sec.*	246 *km.*
Taichu	11.4	120
Taito	12.8	131
Hokoto	12.7	130

Earthquake of Nov. 6, 1904.

Place.	Duration of Prel. Tremor=y.	Epicentral Distance=x.
Taihoku	28.8 *sec.*	246 *km.*
Taichu	11.2	119
Tainan	8.3	98
Taito	15.5	150
Hokoto	9.0	103

The circles drawn, for each of the two earthquakes, about the different places with the radii equivalent to the corresponding epicentral distances enclose an area, whose centre approximately coincides with the middle of the meizoseismal zone already mentioned.

9. *Relation of the Earthquake of March* 17, 1906, *with those in* 1904.* The violent earthquake of Nov. 6, 1904, was small in area, and its epifocus had a length of only 57^{km}, nearly coinciding with the northern half of that of the earthquake of

* The times are given in that of *long.* 120° E. of Greenwich.

April 24 in the same year, whose epifocal zone had a length of 123^{km}. Thus the April earthquake was, in magnitude, 2 or 3 times greater than the November one, while the intensity of motion in the latter was very much higher than in the former, the difference in the amount of the damage and casualties being also considerable.* It is evident, therefore, that the focus of the 1st earthquake was deep, while that of the 2nd was shallow. The two seismic foci may diagrammatically be represented by the two lines

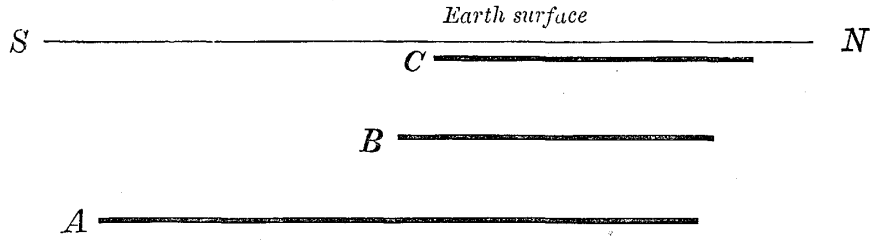


Fig. 10.

A and *B* respectively (Fig. 10). It is probable that the second earthquake was in some way connected with the first; and, as the direction of the maximum displacement at the different places was in the 2nd earthquake generally directed *toward* the epifocus, which implies an initial outward motion, the cause of these two shocks was probably the sudden formation in an N-S direction of an underground cavity, the 2nd earthquake being due to an upward extension of the latter at its northern part. Thus it was to be inferred that the earthquake of Nov. 6, 1904, was only a disturbance which marked an intermediate stage in the development of the seismic activity along the zone under consideration, leaving a possibility of the occurrence of a final destructive shock, whose origin would be quite near the surface and at the northern end of the epifocal zone of the earthquake of April 24, 1904.

* These two earthquakes are Nos. 15 and 16 given in the Table, § 1.

From these considerations, and also because such severe but local shocks as those which happened in the south-western part of Formosa, often take place successively at neighbouring places in the course of a few years, I stated at the time of my visit to Formosa in the end of 1904 that the districts about Kagi might be visited after some years by a third shock, against which, however, it would be possible to make structures earthquake-proof, provided proper cares be taken in the building.* My anticipation was, in a measure, fulfilled by the occurrence of the earthquake of March 17, 1906, although its epifocal zone was at right angles to those of the two preceding ones.

After the occurrence of the destructive shock of March 17, accompanied by the formation of remarkable faults, it was to be expected that the next severe shock, if any, would rather have its origin displaced southwards and at a greater depth such that the surface intensity would not be so very violent. I have stated this view in a Tainan daily newspaper, the "Tainan Shinpō," of April 13, 1906, and on the next day, April 14, there took place an earthquake, nearly as extensive as that of March 17, the origin however, having been displaced about 10 miles towards the south, so that the city of Kagi was now at the northern limit of the area of destructive motion. The position of the origin of the earthquake of April 14, which was accompanied by no surface fault, was approximately

$$\begin{cases} \textit{Longitude}, & 120^\circ\ 30'\ \text{E} \\ \textit{Latitude}, & 23^\circ\ 25'\ \text{N}. \end{cases}$$

10. *Periodic Repetitions of Strong After-shocks.* The violent earthquak of March 17, 1906, was followed by numerous

* F. Omori: "on the Earthquakes in Formosa." *Reports* (Japanese) *of the Imperial Earthquake Investigation Committee*, No. 54.

after-shocks, attended by the usual phenomena of sound. What was very peculiar in this case was the abnormal severity of many of these subsequent shocks, some of which, like the severe earthquake of April 14, was in reality not an after-shock at all, but rather a separate manifestation at a different place of the same seismic activity which caused the first great shock. The following table gives a list of the more prominent among the after-shocks, which occasioned more or less damage.

No.	Date. 1906.	Time of occurrence at the origin.*	Prefecture.	Number of			
				Killed.	Wounded.	Houses totally destroyed.	Houses partially destroyed.
Initial Eq.	March 17	h m s 6. 42. 30 A.M.	Toroku.	11	35	254	293
			Kagi.	1237	2338	5345	2900
			Ensuikō.	1	5	68	40
1	March 26	11. 29. 20 A.M.	Toroku.	0	4	16	17
			Kagi.	1	1	4	26
2	April 4	8. 42. 00 P.M.	Kagi.	0	0	5	—
3	April 6	2. 58. 00 A.M.	Kagi.	0	4	39	59
4	„ 7	0. 52. 40 P.M.	Ensuikō.	1	2	13	35
5	„ 8	6. 39. 40 A.M.					
			Kagi.	9	56	829	1320
			Toroku.	1	4	34	55
			Ensuikō.	3	17	659	482
6	April 14	3. 18. 00 A.M.	Tainan.	0	3	6	25
7	„ „	7. 52 00 „	Banshoryō.	2	4	4	15
			Hōzan.	0	2	2	7
			Shōka.	0	1	5	1
			Taichu.	0	0	1	1

It may here be noted that the study of the after-shocks of the Mino-Owari and other recent large Japan earthquakes has shown the existence of a series of periods in the variation of the number and intensity of these shocks, the most well-defined ones being $4\frac{1}{2}$ days, 8 or 9 days, about 12 days, and about 33 days, in length.

* Times are given in that of longitude 120° E.

Of these, the first is evidently the fundamental period, and the others are probably its multiples.* I have recently examined the variation from day to day of the atmospheric pressure for Tokyo, Gifu, and for whole Japan, and found the periods of 4.6 days, 9.0 days, and 34 days. It thus seems highly probable that the different periods in the seismic frequency above mentioned are due to the fluctuations in the barometric pressure.†

Now what is very interesting of the after-shocks of the Formosa earthquake of March 17, 1906, is the regularity with which strong shocks happened successively, the period being that of 9 days. Thus the first strong after-shock (No. 1 in the foregoing table) took place on March 26, about 9 days 5 hours after the initial violent earthquake. As this circumstance seemed to indicate the predominance of the 9-days periodicity, I predicted the possible repetitions of strong after-shocks at this interval. This was practically verified, and the next severe shock (No. 2) occurred on April 4, about 9 days 9 hours after the first (No. 1), the strong shocks Nos. 3, 4, and 5 being regarded as forming a group with No. 2. Thus the inhabitants in the city of Kagi and other places began to put great faith in the periodicity of the recurrence of seismic phenomena, such that on the night of April 13, which happened to be 9 days after April 4, the date of the shock No. 2, many people anticipated the occurrence of a strong disturbance and did not go to sleep. As a matter of fact there took place the next morning two very severe earthquakes, the time interval in this case being 9 days 7 hours.

---

* F. Omori: "The After-shocks of Earthquakes." Jour. Coll. Sc., Imp. Univ. Tokyo, Vol. VII, Part 2.

† F. Omori: "On long-periods Variations of the Atmospheric Pressure" *Reports* (Japanese). *of the Imp. Earthquake Investigation Committee, No.* 57.

The earthquake No. 7, which was the strongest among the after-shocks, apparently restored the equilibrium of the disturbed earth's crust in this part of Formosa, there being no subsequent severe shock.

Tokyo.

January 1907.