The Formosa Earthquake of April 21, 1935

WITHIN a year after its occurrence, the reports on this destructive earthquake have been issued in a special volume (Supplementary volume 3, 238 pages) of the *Bulletin of the Earthquake Research Institute*. The memoirs (eleven in number) are written in Japanese, each being followed by a summary in English. The five reports are also in Japanese, but only one of them contains an outline in a Western language. Few works on any earthquake have been so admirably illustrated, for half the volume consists of 29 maps and 119 plates, each of the latter containing reproductions of two or three photographs, with titles in English as well as in Japanese. They represent the damage to villages and buildings, the buckling of railway lines, the fissures in roads and fields, and various aspects of the remarkable earthquake faults.

The recent seismic activity of the northern half of the island is described by Prof. N. Miyabe (pp. 1–9), who notes that, since the beginning of 1934, the frequency of minor shocks felt at Ari-san (near the centre of the island) showed a continual increase up to the time of the great earthquake at 7.2 a.m. on April 21 (April 20, 10.2 p.m., G.M.T.). From seismographic records, the epicentre was found to be in lat. 24° 20′ N., long. 120° 38′ E., and the depth of its focus about 10 km. below the land-surface. The earthquake was very destructive to life and property; 3,279 persons were killed and 54,792 houses destroyed. In seven villages in the Taityu district, more than 70 per cent of the houses were ruined, but, as several of the authors notice, this was mainly due to their poor construction, the walls being formed of *dokaku* or blocks of hardened clay and straw, and very much weaker than those of the wooden houses in Japan. Mr. R. Takahasi (pp. 120–140) notes that the greatest intensity of the earthquake was reached in two regions that coincide with the north and south branches of the earthquake faults.

According to Mr. Y. Otuka (pp. 22–74), there were two main faults along which displacement of the crust occurred. The northern or Siko fault is about 15 km. long and runs in a direction about N. 30° E. from Gabi-syo to Taitosei. Along this fault, the west side rose in two places about 3 metres relatively to the other side, the horizontal displacement being quite insignificant. The southern or Tonsikyaku fault is about 12 km. long and its general trend about N. 60° E. The northwest side of this fault was, relatively to the other side, shifted 1–1½ metres to the north east. Shortly before the earthquake, a fault was traced running from Gabi-syo to Taian, and the earthquake faults lie close to and parallel to this line. Mr. Otuka records the interesting fact that, at two places, the fault-movement took place after the houses in which the observers lived were destroyed.

From August until December 1935, the after-shocks were recorded at a network of four stations at which Ishimoto acceleration seismographs were installed. Most of the epicentres, according to Mr. N. Nasu (pp. 75–86), lay on the west side of the faults, and the focal depths were usually about 10 km. or less. In many of the shallow-focus earthquakes (depth 0–5 km.), the epicentres were close to the fault, especially in the upheaved region on its west side. Mr. Nasu notices that this was also the case with the after-shocks of the Tango earthquake of 1927 that he studied with so much care. At Byoritu (Taiwan), where the after-shocks were frequent, the level of the water in a well was measured from October 1935 (N. Miyabe and S. Kawasima, pp. 93–95). On the curve representing the changes of level from October 30 until January 10, dots are placed corresponding to the times of the after-shocks, and these occur at every point at which the level varies in direction.

The buckling of railway lines during a great earthquake is due, as a rule, to subsidence of the ground or to the destruction of the embankments on which the rails are laid. Such buckling occurs in both horizontal and vertical directions. Mr. R. Takahasi (pp. 148–153) describes and illustrates several cases of sinuous buckling. These are confined to a horizontal plane and lie along the fault-zone or its continuation. The buckling thus seems to be due to the movement of the surface layer of the ground on one or both sides of the fault.

Immediately after the earthquake, repetitions of first order triangulation and first order levelling were carried out in the central area by the Japanese Land Survey. The former, begun in August and finished in December 1935, included 14 points, three of which by comparison with the previous survey in 1917 had shifted by 26, 33 and 44 cm. The levelling was repeated along a route, 270 km. in length, from Kiirun and Musya, and was begun in October 1935 and completed in the following March. In the interval since the preceding survey, it appears that one point rose 23 cm., while another subsided 68 cm. C. D.