

ART. XLIV.—Notes on some Recent Earthquakes in New Zealand.

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[Read before the Wellington Philosophical Society, 24th September, 1913.]

INNER NEW ZEALAND REGION.

(1.) *16th March, 1912.*—A sharp shock. Epicentrum about sixteen miles north-west of Westport.[†]

(2.) *26th May, 1912.*—Felt at Stratford, New Plymouth, Auckland, Thames, Morrinsville, Tauranga, Wanganui, Wellington. Maximum intensity, observed at New Plymouth, VII–VIII on the Rossi-Foré scale. Several chimneys fell at New Plymouth; one chimney fell at Auckland. Intensity at Hamilton, VI–VII, R.-F. scale. Double origin: (a.) 38° 28' S., 173° 51' E., forty miles north by west of New Plymouth, about sixteen miles from the origin of earthquake of 24th June, 1891; (b) near south west end of Waiheke Island, at the entrance of the Firth of Thames.

(3.) *22nd February, 1913.*—Westport earthquake, VIII–IX, R.-F. scale. Epicentral area, at least twenty miles long, running north-north-east; principal movement from a point about twenty-two miles west-south-west from Westport, opposite Tauranga Bay.

(4.) *16th April, 1913.*—Sharp, IV–V, R.-F. scale. Origin near Lake Manapouri.

(5.) *12th July, 1913.*—Sharp, near origin of earthquake of 24th June, 1891.

It will be noted that these five earthquakes (besides a number of slighter shocks felt at Westport and some proceeding from an origin apparently north-west of Cape Farewell) came from origins lying near a line parallel to the general axis of New Zealand. Moreover, the origin of a very severe earthquake on 7th September, 1910, observed at all the chief stations of the world, was near the Kermadecs on a continuation of the same line. Near the same line, to the south-south-west, in lat. 52° S., 153° E., occurred also another world earthquake on 3rd February, 1910.

OUTER NEW ZEALAND REGION.

(6.) *12th April, 1913.*—Felt all along the east coast, in the Wairarapa, Wellington, and Manawatu districts. Probably proceeded from the well-known region, 200 miles east-south-east of Wellington (between Wellington and the Chatham Islands), which gave us the severe shock of 9th August, 1904. As in that shock also, the level at Wellington was slightly tilted towards the west. This suggests a series of folding movements about axes nearly parallel to the general axis.

FURTHER NOTES ON THE WESTPORT EARTHQUAKE OF 22ND FEBRUARY, 1913.

Times.—Christchurch (Milne seismograph): Preliminary tremors (?), 1.09.1; long waves commence, 1.09.7; maximum, 1.10.1. Riverview Observatory, Sydney (Wiechert horizontal pendulum): P.t., 1.08.2; long waves, 1.12.6 and 1.16.15. Westport: 1.08, or perhaps 1.07.5 (Morgan). Nelson (galvanometer), 1.09. (All times are Greenwich mean civil time.)

It is difficult to determine which times at Sydney and Christchurch belong to the same phases (the instrument at Wellington was not working;

owing to the absence of the observer). The hypothesis that seems to agree most nearly with the times, and with the evidence of stopped clocks and other notes of direction, is that the principal point of maximum disturbance was situated about 155 miles from Christchurch and twenty to twenty-five miles west-south-west from Westport, and that the epicentral area extended north-north-east and south-south-west from this point about fifteen to twenty-five miles in each direction.

Direction (as stated by observers).—Nelson, north-east to south-west; Charleston, west to east; Westport, south-west to north-east; Buller Gorge, south-west.

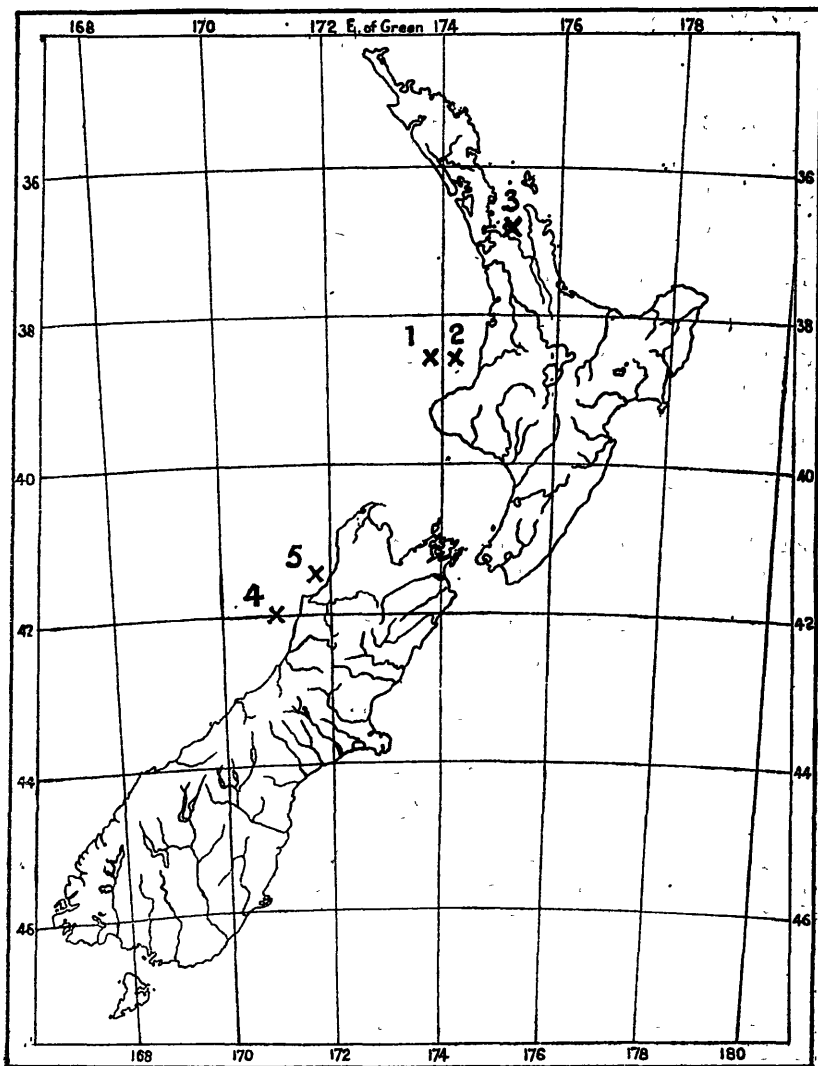
Duration.—Very variously stated, varying from 4 seconds to 1 minute; the best observations, by two engineers who specially timed the shock, give the time of the principal vibrations as 10 to 12 seconds.

Effects.—Westport: Movable objects overturned, crockery and bottles broken generally; plaster fell from ceilings and walls in some buildings; numerous chimneys destroyed or damaged (mostly old chimneys, according to some observers); brick post-office cracked, south-west wing moved $\frac{1}{2}$ in. on its base towards south-west, and metal down-pipe was bent; loose rocks fell from cliffs; cracks were formed in bridge embankment at Orawaiti; slips formed on Buller Road and on railway; narrow fissures opened in made ground; rents and fissures on beach parallel to coast, especially between Cape Foulwind and Tauranga Bay; shock felt with same intensity for about fifteen miles each way along coast from Cape Foulwind (Morgan); walls running east-and-west cracked right through; shop-windows broken in street running north by west to south by east; clocks stopped facing south-west and north-east; tidal wave reported (doubtful, it was a spring tide); preceded by boom, as if of blast or explosion, and accompanied by rumbling. Waimangaroa: Clock facing north-east stopped. Charleston: Doors and windows rattled; lamps and crockery thrown down; rock-falls from hillsides; crack in ground on north beach; rumbling 5 or 6 seconds before, also afterwards. Hokitika: Clocks stopped; rumbling. Grey-mouth: Clock facing east stopped; bell of town clock chimed, also fire-bell; a few movable objects fell; two chimneys thrown down. Reefton: Movable objects thrown down; bricks dislodged. Murchison: Two clocks stopped, facing north. Lyell: Clock stopped, facing east by north. Moki-hinui: Clocks facing east and west stopped. Cape Foulwind: Cliff-fall; all jars fell off shelves; &c.

Previous Shocks.—16th March, 1912 (see above); 12th December, 1912, about 8 p.m., with rumble.

After-shocks.—I have received records of fifty-two (Mr. P. G. Morgan, Director of the Geological Survey, says seventy after-shocks were reported). Those reported to me occurred as follows: 22nd February, 16; 23rd February, 7; 24th February, 7; 25th February, 5; 26th February, 2; 27th February, 2; 2nd March, 2; 5th March, 2; 6th March, 1; 8th March, 2; 10th March, 3; 12th March, 1; 15th March, 2. Most of the shocks, according to most observers, were immediately preceded by loud booms. Of twenty-six observations actually taken by Mr. Morgan, twelve were shocks with rumbles, seven shocks without rumbles, and seven rumbles without perceptible shaking.

[Much valuable assistance was given to me in the collection of data by Mr. P. G. Morgan; also by Mr. T. Thompson, County Engineer, Westport, and by many private correspondents.]



- × 1. Origin of earthquake of 24th June, 1891.
- × 2.) " " 26th May, 1912.
- × 3.) " " 22nd February, 1913.
- × 4. " " 16th March, 1912.
- × 5. " " " " " " " " " " " "