

THE KINGSTON EARTHQUAKE.

WHEN Port Royal was destroyed by the great earthquake of 1692, some of the surviving inhabitants took refuge on ships, others moved across the haven to a place called Kingstown or Killscown, where, in huts made of boughs, exposed to the heavy rains and in close proximity to hundreds of dead bodies in the bay, they "died miserably in heaps." Port Royal was rebuilt and maintained as a naval station; its successor, as a place of business, was founded the following year at Kingston, and by the earthquake of January 18 has now met with a similar, though fortunately less complete, destruction.

The two earthquakes differed considerably in intensity. In 1692 the whole island suffered. Scarcely a house in any part of it was left standing. By numerous land-slips, the mountains were stripped of vegetation and altered in form. The earthquake of that year was one of the first order of magnitude. The most remarkable fact about the recent shock is the very limited area of damage. Kingston seems to have suffered most severely. The more important buildings are ruined, and few, if any, houses have escaped some injury. Port Royal, six miles to the south, and St. Andrew, within five miles to the north, have shared to a great extent in the ruin, but outside a radius of ten or twelve miles from Kingston the loss to property is small. Some houses in Spanish Town, eleven miles to the west, are said to be damaged, while Port Antonio, twenty-eight miles to the north-east, and Holland Bay, thirty-eight miles to the east, are almost unharmed.

From the small area of excessive damage and from the rapid decline in the intensity of the shock, it may be inferred that the focus was situated close to Kingston and at no great depth below the surface. Partly to the proximity of the focus, partly also to the sandy or gravelly nature of the ground (for earthquakes are always more strongly felt on loose, friable beds than on hard, compact rock), we must attribute the destructive energy of the shock. That, in its initial power, the earthquake was inferior to those of Valparaiso and San Francisco is clear from the smallness of the meizoseismal area, and also from the comparatively slight disturbances recorded at the observatories of Washington, Shide, and Edinburgh.

The onset of the shock was sudden, there being no warning tremors or sound. For thirty-six seconds the motion was like that felt on a ship in a choppy sea. All observers agree that the movement was chiefly vertical. It is said that objects jumped from the ground, and this, if it be true, shows how violent was the shock and how close was Kingston to the focus. In many places the ground is fissured, the electric-tram rails are twisted, and the water-supply pipes are partially damaged—all indications of a neighbouring focus. The direct line of cable to Colon is broken about three miles from the shore, pointing either to a displacement of the ocean-bed or to a submarine land-slide—probably to the latter, for there were no marked seismic sea-waves on the south side of the island,¹ and the shipping in the roadstead and harbour are unharmed. The subsidence of the battery at Port Royal and the sinking of the shore at Kingston show that the superficial beds, at any rate, have undergone important changes of level.

Whether these changes be due to bodily displace-

¹ A so-called "tidal" wave was observed on the north side of the island. It is said that Anotta Bay was inundated and that houses were swept away. No time is mentioned, and, if the sea-waves were of seismic origin, we should expect to hear of similar reports from Port Antonio and other adjoining harbours.

ments of the crust, to mere shifting of the surface-beds or to both is by no means clear. When the island was surrendered to English forces in 1655, the spit, called the Palisadoes, which now terminates in Port Royal, was discontinuous, and the end resembled one of the quays or small islands outside the harbour. By 1692 the gap was bridged by a bar of sand. During the earthquake of that year a portion of the spit, a quarter of a mile in length, suddenly subsided, so that only the chimneys or upper parts of houses that were not overthrown appeared above the water. The harbour of Port Royal also sank, so that the streets along the harbour-side afterwards lay at a depth of from four to eight fathoms. Yet the depression of the ground itself at Port Royal and in other places was not supposed to exceed a foot.

There can be no doubt from the evidence above described that the seismic focus was situated, in part at least, almost vertically below the haven between Kingston and Port Royal, though a portion of it may have extended as far as three miles to the south of the coast. It is also probable that the Port Royal and Kingston earthquakes originated roughly within the same focus.

The West Indian region is distinguished by those steep surface-gradients which characterise areas of great instability. Jamaica, in common with Porto Rico and the south of Haiti, lies along a crust-ridge, which towards the west is prolonged into the mountains of Honduras, while it is separated from a corresponding ridge, constituting the island of Cuba, by the submarine depression of the Bartlett deeps. To the east, the Jamaican and Cuban arcs unite in one main ridge which bends round to overlap the curved line followed by the volcanic islands of the Lesser Antilles. These form the north and east boundaries of the great deeps of the Caribbean Sea. On the south lie the mountain ranges of Venezuela, &c., which, as we know from the destructive earthquakes of Cumana in 1799 and 1853 and of Caracas in 1812, are still in the stage of vigorous growth. Towards the west, and connected with the West Indian series, are the central American chains, also studded with volcanoes, and in parts frequently visited by violent earthquakes. In this West Indian region, as elsewhere, it is not unlikely that the mountain arcs have a tendency to press forward on their outer and convex side, and to subside towards the interior of the arcs. The movements along the line of the Lesser Antilles certainly suggest a slipping westwards into the Caribbean deeps. In Jamaica, along the northern boundary of that sea, the movement may be more complex, the northern side of the Jamaican ridge having a tendency to move northwards and forwards towards the Bartlett deeps, while on the south there is a continued subsidence and slipping towards the Caribbean Sea. Of such intermittent slips, the Port Royal and Kingston earthquakes appear to be some of the latest manifestations.

So far as I am aware, there is no evidence of that intense crushing that was so conspicuous a feature of, say, the Japanese earthquake of 1891. Extension rather than compression was manifested in 1692, for at Port Royal one whole street, in which many houses were left standing, was said to have been doubled in width by the earthquake. There is much evidence to favour such a view in the case of the Kingston earthquake—the extremely local character of the destructive shock, the snapping of the cable to the south, and the minor character of the disturbances registered by distant seismographs.

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