

Chile, Peru, and Ecuador, between the line of the Andes and the Pacific coast.¹⁷⁸

Extent of country affected.—The area shaken by an earthquake varies with the intensity of the shock, from a mere local tract where a slight tremor has been experienced, up to such catastrophes as that of Lisbon in 1755, which, besides convulsing the Portuguese coasts, extended into the north of Africa on the one hand and to Scandinavia on the other, and was even felt as far as the east of North America. Humboldt computed that the area shaken by this great earthquake was four times greater than that of the whole of Europe. The South American earthquakes are remarkable for the great distances to which their effects extend in a linear direction. Thus the strip of country in Peru and Ecuador severely shaken by the earthquake of 1868 had a length of 2000 miles.

Depth of source.—According to Mallet's observations, over the centre of origin the shock is felt as a vertical up-and-down movement (*Seismic vertical*); while, receding from this centre in any direction, it is felt as an undulatory movement, and comes up more and more obliquely. The *angle of emergence*, as he termed it, was obtained by him by taking the mean of observations of the rents and displacements of walls and buildings. In Fig. 72, for example, the wall there represented has been rent by an earthquake which emerged to the surface in the path marked by the arrow.

By observations of this nature, Mallet estimated the ap-

¹⁷⁸ For a list of Peruvian earthquakes from A.D. 1570 to 1875, see Geograph. Mag. iv. (1877), p. 206. The earthquake of 9 May, 1877, at Iquique, and its ocean-wave are described by E. Geinitz, Nova Act. Ac. Cæs. Leopold. Car. xl. (1878), pp. 383-444.