

*earthquake of translation.* This species may become destructive, especially in a secondary way, when occurring either on land or under the sea, in such relation to sea-level as to cause a rush of the sea upon the land. With this discrimination in view, let us consider what causes may be assigned.

The earthquake of vibration is evidently caused by a sudden *blow* or *jar*; the earthquake of translation, by a *lift*, either permanent or transient.

From time immemorial earthquakes have been connected in the minds of men with volcanic action; but careful study shows no uniform correlation between them. Volcanic action, moreover, is too local and too feeble. Some, in modern times, attribute earthquakes to the movements of the molten interior of the earth, acting against the walls of its prison; or as resulting from some other mechanical action within the crust. This opinion is supported by most reputable names—Humboldt, Scrope, Sir William Thomson. Movements of translation are undoubtedly produced by volcanic forces. Portions of mountains are lifted or even blown away; fissures are caused and many distinct movements result, which are commonly embraced under earthquakes. Undoubtedly, it sometimes happens, also, as an incident of volcanic action, that sudden blows, or violent explosions occur which impart vibratory tremors on a *narrow scale*, in character like those which sometimes spread over kingdoms and work vast destruction. But it can not be admitted that earthquakes as best known—earthquakes of vibration—are ascribable to any volcanic agency.

It may be mentioned, also, that the fall of large rocks, mountain-slides, great explosions, whether natural or artificial, sometimes occasion genuine earthquake tremors. The jar of a train of freight cars, or of a loaded wagon on the city pavement, generates real earthquake tremors; but in all these cases, on a scale too insignificant to be dignified with the name.

What is it, then, which stands as the physical cause of those *blows* or *shocks* which, originating at certain foci in the earth, spread radially in earth vibrations which sometimes