beam, and listen attentively when the other end is struck by a pin's head, we hear the shock distinctly; which shows that every fibre throughout the whole length has been made to vibrate. The rattling of carriages on the pavement shakes the largest edifices; and in the quarries underneath some quarters in Paris, it is found that the movement is communicated through a considerable thickness of rock.*

The great sea-wave originating directly over the centre of disturbance is propagated, as Michell correctly stated, in every direction, like the circle upon a pond when a pebble is dropped into it, the different rates at which it moves depending (as he also suggested) on variations in the depth of the water. This wave of the sea, says Mr. Mallet, is raised by the impulse of the shock immediately below it, which in great earthquakes lifts up the ground two or three feet perpendicularly. The velocity of the shock, or earth-wave, is greater because it "depends upon a function of the elasticity of the crust of the earth, whereas the velocity of the sea-wave depends upon a function of the depth of the sea."

"Although the shock in its passage under the deep ocean gives no trace of its progress, it no sooner gets into soundings or shallow water, than it gives rise to another and smaller wave of the sea. It carries, as it were, upon its back, this lesser aqueous undulation; a long narrow ridge of water which corresponds in form and velocity to itself, being pushed up by the partial elevation of the bottom. It is this small wave, called technically the 'forced sea-wave,' which communicates the earthquake-shock to ships at sea, as if they had struck upon a rock. It breaks upon a coast at the same moment that the shock reaches it, and sometimes it may cause an apparent slight recession from the shore, followed by its flowing up somewhat higher than the usual tide mark: this will happen where the beach is very sloping, as is usual where the sea is shallow, for then the velocity of the low flat earth-wave is such, that it slips as it were, from under the undulation in the fluid above. It does this at the moment of reaching the beach, which it elevates by a vertical height equal to its own, and as instantly lets drop again to its former level."

"While the shock propagated through the solid earth has thus travelled with extra rapidity to the land, the great sea-wave has been following at a slower pace, though advancing at the rate of several miles in a minute. It consists in the deep ocean, of a long low swell of enormous volume, having an equal slope before and behind, and that so gentle that it might pass under a ship without being noticed. But when it reaches the edge of soundings, its front slope, like that of a tidal wave under similar circumstances, becomes short and steep, while its rear slope is long and gentle. If there be water of some depth close into shore, this great wave may roll in long after the shock, and do little damage; but if the shore be shelving, there will be first a retreat of the water, and then the wave will break upon the beach and roll in far upon the land." (Mallet, ibid.)

* Ann. de Ch. et de Ph., tom. xxii. p. 428.