

is generally not in the ratio of the force of the shocks. At Cumana it constantly precedes them, while at Quito, and recently at Caracas, and in the West India Islands, a noise like the discharge of a battery was heard a long time after the shocks had ceased. A third kind of phenomenon, the most remarkable of the whole, is the rolling of those subterranean thunders, which last several months, without being accompanied by the least oscillatory motion of the ground.*

In every country subject to earthquakes, the point at which, probably owing to a particular disposition of the stony strata, the effects are most sensibly felt, is considered as the cause and the focus of the shocks. Thus, at Cumana, the hill of the castle of San Antonio, and particularly the eminence on which stands the convent of St. Francis, are believed to contain an enormous quantity of sulphur and other inflammable matter. We forget that the rapidity with which the undulations are propagated to great distances, even across the basin of the ocean, proves that the centre of action is very remote from the surface of the globe. From this same cause no doubt earthquakes are not confined to certain species of rocks, as some naturalists suppose, but all are fitted to propagate the movement. Keeping within the limits of my own experience I may here cite the granites of Lima and Acapulco; the gneiss of Caracas; the mica-slate of the peninsula of Araya; the primitive thonschiefer of Tepecuacuilco, in Mexico; the secondary limestones of the Apennines, Spain, and New Andalusia; and finally, the trappean porphyries of the provinces of Quito and Popayan.† In these different places the ground is frequently agitated by the most violent shocks; but sometimes, in the same rock, the superior strata form invincible obstacles to the

* The subterranean thunders (*bramidos y truenos subterranos*) of Guanaxuato. The phenomenon of a noise without shocks was observed by the ancients.—Aristot. *Meteor.*, lib. ii., (ed. Duval, p. 802). Pliny, lib. ii., c. 80.

† I might add to the list of secondary rocks, the gypsum of the newest formation, for instance, that of Montmartre, situated on a marine calcareous rock, which is posterior to the chalk.—See the *Mémoires de l'Académie*, tom. i., p. 341, on the earthquake felt at Paris and its environs in 1681.