

active volcanoes is always manifested in the chain of the Andes by the appearance of certain rocks (as dolerite, melaphyre, trachyte, andesite, and dioritic porphyry), which divide the so-called primitive rocks, the transition slates and sandstones, and the stratified formations. The constant recurrence of this phenomenon convinced me long since that these sporadic rocks were the seat of volcanic phenomena, and were connected with volcanic eruptions. At the foot of the grand Tunguragua, near Penipe, on the banks of the Rio Puela, I first distinctly observed mica slate resting on granite, broken through by a volcanic rock.

In the volcanic chain of the New Continent, the separate volcanoes are occasionally, when near together, in mutual dependence upon one another; and it is even seen that the volcanic activity for centuries together has moved on in one and the same direction, as, for instance, from north to south in the province of Quito.\* The focus of the volcanic action lies below the whole of the highlands of this province; the only channels of communication with the atmosphere are, however, those mountains which we designate by special names, as the mountains of Pichincha, Cotopaxi, and Tunguragua, and which, from their grouping, elevation, and form, constitute the grandest and most picturesque spectacle to be found in any volcanic district of an equally limited extent. Experience shows us, in many instances, that the extremities of such groups of volcanic chains are connected together by subterranean communications; and this fact reminds us of the ancient and true expression made use of by Seneca,† that the igneous mountain is only the issue of the more deeply-seated volcanic forces. In the Mexican highlands a mutual dependence is

\* Humboldt, *Geognost. Beobach., über die Vulkane des Hochlandes von Quito*, in Poggend., *Annal. der Physik*, bd. xlv., s. 194.

† Seneca, while he speaks very clearly regarding the problematical sinking of *Ætna*, says in his 79th letter, "Though this might happen, not because the mountain's height is lowered, but because the fires are weakened, and do not blaze out with their former vehemence; and for which reason it is that such vast clouds of smoke are not seen in the day-time. Yet neither of these seem incredible, for the mountain may possibly be consumed by being daily devoured, and the fire not be so large as formerly, since it is not self-generated here, but is kindled in the distant bowels of the earth, and there rages, being fed with continual fuel, not with that of the mountain, through which it only makes its passage." The subterranean communication, "by galleries," between the volcanoes of Sicily, Lipari, Pithecusa (*Ischia*), and Vesuvius, "of the last of which we may conjecture that it formerly burned and presented a fiery circle," seems fully understood by Strabo (lib. i., p. 247 and 248). He terms the whole district "sub-igneous."