The test of age by superposition is strictly applicable to all stratified volcanic tuffs, according to the rules already explained in the case of other sedimentary deposits. (See p. 97.)

Test of age by organic remains.—We have seen how, in the vicinity of active volcanos, scoriæ, pumice, fine sand, and fragments of rock are thrown up into the air, and then showered down upon the land, or into neighboring lakes or seas. In the tuffs so formed shells, corals, or any other durable organic bodies which may happen to be strewed over the bottom of a lake or sea will be imbedded, and thus continue as permanent memorials of the geological period when the volcanic eruption occurred. Tufaceous strata thus formed in the neighborhood of Vesuvius, Etna, Stromboli, and other volcanos now active in islands or near the sea, may give information of the relative age of these tuffs at some remote future period when the fires of these mountains are extinguished. By evidence of this kind we can establish a coincidence in age between volcanic rocks, and the different primary, secondary, and tertiary fossiliferous strata.

The tuffs alluded to may not always be marine, but may include, in some places, freshwater shells; in others, the bones of terrestrial quadrupeds. The diversity of organic remains in formations of this nature is perfectly intelligible, if we reflect on the wide dispersion of ejected matter during late eruptions, such as that of the volcano of Coseguina, in the province of Nicaragua, January 19, 1835. Hot cinders and fine scoriæ were then cast up to a vast height, and covered the ground as they fell to the depth of more than 10 feet, and for a distance of 8 leagues from the crater in a southerly direction. Birds, cattle, and wild animals were scorched to death in great numbers, and buried in ashes. Some volcanic dust fell at Chiapa, upwards of 1200 miles, not to leeward of the volcano, as might have been anticipated, but to windward, a striking proof of a counter current in the upper region of the atmosphere; and some on Jamaica, about 700 miles distant to the northeast. In the sea, also, at the distance of 1100 miles from the point of eruption, Captain Eden of the Conway sailed 40 miles through floating pumice, among which were some pieces of considerable size.*

Test of age by mineral composition.—As sediment of homogeneous composition, when discharged from the mouth of a large river, is often deposited simultaneously over a wide space, so a particular kind of lava, flowing from a crater during one eruption, may spread over an extensive area; as in Iceland in 1783, when the melted matter, pouring from Skaptar Jokul, flowed in streams in opposite directions, and caused a continuous mass, the extreme points of which were 90 miles distant from each other. This enormous current of lava varied in thickness from 100 feet to 600 feet, and in breadth from that of a narrow river gorge to 15 miles.† Now, if such a mass should afterwards be divided into separate

* Caldcleugh, Phil. Trans. 1836, p. 27.

† See Principles, *Index*, "Skaptar Jokul."