

times, they pierced contorted Silurian rocks in central Scotland. In late Tertiary and post-Tertiary ages, they found their way through recent soft marine strata, and formed the huge piles of Etna, Somma, and Vesuvius; while in North America, during the same cycle of geological time, they flooded with lava and tuff many of the river-courses, valleys, and lakes of Nevada, Utah, Wyoming, Idaho, and adjacent territories. On the banks of the Rhine, at Bonn and elsewhere, they have penetrated some of the older alluvia of that river. In many instances, also, newer volcanoes have appeared on the sites of older ones. In Scotland, the Carboniferous volcanoes have risen on the ruins of those of the Old Red Sandstone, those of the Permian period have broken out among the earlier Carboniferous eruptions, while the older Tertiary dikes have been injected into all these older volcanic masses. The newer *puy*s of Auvergne were sometimes erupted through much older and already greatly denuded basalt-streams. Somma and Vesuvius have risen out of the great Neapolitan plain of older marine tuff, while in central Italy newer cones have been thrown up upon the wide Roman plain of more ancient volcanic débris.³¹ The vast Snake River lava-fields of Idaho overlie denuded masses of earlier trachytic lavas, and similar proofs of a long succession of intermittent and widely-separated volcanic outbursts can be traced northward into the Yellowstone Valley.

When a volcanic vent is opened, it might be supposed always to find its way to the surface along some line of fis-

³¹ According to Prof. G. Pozzi, the principal volcanic outbursts of Italy are of the Glacial Period. *Atti Lincei*, 3d ser. vol. ii. (1878), p. 35. Stefani regards those of Tuscany as partly Miocene, partly Pliocene and post-Pliocene. (*Proc. Tosc. Soc. Nat. Pisa*, 1. p. xxi.)