

and depth to allow of the simultaneous accumulation of the loess, at various heights, throughout the whole area where it now occurs, I formerly suggested that, subsequently to the period when the countries now drained by the Rhine and its tributaries had nearly acquired their actual form and geographical features, they were again depressed gradually by a movement like that now in progress on the west coast of Greenland.* In proportion as the whole district was lowered, the general fall of the waters between the Alps and the ocean was lessened; and both the main and lateral valleys, becoming more subject to river inundations, were partially filled up with fluviatile silt, containing land and freshwater shells. When a thickness of many hundred feet of loess had been thrown down slowly by this operation, the whole region was once more upheaved gradually. During this upward movement most of the fine loam would be carried off by the denuding power of rains and rivers; and thus the original valleys might have been re-excavated, and the country almost restored to its pristine state, with the exception of some masses and patches of loess such as still remain, and which, by their frequency and remarkable homogeneousness of composition and fossils, attest the ancient continuity and common origin of the whole. By imagining these oscillations of level, we dispense with the necessity of erecting and afterwards removing a mountain barrier sufficiently high to exclude the ocean from the valley of the Rhine during the period of the accumulation of the loess.

The proportion of land shells of the genera *Helix*, *Pupa*, and *Bulimus*, is very large in the loess; but in many places aquatic species of the genera *Lymnea*, *Paludina*, and *Planorbis* are also found. These may have been carried away during floods from shallow pools and marshes bordering the river; and the great extent of marshy ground caused by the wide overflowings of rivers above supposed would favor the multiplication of amphibious mollusks, such as the *Succinea* (fig. 106), which is almost everywhere characteristic of this formation, and is sometimes accompanied, as near Bonn, by another species, *S. amphibia* (fig. 34, p. 29). Among other abundant fossils are *Helix plebeia* and *Pupa muscorum*. (See Figures.) Both the terrestrial and aquatic shells preserved in the loess are of most fragile and delicate structure, and yet,

Fig. 106.

*Succinea elongata*.

Fig. 107.

*Pupa muscorum*.

Fig. 108.

*Helix plebeia*.

they are almost invariably perfect and uninjured. They must have been broken to pieces had they been swept along by a violent inundation. Even the color of some of the land-shells, as that of *Helix nemoralis*, is occasionally preserved.

* Princ. of Geol. 3d edition, 1834, vol. iii. p. 414.