

VI. EARTH-SHAPING, MOUNTAIN-MAKING, AND THE ATTENDANT PHENOMENA : HYPOGEIC WORK.

The preceding chapters on the origin of geological phenomena treat of the agencies by which rocks were made, denuded, crystallized, and filled with veins and ores. The subject of the present chapter is the nature and origin of the changes through which the earth has received its form and features, hypogeic work, of which the orogenic part is the most noticeable. It does not comprise the work of waters in giving mountain-like shapes to plateaus, and thus producing *mountains of circumdenudation*, or in making, by accumulation, hills of detritus; nor the work of heat in building up volcanic cones, the earth's *mountains of igneous accumulation*, or in making laccolithic domes or masses (laccoliths) — *mountains of subterranean igneous accumulation*; for these operations have already been considered; but work that is consequent, whatever its source, on crustal and interior movements in the earth, as expressed in the term HYPOGEIC, from the Greek *ὑπό*, *beneath*, and *γῆ*, *the earth*. The attendant phenomena comprise fractures of the earth's crust and supercrust, dislocations, flexures, crystallization and alteration of rocks, rock-melting, and other effects.

The facts and explanations here presented are supplemented in the following pages on Historical Geology, and the chapter will be best understood if those pages have already been made familiar.

ACTUALITY OF CHANGES OF LEVEL.

All geological history testifies against the stability of the rocky crust of the globe; and if the earth, as is believed, has cooled from fusion, abundant reason for this unstableness exists; for the effects of the earth's slowly progressing refrigeration reach backward indefinitely, and downward beneath all other agencies of change.

But the evidence of instability, although the fact is so obvious, is beset with doubts as to amount and position, because of possible and actual variations in the base from which measurements are naturally made. This base is the water-line about the land. Hence, we have to consider the sources of variation in sea level.

1. *Changes in the level of the sea-bottom.* — When water-made strata full of marine fossils are found at a height of 1000 feet above the sea, the evidence of a rise of at least 1000 feet *appears to be plain*. Yet, a lowering of the sea-bottom might produce the same result; and it may, therefore, be a question whether in such a case part, or all, of the *apparent* upward change has not been so produced.

So, also, by a reverse movement in the sea-bottom, an *apparent* subsidence might result. Here there is actual change of level, but it may be thousands of miles away from the land along which the change is made visible. *Change so caused will affect all seacoasts alike*; and in this fact a criterion exists for judging of its reality.