

*Ground-ice.*—When a current of cold air passes over the surface of a lake or stream it abstracts from it a quantity of heat, and the specific gravity of the water being thereby increased, the cooled portion sinks. This circulation may continue until the whole body of fluid has been cooled down to the temperature of 40° F., after which, if the cold increase, the vertical movement ceases, the water which is uppermost expands and floats over the heavier fluid below, and when it has attained a temperature of 32° Fahr. it sets into a sheet of ice. It should seem therefore impossible, according to this law of congelation, that ice should ever form at the bottom of a river; and yet such is the fact, and many speculations have been hazarded to account for so singular a phenomenon. M. Arago is of opinion that the mechanical action of a running stream produces a circulation by which the entire body of water is mixed up together and cooled alike, and the whole being thus reduced to the freezing point, ice begins to form at the bottom for two reasons, first, because there is less motion there, and secondly, because the water is in contact with solid rock or pebbles which have a cold surface.\* Whatever explanation we adopt, there is no doubt of the fact, that in countries where the intensity and duration of the cold is great, rivers and torrents acquire an increase of carrying power by the formation of what is called ground-ice. Even in the Thames we learn from Dr. Plott that pieces of this kind of ice, having gravel frozen on to their under side, rise up from the bottom in winter, and float on the surface. In the Siberian rivers, Weitz describes large stones as having been brought up from the river's bed in the same manner, and made to float.†

*Glaciers.*—In the temperate zone, the snow lies for months in winter on the summit of every high mountain, while in the arctic regions, a long summer's day of half a year's duration is insufficient to melt the snow, even on land just raised above the level of the sea. It is therefore not surprising, since the atmosphere becomes colder, in proportion as we ascend in it, that there should be heights, even in tropical countries, where the snow never melts. The lowest limit to which the perpetual snow extends downwards, from the tops of mountains at the equator, is an elevation of not less than 16,000 feet above the sea; while in the Swiss Alps, in lat. 49° N. it reaches as low as 8,500 feet above the same level, the loftier peaks of the Alpine chain being from 12,000 to 15,000 feet high. The frozen mass augmenting from year to year would add indefinitely to the altitude of alpine summits, were it not relieved by its descent through the larger and deeper valleys to regions far below the general snow-line. To these it slowly finds its way in the form of rivers of ice called glaciers, the consolidation of which is produced by pressure, and by the congelation of water infiltrated into the porous mass, which is always undergoing partial liquefaction, and receiving in summer

\* M. Arago, *Annuaire*, &c. 1833; and Rev. J. Farquharson, *Phil. Trans.* 1835, p. 329.

† *Journ. of Roy. Geograph. Soc.* vol. vi. p. 416.