

of motion ; the expansion of the crystallizing molecule aids it ; and the shearing force is lost by the molecular melting. But it seems to be hardly probable that a glacier, hundreds of feet thick, could be thus urged forward. Any crevasse or crack would intercept the molecular transmission ; and the cause would hardly have a chance to act in a crevassed glacier like the Mer de Glace. Professor Croll, however, explained the formation of crevasses on the same principle.

Avalanches, like other kinds of landslides, do rapid denuding work over the slopes they descend, ice, water, mud, and stones hurrying on together, each in deluge-like form, with destructive effects. The noted avalanche of the 12th of July, 1892, at St. Gervais, in Switzerland, was more a discharge of water than of ice and mud. The water occupied two great cavities or reservoirs in the ice and was the occasion of the disaster. The cavities had been made by gradual melting.

The movement of glaciers, although so slow, may be illustrated by comparison with that of pitch. Pitch will not only descend all slopes, but will flow over a horizontal surface if the supply of material is kept up ; and in case the area is a depression, it will fill the depression, and then flow on beyond it. So it is with the glacier. If there is a deep basin in a glacier valley, the glacier will move on over the ice-filled basin as if it were not there. While the mass of a glacier is flowing in accordance with the surface slope, a lower portion lying in a channel oblique to the course will take, if friction does not prevent, the course of the channel, for the reason that it cannot get out of the channel or valley to flow otherwise. (The principle is easily verified by means of pitch.) Thus in the same part of the glacier an upper portion may have a different course from the lower in spite of the resistance to be overcome.

### 3. Denudation, Transportation, and Deposition.

The weight of the glacier makes it a tool of great power. The pressure for 100 feet of ice in height is about 40 pounds to the square inch, and for 1250 feet, 500 pounds.

A glacier obtains its material for transportation both (1) passively, and (2) aggressively, through its power of denudation.

In a passive way (*a*) it receives from overhanging bluffs and adjoining ridges a great amount of earth, stones, and rocks, which the frost, waters, and other causes may have loosened ; and where the glacier extends down far below regions of vegetation, it may have contributions of vegetable debris and animal relics. (*b*) The winds contribute dust. (*c*) Freezing in the colder season or in the advance of a glacier may add gravel and stones that lie along its side or underneath it, a method of acquisition which has its maximum in an avalanche. (*d*) The materials received may descend opened crevasses, either by falling down, or by being carried in descending waters.

Aggressively, the glacier augments its load (*a*) by abrasion, carried on by means of the stones with which its sides are armed, or those that may lie between the glacier and the rock against which it moves ; it thus occasions