

finding a temperature which will suffice to melt it all away before the next winter. So tongues of granular snow stretch down the mountain valleys, and being, like our late spring snow, exposed to increased action of warmth, these valley prolongations of the upper firn become completely changed into solid ice. This is now a *glacier*.

We may reason a step further from facts of observation. All substances expand with increase of temperature, and contract with reduction of temperature. The glacier is certainly at a lower temperature in winter than in summer—though it can never be warmed above thirty-two degrees Fahrenheit, which is the thawing temperature. The surface of the glacier is also at a lower temperature during the night than during the day. The glacier, therefore, must sometimes expand and sometimes contract. Now, when it expands, the whole expansion will be developed at the free lower border, since the upper border is frozen to the earth, and pressed also, by the snows beyond. Also, if both were free, *most* of the expansion would be developed below, because gravity aids motion downwards. Next, when the glacier contracts, the lower border does *not* retreat, because the ice is not strong enough to bear the pull of the mass up the slope. The ice breaks in innumerable little cracks. These are soon filled with water, which freezes, and thus restores the complete solidity of the glacier. Thus, when the next expansion takes place, the glacier takes another slide down the valley. So the glacier travels. So, if a whole state should become glacier-covered, the ice-sheet would have a motion from higher to lower, and from colder to warmer. Every thing on its surface would be transported; every loose object beneath it or in front of it would be pushed forward.

Now, here are some hints toward an explanation of the method of transportation of our millions of bowlders. If we go to the Alps we find exactly such glaciers, on a small scale, performing precisely such work. Thus our theory receives confirmation. We can not pretend that glacier action explains all the phenomena of the Drift. Nor do we pretend that any thing more than a hint has been given toward an ex-