

sufficiently large to have excavated it. As there is a valley extending from Stratton to Canada, with a general northerly descent, it is not improbable that there may have been, in Mesozoic or Palæozoic periods, a river from southern Vermont east of the Green Mountains to the St. Lawrence, although several streams now cross this valley transversely.

Frozen Deposits of Modified Drift, (Frozen Wells,) and Ice Caverns.—In Brandon, Vermont, in November, 1858, a well was dug through layers of gravel and marly clay, to the depth of thirty-five feet. After reaching a depth of about fourteen feet, a frozen mass of the same materials was passed through, from twelve to fifteen feet thick; then a few feet of unfrozen gravel, when water was reached. During the winter the water was frozen over quite hard, and for most of the summer ice lined the stones of the well several inches thick, and the temperature of the water never rose more than 2° or 3° above the freezing point. In the winter of 1859–60, the ice which in September had disappeared, returned.

In Owego, New York, a similar well was dug many years ago, in loose soil, seventy-seven feet deep, which for four or five months in the year was so frozen as to be useless. Another was dug in Ware, Massachusetts, in 1858, in gravel, thirty-five feet deep, which froze over the following winter. Another is described in Lyman, New Hampshire.

On the eastern continent, in the Alps, the Jura, and the Ural Mountains, are numerous caverns in the rocks, where ice forms in the summer, especially, often in such quantity as to be an article of commerce. In all these cases, the caverns have two openings, one at the top the other at the bottom, laterally. This causes a current of air downward in the summer, and upward in the winter. This current evaporates the water upon the sides and floor of the cavern, and thus produces the cold; since evaporation takes up into a latent state nearly 1000° of heat. In the winter the evaporation is less, and the congelation less. On this principle, at Monte Testaceo, in Rome, (which is a hill 300 feet high, made up of broken pottery), excavations are made laterally, connected with chimneys, and thus fine ice houses are formed.

Now, in the case of frozen wells, it seems as if there must be some such circulation of air as in these ice caverns; and why must there not be through the beds of quite clean gravel that occur in the wells, and which sometimes, as at Brandon, we can see cropping out at the surface? The interstices must be filled with air, and at different temperatures this must have motion, even though slow. This would carry off the heat that rises from the earth's interior, while the beds of clay near the surface would prevent the external heat from penetrating far. Thus masses of gravel, frozen during the drift period, may have been preserved to our day, and form a nucleus to which more frost might be added at certain seasons of the years. Such an hypothesis is not without difficulties; but the case of the ice caverns gives it some plausibility.

THEORIES OF SURFACE GEOLOGY.

The origin of drift has long been discussed by geologists. It was formerly thought to have been the result of the deluge of Noah. But this view is now wholly abandoned by geologists, because the remains of man and associated animals living before the flood are not found in it, and because the agency of water, and the brevity of the time involved, are inadequate to explain it. There are