stones from valley rocks — chiefly trap and red sandstone — and made scratches in the direction of the valley, while the upper ice left similar evidence of its direction of flow, S. 30°-50° E., in the distribution of bowlders from the region west of the valley. These bowlders, in general, were dropped in the valley, they sinking in the ice till within the *valley flow;* so that, in such a case, they prove only that the flow characterizing the upper ice continued part of the way across the Connecticut valley.

Other examples of valley ice-streams are those of the Merrimac, N.H., of the Winooski Valley in Vermont, and that of Lake Champlain, as proved by the glacial scratches observed by C. H. Hitchcock.

Transportation and Deposition.

1. *Gathering of material, and its condition.* — The ice-sheet received little material from avalanches, that is, through falls of ice or stones from precipitous declivities or overhanging cliffs, except toward its front margin; for, in the maximum stage of the ice, it covered all the mountains, except the highest. The moving mass carried debris for the most part, not from the slopes and summits of *emerged* ridges, but from those underneath it, against or upon which it rested, and chiefly from the slopes and summits of such ridges rather than from level surfaces. It obtained its load by abrading, plowing, crushing, and tearing from these underlying slopes and summits. It took up the loose earth and stones, abraded the hard rocks, plowed into the soft, and broke and tore off small and large bowlders from the fissured or jointed rocks.

The ice-mass was a coarse tool; but through the facility with which it broke and adapted itself to uneven surfaces, it was well fitted for all kinds of shoving, tearing, and abrading work. Moreover, it was a tool urged on by enormous pressure. A thickness of 1000 feet corresponds to at least 50,000 pounds to the square foot. The ice that was forced into the openings and crevices in the rocks had thereby enormous power in breaking down ledges, prying off bowlders, and in abrading and corrading. In contrast, the ice of an Alpine glacier has a thickness ordinarily of but 300 to 500 feet.

It gathered little from the lowest parts of the narrower valleys, because of the subglacial stream often present there, and the open space in the ice above it — the ice resting itself in such cases mostly against the sides of the valley.

Where the fissured rocks were hard, large stones were taken up, some of them hundreds, and occasionally thousands, of tons in weight. But in regions of soft rocks, such as shale, slate, and fragile sandstone, and of rocks easily decomposed, the material obtained was merely sand, earth, or small stones that were readily reduced to earth. Over areas of great extent, therefore, the glacier moved on with little besides the finer debris to distribute. Such facts suggest a reason for the frequent absence of stones and large bowlders from large parts of a glaciated region.

In consequence of this subglacial method of gathering materials, nearly all transported debris of the glacier was confined at first to its lower part,