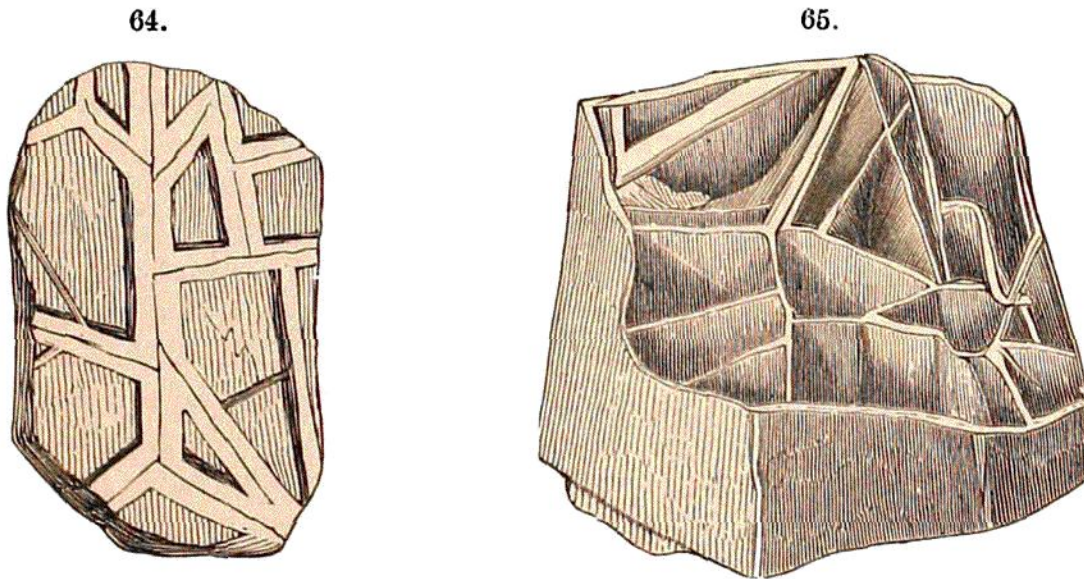


structure is produced. It characterizes part of the "Pictured Rocks" of the south shore of Lake Superior (Foster and Whitney's Report, from which the above figure was taken), and shows that the beds were not made in deep waters, but above the sea level by the drifting winds, like the drift-sand ridges of a windward coast.

(12) The *mud-cracks* made over a drying mud-flat are often preserved in the rocks (Figs. 64 and 65), and prove the mud-flat origin of the bed. Such cracks are necessarily shallow, as they are limited by the depth of the mud. The cracks become filled by the sediment after a return of the waters,



Mud-cracks. D. '49.

and into this filling a cementing solution may pass from above. If the solution is siliceous, the filling becomes harder than the rock either side, so that when worn, the surface is one of prominent intersecting ridgelets, as in the figures. Moreover, these ridges are generally double, the filling having solidified against either wall of the crack until the two sides met at the center, and became more or less perfectly united. Layers having such filled-up mud-cracks are very common in stratified rocks.

(13) *Ripple-marks* (Fig. 66), a series of wavy ridgelets, precisely like the ripples on a sand-beach, are also common in many sandstones, the oldest as well as the latest, and are often indications of sand-flat origin, — like the sand-flats off many seashores or in bays, though not necessarily so, since ripples may form over the bottom as far down as oscillation in the water extends, which may be a hundred yards or more; and they are also formed by the winds over surfaces of loose sand.

(14) *Wave-marks* are faint outlinings on a bed of sandstone, like the outline left by a wave along the limit where it dies out upon a beach, marking the outline of a very thin deposit of sand. They have the same kind of significance as ripple-marks, but are surer evidence that the beds are of beach origin.