which is every where observable in the ice, and might be produced by lines of discontinuity, arising from the different rates at which the various portions of the semi-rigid glacier advance and pass each other. Many examples are adduced to prove that a glacier can model itself to the form of the ground over which it is forced, exactly as would happen if it possessed a certain ductility, and this power of yielding under intense pressure, is shown not to be irreconcileable with the idea of the ice being sufficiently compact to break into fragments when the strain upon its parts is excessive; as where the glacier turns a sharp angle, or descends upon a rapid or convex slope. The increased velocity in summer is attributed partly to the greater plasticity of the ice, when not exposed to intense cold, and partly to the hydrostatic pressure of the water in the capillary tubes, which imbibe more of this liquid in the hot season.

On the assumption of the ice being a rigid mass, Mr. Hopkins attributed the more rapid motions in the centre to the unequal rate at which the broad stripes of ice, intervening between longitudinal fissures, advance; but besides that there are parts of the glacier where no such fissures exist, such a mode of progression, says Mr. Forbes, would cause the borders of large transverse rents or "crevasses," to be jagged like a saw, instead of being perfectly even and straight-edged.* An experiment recently made by Mr. Christie, Secretary to the Royal Society, appears to demonstrate that ice, under great pressure, possesses a sufficient degree of moulding and self-adapting power to allow it to be acted upon, as if it were a pasty substance. A hollow shell of iron an inch and a half thick, the interior being ten inches in diameter, was filled with water, in the course of a severe winter, and exposed to the frost, with the fuze-hole uppermost. A portion of the water expanded in freezing, so as to protrude a cylinder of ice from the fuze-hole; and this cylinder continued to grow inch by inch in proportion as the central nucleus of water froze. As we cannot doubt that an outer shell of ice is first formed, and then another within, the continued rise of the column through the fuze-hole must proceed from the squeezing of successive shells of ice concentrically formed, through the narrow orifice; and yet the protruded cylinder consisted of entire, and not fragmentary ice.†

The agency of glaciers in producing permanent geological changes consists partly in their power of transporting gravel, sand, and huge stones to great distances, and partly in the smoothing polishing, and scoring of their rocky channels, and the boundary walls of the valleys through which they pass. At the foot of every steep cliff or precipice in high Alpine regions, a talus is seen of rocky fragments detached by the alternate action of frost and thaw. If

* See Mr. Hopkins on Motion of Glaciers, Cambridge Phil. Trans. 1844, and Phil. Mag. 1845. Some of the late concessions of this author as to a certain plasticity in the mass, appear to me to make the difference between him and Professor Forbes little more than one of degree. (For the latest summary of Prof. Forbes' views, see Phil. Trans. 1846, part 2.)

† This experiment is cited by Mr. Forbes, Phil. Trans. 1846, p. 206.; and I have conversed with Mr. Christie on the subject.