solutions, obtained crystals of nephelite and orthoclase; and with the addition of silica, obtained leucite.

As early as 1804, Gregory Watt published in the *Philosophical Transactions* "Observations on Basalt," in which he gave a detailed account of the melting of 700 pounds of basalt from Rowley-Rag (G = 2·743) to glass, and of its becoming, on slow cooling, a gray, crystalline-granular mass (with G = 2·934–2·949) consisting of spherical concretions, many 2 inches in diameter and having a somewhat radiated structure (which was mostly lost with the slowest cooling); and of the adjoining concretions being often rendered hexagonally prismatic from contact, whence he inferred the concretionary origin of basaltic columns.

2. Conditions Determining the Forms of Cones.

1. *Dependence on fusibility of the lavas.* — Cones of lavas of the basalt class are of gentle slope, and great breadth, owing to the easy flow of the rock. The lavas are glassy only at surface, or when in scoriaceous forms.

The *craters* also derive their characters from the liquidity. They are broad, with the walls often vertical, meriting the name they have of *pit-craters*, as is well seen in figures 229–231, on page 269.

But the great cones of western North and South America are mostly examples of the andesyte or trachyte class. The slope seldom exceeds 35°, except where caused by breaks. The steepness, however, may be in part owing to intercalated beds of cinders or tufa. Mount Shasta, represented in Fig. 226, is one of them, — its slopes 28°–32° (Whitney). Chimborazo, 20,498 feet high, has angles of about 25° in a view looking northeast; Cotopaxi, 19,613 feet high, in a westward view, angles of 27½° to 30½°, rising near the summit to 37° (Whymper); and Arequipa, angles of 27½° to 32° 50′.

Trachytes, and other lavas of the third class, take part in cones of the second kind. But as the temperature of free fusion is above 3100° F., the heat required for complete liquidity is generally wanting, so that at the time of ejection they commonly are already in a pasty state, or that of incipient solidification. The streams are thick, compared with the basaltic. Sometimes the lava swells up into steep and lofty craterless domes, instead of flowing away in streams. The high domes of Auvergne, France, are examples. But when a trachytic lava has the heat of complete fusion, it may flow and make great streams.

The following sketch represents "Gothic Mountain," in Colorado, in which a mountain mass of trachyte rests on a base of Cretaceous rocks, much eroded over its surface. (Hayden Rep., 1873.) In the nearly horizontally stratified base there is an independent dike of the trachyte, which was probably produced contemporaneously with the outflow that made the mountain. The mountain is nearly 2000 feet in height above the Cretaceous base, and 12,465 feet high above the sea level. The rock is without bedding or any evidence of separate lava flows.

Melted beeswax poured out on a flat surface, while heated above the fusing point, would flow off at a very small angle; but if its temperature were below that of fusion, it would be pasty, and the angle of flow would