Two types of basalt have been recognized in the great basaltic outbursts of Western America: (1) the porphyritic, consisting of a glassy and microlitic or micro-crystalline ground-mass, bearing relatively large crystals of olivine, felspar, and occasionally augite, a structure showing close relations to that of many andesites; (2) the granular (in the sense in which that term is used by Rosenbusch, *ante*, p. 177) —an aggregate of quite uniform grains, composed of well-developed plagioclase and olivine crystals, with ill-defined patches of augite, and frequently with a considerable amount of glass-base. By diminution of olivine and augmentation of silica, and the appearance of hypersthene, gradations can be traced from true olivine-basalts into normal andesites. Basalts with free quartz are not infrequent in Western America.[199]

Basalt occurs in amorphous and columnar sheets, which may alternate with each other or with associated tuffs. It also forms abundant dikes, veins, and intrusive bosses. It frequently assumes a cellular structure, which becomes amygdaloidal by the deposit of calcite, zeolites, or other minerals in the vesicles. A relation may be traced between the development of amygdales and the state of the rock; the more amygdaloidal the rock, the more is it decomposed, showing that the amygdales have probably in large measure been derived by infiltrating water from the basalt itself.

Vitreous Basalt (Basalt-glass, Tachylyte, Hyalomelan).[200]—Basalt passes into a condition which, even to the naked eye, is recognizable as that of a true glass. This more especially takes place along the edges of dikes and intrusive sheets. Where an external skin of the original molten rock has rapidly cooled and consolidated, in contact with the rocks through which the eruption took place, a transition can be traced within the space of less than a quarter of an inch from a crystalline dolerite, anamesite, basalt, or andesite into a black glass, which under the microscope assumes a pale brown or yellowish color, and is isotropic, but generally contains abundant microlites, sometimes with a globular or spherulitic concretionary structure. In such cases it seems indisputable that this glass represents what

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[199] Hague and Iddings, Amer. Journ. Sci. xxvii. (1884), p. 456. Iddings, op. cit. xxxvi. (1888), p. 208, Bull. U. S. Geol. Surv. Nos. 66 and 79 (J. S. Diller).

[200] See Judd & Cole, Q. J. Geol. Soc. xxxix. (1883), p. 444. Cole, op. cit. xliv. (1888), p. 300. Cohen, Neues Jahrb. 1876, p. 744; 1880 (vol. ii.), p. 23 (Sandwich Islands).