

teristic of the older and chiefly of the plutonic eruptive rocks, has been observed in large crystals in modern lava (liparite and quartz-andesite¹⁶). (b) Some show more or less of a half-glassy or stony (devitrified) matrix, in which the constituent crystals are imbedded; this is the most common arrangement. (c) Others are entirely vitreous, such crystals or crystalline particles as occur in them being quite subordinate, and, so to speak, accidental inclosures in the main glassy mass. Obsidian or volcanic glass is the type of this group. (d) They further differ in the extent to which minute pores or larger cellular spaces have been developed in them. According to Bischof, the porosity of lavas depends on their degree of liquidity, a porous lava or slag, when reduced in his fusion-experiments to a thin-flowing consistency, hardening into a mass as compact as the densest lava or basalt.¹⁷ The presence of interstitial steam in lavas, by expanding the still molten stone, produces an open cellular texture, somewhat like that of sponge or of bread. Such a vesicular arrangement very commonly appears on the upper surface of a lava current, which assumes a slaggy or cindery aspect. In some forms of pumice the proportion of air cavities is 8 or 9 times that of the inclosing glass. (4) Lavas vary greatly in color and general external aspect. The heavy basic kinds are usually dark gray, or almost black, though, on exposure to the weather, they acquire a brown tint from the oxidation and hydration of their iron. Their surface is commonly rough and ragged, until it has been sufficiently decomposed by the atmosphere to crumble into soil which, under favorable circumstances, supports a luxuriant vegetation. The less dense lavas, such as phonolites and trachytes, are frequently paler in color, sometimes yellow or buff, and decompose into light soils; but the obsidians present rugged black sheets of rock, roughened with ridges and heaps of gray froth-like pumice. Some of the most brilliant surfaces of color in any rock-scenery on the globe are to be found among volcanic rocks. The walls of active craters glow with endless hues of red and yellow. The Grand Cañon of the Yellowstone River has been dug out of the most marvellously tinted lavas and tuffs.

¹⁶ Wolf, Neues Jahrb. 1874, p. 377.

¹⁷ "Chem. und Phys. Geol." supp. (1871), p. 144. On the production of the vesicular structure consult Dana, "Characteristics of Volcanoes," p. 161. Compare also Judd, Geol. Mag. 1888, p. 7.