

ously seen than in the array of spires, buttresses, gullies and other striking outlines which a mountain crest assumes.

Valleys are mainly due to erosion, guided either by original depressions of the ground, or by geological structure, or by both.<sup>15</sup> Their contours depend partly on the structure and composition of the rocks, and partly on the relative potency of the different denuding agents. Where the influence of air, rain, frost and general subaerial weathering has been slight, and the streams, supplied from distant sources, have had sufficient declivity, deep, narrow, precipitous ravines or gorges have been excavated. The cañons of the Colorado are a magnificent example of this result (Fig. 471). Where, on the other hand, ordinary atmospheric action has been more rapid, the sides of the river channels have been attacked, and open sloping glens and valleys have been hollowed out. A gorge or defile is usually due to the action of a waterfall, which, beginning with some abrupt declivity or precipice in the course of the river when it first commenced to flow, or caused by some hard rock crossing the channel, has eaten its way backward, as already explained (p. 657).

A pass is a portion of a watershed which has been cut down by the erosion of two valleys, the heads of which adjoin on opposite sides of a ridge. Each valley is cut backward until the intervening ridge is demolished. Most passes no doubt lie in original but subsequently deepened

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<sup>15</sup> The student should read the suggestive essay by the late J. B. Jukes (Quart. Journ. Geol. Soc. xviii. 1862, p. 378, which was the first attempt to work out the history of the excavation of a valley system in reference to the geological history of the ground. See also Penck, Neues Jahrb. 1890, p. 165; E. Tietze, Jahrb. Geol. Reichsanst. xxxviii. 1888, p. 633.