

form of the valleys. These may be wide, open, smooth, with gently shelving sides, or they may be only narrow gorges, in which the waters toil between naked walls of rock. It will be observed that the most precipitous ravines fall easily into the general plan, and lie as naturally in the pathways of the streams as do the widest straths. Evidently this close harmony between the shape of the ground and the drainage-lines cannot be the mere fortuitous result of some operation that took place entirely independent of the flow of water. The valley-systems and drainage-lines are so intimately related that we are compelled to trace them backward to some common origin.

An attentive study of what is now taking place in the channels of brooks and rivers shows that running water, by bearing along sand and gravel, rubs down the rocks over which it flows, and thus deepens and widens the bed that contains it. All over the globe, and in the most widely diverse kinds of material, this process of excavation may be seen in progress. From the early ages of human observation the fact that water wears down the hardest rocks has been familiar. But the connection of this fact with the history of valleys was not perceived till towards the close of last century. And though there are many regions where the process is far more wonderfully displayed, it was first clearly understood and authentically proclaimed in Scotland. Hutton, in his immortal *Theory of the Earth*, declared that 'the mountains have been formed by the hollowing out of the valleys, and the valleys have been hollowed out by the attrition of hard materials coming from the mountains.'¹ His friend and illustrator, Playfair, expounded and enforced the same doctrine in his own characteristically lucid and elegant language. 'If, indeed,'

¹ *Theory of the Earth*, vol. ii. p. 401.