

so hard, that it could only be broken by the hammer.

The vitreous rock which composes the interior mass of the globe, is harder than common glass. But it is not harder than certain volcanic lavas, and much softer than cast iron, which, however, is only glass mixed with ferruginous particles. This great hardness of the interior rock shows that it consists of the most fixed particles of matter, and that, from the time of their consolidation, they assumed the consistence and hardness which they still possess. Hence it cannot be objected to my hypothesis of general vitrification, that bodies reduced to glass by our furnaces are less hard than the rock of the globe; since cast iron, some lavas, or basalts, and even certain porcelains, are harder than this rock, and yet they derive their hardness from the action of fire alone. Besides, the elements of iron and other minerals which give hardness to matters liquified by fire, or attenuated by water, existed, as well as the fixed earth, from the time that the globe was first consolidated: And I have already remarked, that the interior rock ought not to be regarded as pure glass, similar to that we make with sand and salts, but as a vitreous product mixed with matters the most fixed, and most capable of supporting the great and long continued action of the primitive fire, the great effects of which can only be compared

in

in a very distant manner with the inconsiderable operations of our furnaces; and yet, from this comparison, though unfavourable, we clearly perceive what effects are common to the primitive fire and to our furnaces; and it shows, at the same time, that the degree of hardness depends less on the degree of heat than on the combination of matters submitted to its action.

V.

Of the Inclination of the Strata in the Mountains.

I Remarked, in vol. i. p. 15. that, *in plains, the strata are exactly horizontal. It is in the mountains only that they are inclined to the horizon; because they have originally been formed by sediments deposited upon an inclined base.*

The beds of calcareous matters are not only horizontal in the plains, but likewise in all mountains which have not been disturbed by earthquakes or other accidental causes: And, when the strata are inclined, the whole mountain is likewise inclined, and has been forced into that position by a subterraneous explosion, or by the sinking of a part of the earth, which had served it as a basis. We may therefore conclude, in general, that all strata formed by the sediments of water are horizontal, like the

E 2

water

water itself, except those which have been formed on an inclined base, as is the case with the most part of coal-mines.

The most external part of the earth, whether in plains or mountains, is solely composed of vegetable earth, which owes its origin to sediments of the air, of vapours, and of dews, and to the successive destruction of herbs, leaves, and other parts of decomposed plants. This first stratum every where follows the declivities and curvatures of the earth, and is more or less thick according to particular local circumstances*. The vegetable stratum is commonly much thicker in valleys than on hills; and its formation is posterior to that of the primitive strata of the globe, the most ancient and most internal of which have been formed by fire, and the newest and most external have derived their origin from matters transported and deposited in the

* On the tops of some mountains, the surface is absolutely naked, and presents nothing to the view but pure rock, or granite, without any vegetation, except in the small fissures, where the wind has transported sand, and collected the particles of earth which float in the air. At some distance from the last branch of the Nile, there is a mountain composed of granite, of porphyry, and of jasper, which extends more than twenty leagues in length, by perhaps an equal number in breadth. The surface of the summit of this enormous quarry, we are assured, is absolutely devoid of vegetables, and forms a vast desert, where neither quadrupeds, nor birds, nor even insects, can exist. But exceptions of this kind, which are particular and local, merit no consideration.

form

form of sediments by the motion of the waters. These, in general, are horizontal; and it is only by the action of particular causes that they sometimes appear inclined. The beds of calcarious stones are commonly horizontal, or slightly inclined; and, of all calcarious substances, the beds of chalk preserve their horizontal position most exactly. As chalk is only the dust of decayed calcarious bodies, it has been deposited by waters whose movements were tranquil, and their oscillations regular; whilst the matters which were only broken into large masses, have been transported by currents, and deposited by the removal of the waters; which is the reason why their strata are not so perfectly horizontal as those of chalk. The high coasts of Normandy are composed of horizontal strata of chalk so regularly perpendicular, that, at a distance, they have the appearance of fortified walls. Between the strata of chalk there are small beds of black flint, which give rise to the black veins in white marble.

Beside the calcarious shells, the strata of which are slightly inclined, and whose position has never been changed, there are many others which have been deranged by different accidents, and which are all much inclined. Of these there are many examples in various parts of the Pyrenees, some of which are inclined forty-five, fifty, and even sixty degrees below the horizon-

E 3

tal

tal line. This circumstance seems to prove, that great changes have been produced in these mountains by the sinking of subterraneous caverns which had formerly supported them.

VI.

Of the Peaks of Mountains.

I Endeavoured to explain, vol. i. p. 247. how the peaks of mountains had been deprived of the vitrifiable sands with which they had been originally invested; and my explanation errs in this circumstance only, that I attributed the first formation of the rocks which form the nuclei of these peaks to the intervention of water, instead of ascribing it to the action of fire. These peaks or horns of mountains are nothing but prolongations of the interior rock of the globe, which were environed with great quantities of scorix and dust of glass. These loose materials must have been carried down by the movement of the sea, when it made its retreat. Afterwards, the rains and torrents of water would soon deprive the masses of pure rock of all their coverings, and make them completely bare, as they are at present. I may remark, in general, that no other change falls to be made in my theory of the earth than the following fact, that

that the first mountains derived their origin from the primitive fire, and not from the intervention of water, as I had conjectured; because I had then been induced to believe, by the authority of Woodward and some other naturalists, that shells were found on the tops of all mountains. But, from more recent observations, it appears, that there are no shells on the highest summits, nor above two thousand fathoms above the level of the sea. Hence the waters have never surmounted those high summits, or at least have remained but a short time upon them; so that they have formed only the hills and the calcareous mountains, which never rise to the height of two thousand fathoms.