Thus we have given a view of Mr Houel’s theory, ac­cording to which volcanoes originally began at the bottom of the ſea ; and not only the mountain, but all the adjoin­ing country, was formed by ſucceſſive eruptions. It is rather a theory of mountains raiſed by ſubterraneous heat than of volcanoes, and does not attempt to explain the origin of the fire, which is the principal difficulty ; neither does his theory accouut for the immenſe height to which matters are ſometimes thrown during eruptions. This indeed it is impoſſible to account for, without ſupposing that the reſiſtance of the air is diminiſhed. The exceſſive oppoſition of the atmoſphere to bodies moving with very great degrees of velocity has been taken notice of under the article Gunnery. If it has ſo much effect then upon ſolid and round globes of iron, what ought it to be on irregular masses of rock, or ſtreams of liquid lava? Nevertheleſs, in the great eruption of Veſuvius in 1779, Sir William Hamilton informs us, that a vaſt ſtream of lava was projected to the height of at leaſt 10,000 feet above the top of the mountain. Had the air resiſted this liquid matter as it does a cannon-ball, it must have been daſhed in pieces almoſt as ſoon as it issued from the crater. Either the extreme heat of the lava, therefore, or ſome other cauſe, muſt have contributed very much to diminiſh, or rather, in a manner to annihilate the reſistance of the atmosphere at that time. As for the lighter materials, though they may be ſuppoſed to be carried to a vast diſtance by the wind, after being projected to a great height in the air, it is inconceivable how their motion was not ſuddenly ſtopped, and they ſcattered all around the top of the volcano by the violence of the blast. Substances of this kind, when quietly carried up with ſmoke, will indeed fly to a great diſtance ; for we are aſſured, that the aſhes of the great fire at London in 1666 were carried by the wind to the diſtance of 16 miles. It is therefore the leſs incre­dible, that thoſe of the great eruption of Veſuvius in 1779 ſhould be carried to the diſtance of 100 miles, as we are in­formed was the case.

To account for the volcanic fire, Dr Woodward and others have had recourſe to the hypotheſis of a central fire, to which the volcanoes are only ſo many chimneys or ſpiracles. Dr Hutton, in his theory of the earth, adopts the same opi­nion ; but as it did not immediately concern the ſubject of which he treated, he evades any queſtion concerning its ori­gin, by declaring himſelf ſatisfied of its exiſtence without any inquiry into its origin.

Others, as Dr Lifter, have had recourſe to the well known experiment of the fermentation of ſulphur and iron, which will take fire when mixed in conliderable quantity, and moiſtened with water. Pyrites, therefore, which are a natural mix­ture of theſe two ſubſtances, it is ſuppoſed, may naturally give riſe to volcanoes. Inſtances are indeed adduced, which undeniably prove that theſe ſubſtances will spontaneouſly take fire when thrown together in large heaps. Of this we have a remarkable example in the following anecdote. —“ A covetous copperas maker at Deptford having bought up all the pyrites he could find, in order to ruin the trade of his neighbours, collected a vast quantity below a ſhade in order to secure them from the rain. He was ſoon, however, puniſhed for his avarice ; for the pyrites began to ſmoke, glowed like red-hot coals, and melted into a kind of vitri­fied and partly metallic ſubſtance, grievouſly annoying the neighbourhood for a long time with the ſulphureous fleam they emitted.” Beds of pyrites, therefore, taking fire in the earth by means of a fermentation occaſioned by water, are now generally suppoſed to be the cauſe of volcanoes; and the obſervation, that volcanoes are generally near the sea, is thought to confirm this hypotheſis.

When the matter is properly conſidered, however, it muſt be evident, that neither of theſe hypotheſes can answer the purpoſe. The central fire of Dr Woodward and others is a cauſe too magnificent even for volcanoes. If any ſuch fire is ſuppoſed, we muſt imagine a burning globe in the centre of the earth, whoſe heat is ſufficient to vitrify the most ſolid and refractory terreſtrial ſubſtances. But of what dimenſions are we to ſuppoſe this globe ? Is it one, two, three, four, or more thouſands of miles in diameter ?—Very large indeed it muſt be; for we could ſcarce ſuppoſe that ſtones could be projected even from the depth of 500 miles into the air. But even this ſuppoſition is inadmiſſible; for as the fire of volcanoes is at times exceedingly augmented from ſome cauſe or other, were this cauſe general, as it muſt be in caſe of a burning central globe, the whole number of volca­noes exiſting on earth would be in a ſtate of eruption at once. Beſides, if we were to ſuppoſe a burning globe of 7000 miles in diameter to ſuffer the leaſt dilatation through­out its vaſt bulk, which muſt be the undoubted conlequence of an augmentation of heat from any unknown cauſe, all the volcanoes in the world would not be ſufficient to give vent to it, though they ſhould spout forth incessant cataracts of lava for centuries together. A dissolution of the whole globe muſt therefore undoubtedly take place; and though we ſhould lessen the diameter of our burning globe by 1000 miles, our difficulties will be as far from being removed as before.

Volcanic fire, therefore, cannot originate from any ge­neral collection of burning materials diſperſed throughout the vaſt maſs of ſolid earth which lies betwixt the ſurface and the centre. All the volcanoes at preſent in an active ſtate would not be ſuch a vent for that fire as a tobacco- pipe would be to a glaſs-houſe furnace. We muſt have re­courſe then to ſome operation by which we know that na­ture can kindle and extinguiſh fires occaſionally ; and if we can suppoſe ſuch an operation to take place in the bowels of the earth, we may then reaſonably conclude, that we have diſcovered a cauſe adequate to the production of vol­canoes. Such a cauſe, however, cannot be pyrites, ſul­phur, or nitre, in any quantity under the ſurface of the earth. It is impoſſible that beds of pyrites can remain for thousands of years under the ſame part of the ſurface of the earth, be occaſionally inflamed and ejected, and after­wards undergo a renovation, in order to enable them to go through a ſimilar operation. Nitre is never found in a foſſil ſtate ; nor can it be inflamed in ſuch a manner as to make any conſiderable exploſion without a thorough mix­ture with ſulphur and charcoal ; neither would all the quan­tity which we can ſuppoſe to exiſt under the baſe of any mountain in the world be ſufficient to give force to *one* of thoſe dreadful volleys which are discharged by volcanoes an hundred times in a day. Beſides, neither pyrites nor ſulphur can be inflamed without access of air ; which can­not take place in the bowels of the earth ; for it muſt be remembered, that the first queſtion is concerning the means by which the fire was originally kindled. Most writers, how­ever, ſeem to overlook this difficulty, and to be ſolicitous only about the immediate cauſe of the exploſive force, which is generally aſcribed to ſteam of one kind or other. Mr Houel in general calls it the force of fire, or of ſteam ; though he does not enter very particularly into its nature. Mr Whitehurst ſays, that it is the force of “ fire and water, which is the primary agent in all ſuch operations of nature." He alſo gives a figure, ſhowing how, by means of confined ſteam, a jet, either of hot water or of liquid fire, may be produced. But this applies only to a particular caſe, which we cannot ſuppoſe always to happen; but volcanoes are conſtantly attended with explosions ; nay, ſo great is the ten­dency of volcanic matters to this violent operation, that many ſtones have been observed to built in the air like