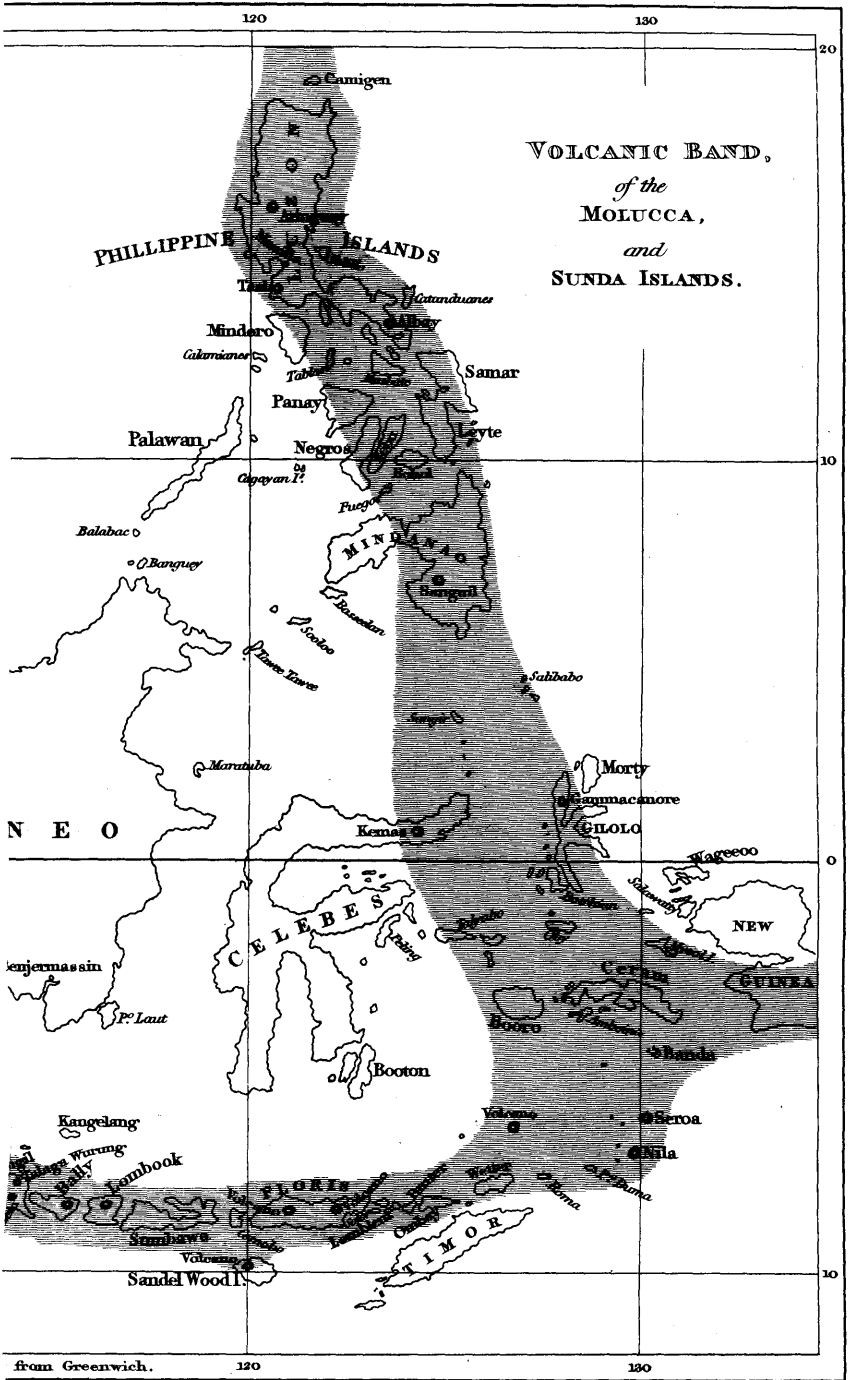


CHAPTER XIX.

History of the volcanic eruptions in the district round Naples—Early convulsions in the island of Ischia—Numerous cones thrown up there—Epomeo not an habitual volcano—Lake Avernus—The Solfatara—Renewal of the eruptions of Vesuvius A.D. 79—Pliny's description of the phenomena—Remarks on his silence respecting the destruction of Herculaneum and Pompeii—Subsequent history of Vesuvius—Lava discharged in Ischia in 1302—Pause in the eruptions of Vesuvius—Monte Nuovo thrown up—Uniformity of the volcanic operations of Vesuvius and the Phlegræan Fields in ancient and modern times.

WE shall next present the reader with a sketch of the history of some of the volcanic vents dispersed throughout the great regions before described, and consider attentively the composition and arrangement of their lavas and ejected matter. The only volcanic region known to the ancients, was that of which the Mediterranean forms a part; and they have transmitted to us very imperfect records of the eruptions in three principal provinces of that region, namely, the district round Naples; that of Sicily and its isles; and that of the Grecian Archipelago. By far the most connected series of records throughout a long period relates to the first of these districts; and these cannot be too attentively considered, as much historical information is indispensable in order to enable us to obtain a clear view of the connexion and alternate mode of action of the different vents in a single volcanic group. The Neapolitan volcanos extend from Vesuvius, through the Phlegræan Fields, to Procida and Ischia, in a somewhat linear arrangement, ranging from the north-east to the south-west, as will be seen in the annexed map. (Pl. 3.) Within the space above limited, the volcanic force is sometimes developed in single eruptions from a considerable number of irregularly scattered points; but a great part of its action has been confined to one principal and habitual vent, Vesuvius or Somma. Before the Christian era, from the remotest periods of which we have any tradition, this principal

[In the original publication, the map on the following two pages was printed as a fold-out.]



from Greenwich.

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vent was in a state of inactivity. Terrific convulsions then took place from time to time in Ischia (Pithecusa), and seem to have extended to the neighbouring isle of Procida (Prochyta), for Strabo* mentions a story of the latter having been torn asunder from Ischia; and Pliny † derives its name from its having been poured forth by an eruption from Ischia. So violent were the earthquakes and volcanic explosions to which Ischia was subject, that Typhon the giant, “from whose eyes and mouth fire proceeded, and who hurled stones to heaven with a loud and hollow noise,” was said to lie buried beneath it. The present circumference of the island along the water’s edge is eighteen miles, its length from west to east about five, and its breadth from north to south three miles. Several Greek colonies which settled there before the Christian era were compelled to abandon it in consequence of the violence of the eruptions. First the Erythræans, and afterwards the Chalcidians, are mentioned as having been driven out by earthquakes and igneous exhalations. A colony was afterwards established by Hiero, king of Syracuse, about three hundred and eighty years before the Christian era; but when they had built a fortress, they were compelled by an eruption to fly, and never again returned. Strabo tells us that Timæus recorded a tradition that a little before his time Epomeus, the principal mountain in the centre of the island, vomited fire during great earthquakes; that the land between it and the coast had ejected much fiery matter which flowed into the sea, and that the sea receded for the distance of three stadia, and then returning, overflowed the island. This eruption is supposed by some to have been that which formed the crater of Monte Corvo on one of the higher flanks of Epomeo, above Foria, the lava-current of which may still be traced, by aid of the scorïæ on its surface, from the crater to the sea. To one of the subsequent eruptions in the lower parts of the isle, which caused the expulsion of the first Greek colony, Monte Rotaro has been attributed, and it bears every mark of recent origin. The cone is remarkably perfect, and has a crater on its summit precisely resembling that of Monte Nuovo; but the hill is larger, and resembles some of the more considerable cones of single eruption near Clermont in

* Lib. v.

† Nat. Hist., lib. iii., c. 6.

Auvergne, and, like some of them, it has given vent to a lava-stream at its base, instead of its summit. A small ravine swept out by a torrent exposes the structure of the cone, which is composed of innumerable inclined and slightly undulating layers of pumice, scoriæ, white lapilli, and enormous angular blocks of trachyte. These last have evidently been thrown out by violent explosions, like those which, in 1822, launched from Vesuvius a mass of pyroxenic lava, of many tons weight, to the distance of three miles, which fell in the garden of Prince Ottajano. The cone of Rotaro is covered with the arbutus, and other beautiful evergreens. Such is the strength of the virgin soil, that the shrubs have become almost arborescent; and the growth of some of the smaller wild plants has been so vigorous, that botanists have scarcely been able to recognise the species. The eruption whereby the Syracusan colony was dislodged, is supposed to have given rise to that mighty current which forms the promontory of Zaro and Caruso. The surface of these lavas is still very arid and bristling, and is covered with black scoriæ; so that it is not without great labour that human industry has redeemed some small spots, and converted them into vineyards. From the date of the great eruption last alluded to, down to our own time, Ischia has enjoyed tranquillity, with the exception of one emission of lava hereafter to be described, which, although it occasioned much local damage, does not appear to have devastated the whole country, in the manner of more ancient explosions.

The population of the isle amounts at present to about twenty-five thousand, and is on the increase. They are supported almost entirely on the production of their vineyards. The lofty central hill, Epomeo or S. Nichola, on this island, is composed of greenish indurated tuff, of a prodigious thickness, interstratified in some parts with argillaceous marl, and, here and there, with great streams of indurated lava. Visconti ascertained, by trigonometrical measurement, that this mountain was 2605 feet above the level of the sea. In mineral composition and in form, as seen from many points of view, it resembles the hill to the north of Naples, on the summit of which stands the convent of Camaldoli, which is 1643 feet in height. Both these mountains, like the greater part of those in the Terra di Lavoro, are of subaqueous origin; although it has frequently

happened to them, as to Epomeo, that, after being elevated above the level of the sea, fresh eruptions have broken through at different points. I found more than one argillaceous stratum containing marine shells, within eight hundred feet of the summit of Epomeo; and from this circumstance, and from the general structure of the mountain, I am compelled to dissent from the opinion expressed by Mr. Scrope, who supposed it to have been once a great habitual volcano, like Vesuvius*. At least it is certain, that if any one of the cones on the present mountain gave vent to several streams of lava in succession, this happened when the whole mass was still beneath the level of the sea. Brocchi long ago announced, that the igneous rocks of this island rest on a plastic clay containing shells. Of these a considerable number have now been obtained, and identified with species still living in the Mediterranean. There are, upon the whole, on different parts of Epomeo, or scattered through the lower tracts of the island, twelve considerable volcanic cones, which have been thrown up since the island was raised above the surface of the deep; and many streams of lava may have flowed, like that of "Arso" in 1302, without cones having been produced; so that this isle may, for ages before the period of the remotest traditions, have served as a safety-valve to the whole Terra di Lavoro, while the fires of Vesuvius were dormant. It seems also clear, that Avernus, a circular lake near Puzzuoli, about half a mile in diameter, which is now a salubrious and cheerful spot, once exhaled mephitic vapours, such as are often emitted by craters after eruptions. There is no reason for discrediting the account of Lucretius†, that birds could not fly over it without being stifled, although they may now frequent it uninjured. There must have been a time when this crater was in action; and for many centuries afterwards it may have deserved the appellation of "atri janua Ditis," emitting, perhaps, gases as destructive of animal life as those suffocating vapours which were given out by Lake Quilotoa, in Quito, in 1797, by which whole herds of cattle on its shores were killed ‡, or as those deleterious

* Geol. Trans., vol. ii., part 3, p. 388; second series.

† De Rerum Nat., VI., 740.—Mr. Forbes on the Bay of Naples, Edin. Journ. of Science, No. 3, *new series*, p. 87, Jan. 1830.

‡ Humboldt, *Voy.*, p. 317.

emanations which annihilated all the cattle in the island of Lancerote, one of the Canaries, in 1730*. Bory St. Vincent mentions, that in the same isle birds fell lifeless to the ground ; and Sir William Hamilton informs us that he picked up dead birds on Vesuvius during an eruption. The Solfatara, also, near Puzzuoli, which may be still considered as a half-extinguished crater, appears, by the accounts of Strabo and others, to have been before the Christian era in very much the same state as at present, giving vent continually to aqueous vapour, together with sulphureous and muriatic acid gases, similar to those evolved by Vesuvius.

Such, then, were the points where the subterranean fires obtained vent, from the earliest period to which tradition reaches back, down to the first century of the Christian era ; but we then arrive at a crisis in the volcanic action of this district—one of the most interesting events witnessed by man during the brief period throughout which he has observed the physical changes on the earth's surface. From the first colonization of Southern Italy by the Greeks, Vesuvius afforded no other indications of its volcanic character than such as the naturalist might infer, from the analogy of its structure to other volcanos. These were recognised by Strabo, but Pliny did not include the mountain in his list of active vents. The ancient cone was of a very regular form, terminating, not as at present, in two peaks, but with a flattish summit, where the remains of an ancient crater, nearly filled up, had left a slight depression, covered in its interior by wild vines, and with a sterile plain at the bottom. On the exterior, the flanks of the mountain were covered with fertile fields richly cultivated, and at its base were the populous cities of Herculaneum and Pompeii. But the scene of repose was at length doomed to cease, and the volcanic fire was recalled to the main channel, which, at some former unknown period, had given passage to repeated streams of melted lava, sand, and scoriæ. The first symptom of the revival of the energies of this volcano was the occurrence of an earthquake in the year 63 after Christ, which did considerable injury to the cities in its vicinity. From that time to the year 79 slight shocks were frequent, and in the month of August of that

* Von Buch, *Ub. einen vulcanisch. Ausbruch auf der Insel Lanzerote.*

year they became more numerous and violent, till they ended at length in an eruption. The elder Pliny, who commanded the Roman fleet, was then stationed at Misenum; and in his anxiety to obtain a near view of the phenomena, he lost his life, being suffocated by sulphureous vapours. His nephew, the younger Pliny, remained at Misenum, and has given us, in his Letters, a lively description of the awful scene. A dense column of vapour was first seen rising vertically from Vesuvius, and then spreading itself out laterally, so that its upper portion resembled the head, and its lower the trunk of the pine, which characterizes the Italian landscape. This black cloud was pierced occasionally by flashes of fire as vivid as lightning, succeeded by darkness more profound than night. Ashes fell even upon the ships at Misenum, and caused a shoal in one part of the sea—the ground rocked, and the sea receded from the shores, so that many marine animals were seen on the dry sand. The appearances above described agree perfectly with those witnessed in more recent eruptions, especially those of Monte Nuovo in 1538, and of Vesuvius in 1822. In all times and countries, indeed, there is a striking uniformity in the volcanic phenomena; but it is most singular that Pliny, although giving a circumstantial detail of so many physical facts, and enlarging upon the manner of his uncle's death, and the ashes which fell when he was at Stabiae, makes no allusion whatever to the sudden overwhelming of two large and populous cities, Herculaneum and Pompeii.

All naturalists who have searched into the memorials of the past, for records of physical events, must have been surprised at the indifference with which the most memorable occurrences are often passed by, in the works of writers of enlightened periods; as also of the extraordinary exaggeration which usually displays itself in the traditions of similar events, in ignorant and superstitious ages. But, of all omissions, the most inexplicable, perhaps, is that now under consideration; and we have no hesitation in saying, that had the buried cities never been discovered, the accounts transmitted to us of their tragical end would have been discredited by the majority, so vague and general are the other narratives, or so long subsequent to the event. Tacitus, the friend and contemporary of Pliny, when adverting in general terms to the convulsion, says merely that

“cities were consumed or buried*.” Suetonius, although he alludes to the eruption incidentally, is silent as to the cities. They are mentioned by Martial, in an epigram, as immersed in cinders; but the first historian who alludes to them by name is Dion Cassius†, who flourished about a century and a half after Pliny. He appears to have derived his information from the traditions of the inhabitants, and to have recorded, without discrimination, all the facts and fables which he could collect. He tells us, “that during the eruption, a multitude of men of superhuman stature, resembling giants, appeared sometimes on the mountain and sometimes in the environs—that stones and smoke were thrown out, the sun was hidden, and then the giants seemed to rise again, while the sounds of trumpets were heard, &c., &c.; and finally two entire cities, Herculaneum and Pompeii, were buried under showers of ashes, while all the people were sitting in the theatre.” That many of these circumstances were invented, would have been obvious, even without the aid of Pliny’s Letters; and the examination of Herculaneum and Pompeii enables us to prove, that none of the people were destroyed in the theatres, and, indeed, that there were very few of the inhabitants who did not escape from both cities. Yet some lives were lost, and there was ample foundation for the tale in its most essential particulars. This case may often serve as a caution to the geologist, who has frequent occasion to weigh, in like manner, negative evidence derived from the silence of eminent writers, against the obscure but positive testimony of popular traditions. Some authors, for example, would have us call in question the reality of the Ogygian deluge, because Homer and Hesiod say nothing of it. But they were poets, not historians, and they lived many centuries after the latest date assigned to the catastrophe. Had they even lived at the time of that flood, we might still contend that their silence ought, no more than Pliny’s, to avail against the authority of tradition, however much exaggeration we may impute to the latter.

It does not appear that in the year 79 any lava flowed from Vesuvius; the ejected substances, perhaps, consisted

* *Haustæ aut obrutæ urbes.* Hist., lib. 1

† Hist. Rom., lib. 66.

entirely of lapilli, sand, and fragments of older lava, as when Monte Nuovo was thrown up in 1538. The first era at which we have authentic accounts of the flowing of a stream of lava, is the year 1036, which is the seventh eruption from the revival of the fires of the volcano. A few years afterwards, in 1049, another eruption is mentioned, and another in 1138 (or 1139), after which a great pause ensued of one hundred and sixty-eight years. During this long interval of repose, two minor vents opened at distant points. In the first place it is on tradition that an eruption took place from the Solfatara in the year 1198, during the reign of Frederic II., Emperor of Germany; and although no circumstantial detail of the event has reached us from those dark ages, we may receive the fact without hesitation*. Nothing more, however, can be attributed to this eruption, as Mr. Scrope observes, than the discharge of a light and scoriform trachytic lava, of recent aspect, resting upon the strata of loose tufa which covers the principal mass of trachyte †. The other occurrence is well authenticated,—the eruption, in the year 1302, of a lava-stream, from a new vent on the south-east side of the island of Ischia. During part of 1301, earthquakes had succeeded one another with fearful rapidity; and they terminated at last with the discharge of a lava-stream from a point named the Campo del Arso, not far from the town of Ischia. This lava ran quite down to the sea—a distance of about two miles: in colour it varies from iron-grey to reddish black, and is remarkable for the glassy felspars which it contains. Its surface is almost as sterile, after a period of five centuries, as if it had cooled down yesterday. A few scantlings of wild thyme, and two or three other dwarfish plants, alone appear in the interstices of the scoriæ, while the Vesuvian lava of 1767 is already covered with a luxuriant vegetation. Pontanus, whose country-house was burnt and overwhelmed, describes the dreadful scene as having lasted two months ‡. Many houses were swallowed up, and a partial emigration of the inhabitants followed. This eruption produced no

* The earliest authority, says Mr. Forbes, given for this fact, appears to be Capaccio, quoted in the *Terra Tremante* of Bonito. *Edin. Journ. of Sci., &c.* No. I., new series, p. 127, July, 1829.

† *Geol. Trans.*, vol. ii., part 3, p. 346, second series.

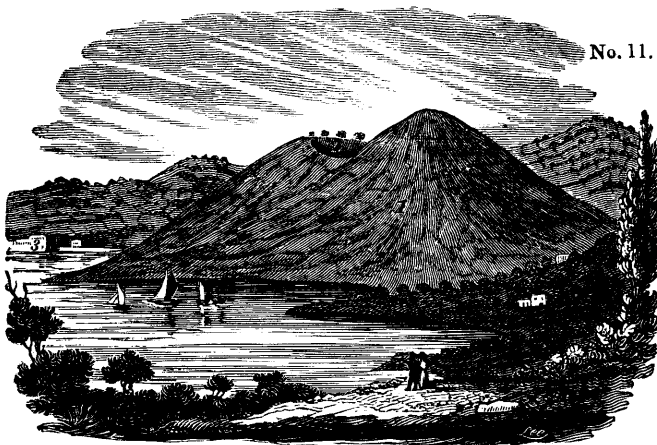
‡ *Lib. vi., de Bello Neap.*, in *Grævii Thesaur.*

cone, but only a slight depression, hardly deserving the name of a crater, where heaps of black and red scoriæ lie scattered around. Until this eruption, Ischia is generally believed to have enjoyed an interval of rest for about seventeen centuries; but Julius Obsequens*, who flourished A.D. 214, refers to some volcanic convulsion in the year 662, after the building of Rome. (91 B.C.) As Pliny, who lived a century before Obsequens, does not enumerate this among other volcanic eruptions, the statement of the latter author is supposed to have been erroneous; but it would be more consistent, for reasons before stated, to disregard the silence of Pliny, and to conclude that some subterranean commotion, probably of no great violence, happened at the period alluded to.

To return to Vesuvius,—the next eruption occurred in 1306; between which era and 1631 there was only one other (in 1500), and that a slight one. It has been remarked, that throughout this period Etna was in a state of such unusual activity as to lend countenance to the idea that the great Sicilian volcano may sometimes serve as a channel of discharge to elastic fluids and lava that would otherwise rise to the vents in Campania. The great pause was also marked by a memorable event in the Phlegræan Fields—the sudden formation of a new mountain in 1538, of which we have received authentic accounts from contemporary writers. Frequent earthquakes, for two years preceding, disturbed the neighbourhood of Puzzuoli; but it was not until the 27th and 28th of September, 1538, that they became alarming, when not less than twenty shocks were experienced in twenty-four hours. At length, on the night of the 29th, two hours after sunset, a gulph opened between the little town of Tripergola, which once existed on the site of the Monte Nuovo, and the baths in its suburbs, which were much frequented. This watering place contained a hospital for those who resorted thither for the benefit of the thermal springs, and it appears that there were no fewer than three inns in the principal street. A large fissure approached the town with a tremendous noise, and began to discharge pumice-stones, blocks of unmelted lava and ashes mixed with water, and occasionally flames. The ashes fell in immense

* Prodig. libell., c. 114.

quantities, even at Naples ; while the neighbouring Puzzuoli was deserted by its inhabitants. The sea retired suddenly for two hundred yards, and a portion of its bed was left dry. We shall afterwards, when treating of earthquakes, show by numerous proofs derived not only from the state of the Temple of Serapis (see Frontispiece), but from many other physical phenomena, that the whole coast, from Monte Nuovo to beyond Puzzuoli, was at that time upraised to the height of many feet above the bed of the Mediterranean, and has ever since remained permanently elevated. On the 3rd of October the eruption ceased, so that the hill (fig. 1, No. 11), the great mass of which was thrown up in a day and a night, was accessible ; and those who ascended reported that they found a funnel-shaped crater on its summit. (Fig. 2, No. 11.)



Monte Nuovo, formed in the Bay of Baia, September 29th, 1538.

1. Cone of Monte Nuovo.
2. Brim of crater of ditto.
3. Thermal spring, called Baths of Nero, or Stufe di Tritoli.

The height of Monte Nuovo has recently been determined, by the Italian mineralogist Pini, to be four hundred and forty English feet above the level of the bay ; its base is about eight thousand feet, or nearly a mile and a half, in circumference. According to Pini, the depth of the crater is four hundred and twenty-one English feet from the summit of the hill, so that its bottom is only nineteen feet above the level of the sea. No lava flowed from this cavity, but the ejected

matter consisted of pumiceous scoriæ and masses of trachyte, many of them schistose, and resembling clinkstone. The Monte Nuovo is declared, by the best authorities, to stand partly on the site of the Lucrine lake (fig. 4, No. 12*), which



The Phlegræan Fields.

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| 1. Monte Nuovo. | 2. Monte Barbaro. |
| 3. Lake Avernus. | 4. Lucrine Lake. |
| 5. The Solfatara. | 6. Puzzuoli. |
| 7. Bay of Baiæ. | |

was nothing more than the crater of a pre-existent volcano, and was almost entirely filled during the explosion of 1538. Nothing now remains but a shallow pool, separated from the sea by an elevated beach, raised artificially.

Immediately adjoining to Monte Nuovo is the larger volcanic cone of Monte Barbaro (fig. 2, No. 12), the Gaurus inanis of Juvenal—an appellation given to it probably from its deep circular crater, which is about a mile in diameter. Large as is this cone, it was probably produced by a single eruption; and it does not, perhaps, exceed in magnitude some of the largest of those in Ischia, which there is every reason to believe to have been formed within the historical era. It is composed chiefly of indurated tufa, like Monte Nuovo, stratified conformably to its conical surface. This hill was once very celebrated for its wines, and is still covered with vineyards; but

* This representation of the Phlegræan Fields is reduced from part of Plate xxxi. of Sir William Hamilton's great work, "Campi Phlegræi," to which we refer the reader for faithful delineations of the scenery of that country.

when the vine is not in leaf it has a sterile appearance, and late in the year, when seen from the beautiful bay of Baiæ, it often contrasts so strongly in verdure with Monte Nuovo, which is always clothed with arbutus, myrtle, and other wild evergreens, that a stranger might well imagine the cone of older date to be that thrown up in the sixteenth century*. There is nothing, indeed, so calculated to instruct the geologist, as the striking manner in which the recent volcanic hills of Ischia, and that now under consideration, blend with the surrounding landscape. Nothing seems wanting or redundant; every part of the picture is in such perfect harmony with the rest, that the whole has the appearance of having been called into existence by a single effort of creative power. What other result could we have anticipated, if Nature has ever been governed by the same laws? Each new mountain thrown up—each new tract of land raised or depressed by earthquakes—should be in perfect accordance with those previously formed, if the entire configuration of the surface has been due to a long series of similar convulsions. Were it true that the greater part of the dry land originated simultaneously in its present state, and that additions were afterwards made slowly and successively; then, indeed, there might be reason to expect a strong line of demarcation between the signs of ancient and modern changes. But the continuity of the plan, and the perfect identity of the causes, are to many a source of deception, and lead them to exaggerate the energy of agents which operated in the earlier ages. In the absence of all historical information they are as unable to separate the dates of the origin of different portions of our continents, as is the stranger to determine, by their physical features alone, the distinct ages of Monte Nuovo, Monte Barbaro, Astroni, and the Solfatara.

The vast scale and violence of the volcanic operations in Campania, in the olden time, has been a theme of declamation, and has been contrasted with the comparative state of quiescence of this delightful region in the modern era. Instead of inferring, from analogy, that the ancient Vesuvius was always at rest when the craters of the Phlegræan Fields were burning,—that each

* Hamilton observes, (writing in 1770,) "the new mountain produces as yet but a very slender vegetation." This remark was not applicable in 1828.—*Campi Phlegræi*, p. 69.

cone rose in succession,—and that many years, and often centuries of repose intervened between each eruption—geologists seem to have conjectured that the whole group sprung up from the ground at once, like the soldiers of Cadmus when he sowed the dragon's teeth. As well might they endeavour to persuade us that on these Phlegræan Fields, as the poets feigned, the giants warred with Jove, ere yet the puny race of mortals were in being.

For nearly a century after the birth of Monte Nuovo, Vesuvius still continued in a state of tranquillity. There had then been no violent eruption for four hundred and ninety-two years; and it appears that the crater was then exactly in the condition of the present extinct volcano of Astroni, near Naples. Bracini, who visited Vesuvius not long before the eruption of 1631, gives the following interesting description of the interior. "The crater was five miles in circumference, and about a thousand paces deep; its sides were covered with brushwood, and at the bottom there was a plain on which cattle grazed. In the woody parts wild-boars frequently harboured. In one part of the plain, covered with ashes, were three small pools, one filled with hot and bitter water, another salter than the sea, and a third hot but tasteless*." But at length these forests and grassy plains were suddenly consumed—blown into the air, and their ashes scattered to the winds. In December, 1631, seven streams of lava poured at once from the crater, and overflowed several villages on the flanks and at the foot of the mountain. Resina, partly built over the ancient site of Herculaneum, was consumed by the fiery torrent. Great floods of mud were as destructive as the lava itself, as often happens during these catastrophes; for such is the violence of rains produced by the evolution of aqueous vapour, that torrents of water descend the cone, and, becoming charged with impalpable volcanic dust, roll along loose ashes, acquiring such consistency as to deserve their ordinary appellation of "aqueous lavas."

A brief period of repose ensued, which lasted only until the year 1666, from which time to the present there has

* Hamilton's *Campi Phlegræi*, folio, vol. i., p. 62; and Brieslak, *Campanie*, tome i., p. 186.

been a constant series of eruptions, with rarely an interval of rest exceeding ten years. During these three centuries no irregular volcanic agency has convulsed other points in this district. Brieslak remarked that such irregular convulsions had occurred in the Bay of Naples, in every second century, as, for example, the eruption of the Solfatara in the twelfth, of the lava of Arso, in Ischia, in the fourteenth, and of Monte Nuovo in the sixteenth; but the eighteenth has formed an exception to this rule, and this seems accounted for by the unprecedented number of eruptions of Vesuvius during that period; whereas, when the new vents opened, there had always been, as we have seen, a long intermittance of activity in the principal volcano.
