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ART. I. *An Account of the Eruptions of the Volcano of Peuquenes, in the Andes of Chile.* BY JOHN GILLIES, M.D. M.W.S. &c.*

The Volcano of Peuquenes has of late years excited considerable attention in consequence of its frequent eruptions. It is situated in the western ridge of that part of the Cordillera of the Andes, which separates the province of Mendoza from Chile, at the distance of a few miles to the south of the route across these mountains, called the road of the Portillo, or the little door, from that part of the ridge over which the road passes, having some resemblance to a gateway. This route, at certain seasons of the year, is preferred by many travellers to the more frequented one of Uspallata, as, besides several other advantages, it is considerably shorter. On the other hand, being more elevated and farther to the south than the ordinary road, the snow renders it impassable for mules during a greater portion of the year; it is seldom open, even in the most favourable seasons, longer than from Christmas to the end of April.

At this place the Cordillera of the Andes consists of two parallel ridges running nearly south and north, and separated from each other, for the distance of about twenty miles, by the extensive valley of the river Tenuyan. The eastern or Mendoza range is the most elevated, being at the Pass of the Portillo about 14,365 feet above the level of the sea. This chain extends, with very little interruption, from the River of Mendoza, in a southerly direction,

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as far as the River Diamante, a distance of about 140 miles. The western or Chilian range, in which the volcano is situated, has an elevation, where it is crossed by the road, of only 13,210 feet. This ridge extends also a considerable way northwards, whilst a little south of the pass it is continued in a south-easterly direction, and at length joins with the eastern or Portillo range, constituting the southern boundary of the valley of the Tenuyan. This river coming from the north, from the base of the mountain of Topongato, decidedly the most lofty of the Chilian Andes, collects the various streams which water this extensive valley, and reaching the north-eastern base of the Volcano of Peuquenes, sweeps towards the south-eastern extremity of the valley. It then crosses the Portillo chain by a deep chasm or valley, which it seems to have formed for itself, at the distance of about twelve miles south of the pass of the Portillo, and has its exit to the extensive plains of Mendoza, which extend along the eastern base of the Andes. The elevation of the bed of the river Tenuyan, where it intersects the road which crosses the valley, is 7,530 feet above the level of the sea.

From the base of the volcanic mountain on the western and south-western sides, there take origin the Rio del Yeso and Rio del Volcan, which constitute the principal northern branches of the river Maypu in Chile. Travellers crossing from the eastern to the western side of the valley of the Tenuyan, have the summit of the volcano concealed from them by a portion of the same mountain, which juts considerably into the south-western part of the valley; but when upwards of half way from the river to the pass of Peuquenes, a very good view is obtained of it, at the distance of from 8 to 9 miles south by compass. Its summit has a rounded appearance on its eastern side, but to the westward it is rather less elevated, and its surface appears more level: the summit is generally covered with snow, and its elevation cannot be less than 15,000 feet above the level of the sea.

As far as I could learn, no one has yet visited the crater of this volcano. It is stated that the peons in charge of the cattle which graze in the valley of the Tenuyan during the summer months, occasionally ascend the mountain, on the side next the valley, in search of their stray cattle; but having accomplished their object, they have never been prompted by curiosity to visit the crater itself. Although this does not appear when viewed from the valley to be an enterprize of great difficulty, it is reported, that about twenty-five years ago, some Germans made a fruitless attempt to reach its summit from the Chilian side.

Public attention seems to have been principally directed to this volcano, since the occurrence of the great earthquake, which, on the evening of the 19th November 1822, converted the busy port of Valparaiso, and various other places in Chile, into a heap of ruins, and which was felt, though with diminished violence, at

Mendoza, on the eastern side of the Andes, and even as far eastward, as the province of San Luis.

I have been unable to obtain any evidence of its having been in a recent state of activity prior to that event; but since then its eruptions have been very frequent, and have attracted the notice of the inhabitants both of Mendoza and Chile. These eruptions have principally consisted of immense quantities of volcanic ashes or pumice, thrown up in a state of such minute division, and of so little specific gravity, as to be carried by the wind to immense distances. These volcanic products, however, generally fall in the greatest abundance on the mountains and vallies in the neighbourhood, more especially to the eastward. In the valley of the Tenuyan such occurrences have been frequently witnessed by those individuals who pass part of the year there in attendance on their cattle, and likewise by the miners, who live during the whole year near the summit of the lofty mountain of San Pedro Nolasco, in Chile, situated about 30 miles S.W. by W. of the volcano. On my visiting these mines in 1826, I was informed by the principal miner, in charge of the silver mines, who had been resident there during a number of years, that he had seen many of these eruptions since the occurrence of the earthquake already mentioned, and more especially during the preceding year: that they generally commenced with a loud murmuring noise, followed by an explosion, and the eruption of volcanic matter, forming at first a dense cloud over the volcano, and then gradually subsiding, and disappearing in the direction in which the wind might blow at the time, which was almost always eastwards; and he likewise remembered, that although the ashes rarely fell upon any part of the mountain of San Pedro Nolasco, yet the nature of the erupted matter was rendered sufficiently apparent by the gray or ash-coloured tint which it gave to the snow on the tops of the mountains in its vicinity, during some time after the occurrence of an eruption.

During my residence in the city of Mendoza, distant upwards of 90 miles to the N.E. of the volcano, I had only once an opportunity of personally witnessing the fall of one of these showers of volcanic ashes at so great a distance from the place where it had been ejected. This event took place on the 15th December 1824, at 5 P. M.; the day was fine, with a cloudless sky, and a moderate breeze coming from the south-west. For some time before the fall of ashes took place, a dark insulated cloud had been observed in the sky in the direction of Peuquenes, but had altogether disappeared on its occurrence. I succeeded in collecting a small portion of the ashes from the flat roof of a house, and on examination found it to consist of minute particles, of a grayish colour, of small specific gravity, and in appearance not unlike common pumice-stone reduced to powder. On inquiry, I was informed that on various occasions showers of ashes, of a similar description, had fallen at Mendoza. And on the 22d July 1827, one took place, which fell under the ob-

servation of an intelligent friend, who brought me a small portion of the ashes collected on that occasion, which I found to correspond exactly in appearance with what I had myself collected on the 15th December 1824.

A very favourable opportunity presented itself to me, of witnessing another eruption and shower of ashes from the same volcano, on the 1st March 1826, while on a journey to Chile by the route of the Portillo. This journey I was induced to undertake, for the purpose of accompanying a much valued friend, who had come from Buenos Ayres in a very precarious state of health, on which account I recommended this route as the most eligible for an invalid at that season. We had passed the preceding night at the Totoral, a farm house on an estancia, or cattle estate of one of my friends, pleasantly situated on the northern banks of the river Tenuyan, and distant about 65 miles south of the city of Mendoza. In reaching this place, we had travelled on the preceding day along the plains which skirt the Cordillera of the Andes on the eastern side, and in a direction nearly parallel with the mountains, the base of which at the Totoral was distant about 20 miles. We had now therefore to cross the plain in the direction of the pass of the Portillo, bearing from us in the direction of W.S.W. distant about 36 miles. At a little distance to the south of this pass, was to be seen the deep chasm formed across that part of the Andes, along which the river Tenuyan issues from among the mountains.

As our party had been considerably augmented by the accession of another of our countrymen, and two gentlemen of Buenos Ayres, proceeding to Chile on a mission from the Government of that country, a good deal of time was spent in making arrangements, and getting ready to start on so long a journey, so that we did not leave our resting-place until 7 o'clock. The morning was fine and agreeable, the sky free from clouds, and a moderate breeze coming almost in a direct line from that part of the mountains towards which we were travelling. We had not proceeded far on our way, when my fellow travellers, as well as myself, were much annoyed by some minute particles getting into our eyes, and causing considerable uneasiness. At first we imagined that it was occasioned by small particles of sand; but a little reflection soon satisfied us that the breeze was not sufficiently strong to raise up in the air the grains of sand which appeared on some parts of the plain, over which we were travelling; and in this state of uncertainty, one of my fellow travellers, who was covered with a dark-coloured poncho, riding near me, afforded me the means of unveiling the mystery, as I perceived, on looking towards him, that the atmosphere betwixt us, was crowded with innumerable minute flocculent particles of a gray or ash colour, but which, owing to their minuteness, had not before been perceived. It being necessary at the time to keep up with the rest of the party, who were somewhat in advance, I could not delay a sufficient time to collect any considerable portion of these

particles, which I immediately concluded to be volcanic ashes; but while continuing to pursue my journey, I succeeded in securing a small portion, by spreading out the fore part of my poncho, though they were so light that the breeze carried the greater part of them again into the air almost as fast as they fell. The little, however, which I did procure, was sufficient, on examination, to satisfy me of its identity with what I had before collected at Mendoza. These particles were wafted in quick succession by the wind to the eastward, and on looking attentively towards the mountains, I perceived, in the direction of a peaked part of the ridge intervening between the pass of the Portillo and the exit of the river Tenuyan, a dark, hazy cloud, which was evidently altogether composed of the same volcanic ashes, as it appeared exactly in the direction from which the breeze came, and there was no where else to be seen any trace of clouds. It continued visible until near nine o'clock, becoming gradually fainter until it altogether disappeared. Soon afterwards the shower of ashes also ceased, having continued without intermission, for nearly two hours, from the time of our first observing it, during which we had travelled over an extent of about eleven miles. I found on further inquiry of our attendants, that the dark cloud had been noticed by some of them before our departure from the Totoral, but that it had not excited particular attention, until we found ourselves enveloped in the shower of ashes.

Soon after it had ceased, we reached the estancia of the Cienega de Zapata, where we remained a short time, during which, on conversing with the capataz or overseer about the shower of ashes, he informed me that he had witnessed the same phenomena which had attracted our attention: that a short time before sunrise, being on foot, he had heard a distant murmuring noise among the mountains, which was soon followed by a dense column, of a dark appearance resembling smoke, which rose up behind the peaked part of the mountain already mentioned,—that it had gradually subsided into the dark cloud we had afterwards noticed, and was then carried by the wind further to the eastward; and that it had certainly come from the volcano of Peuquenes, which we would afterwards see on our crossing the valley of the Tenuyan, and the western ridge of the Cordillera. When we reached these places a few days afterwards, the volcano was pointed out to us by our guides, at a distance from us of about six miles, but then all was in a state of quiescence, and we saw no traces of the recent eruption.

I have been favoured by my friend Mr. James F. W. Johnston, with the following analysis of the volcanic matter which fell at Mendoza.

“ The substance sent has the external appearance of a gray pumice powder, for which at first sight it might be taken. It behaves differently, however, before the blowpipe, and is of greater specific gravity, (sp. gr. 2.25.) Water separates a light

gray dust with which it is invested, but without dissolving it. The microscope shows the remainder to consist of two parts, the greater of which is composed of small grains of angular quartz, scratching glass,—the less of similar grains of a dark red substance, retaining its colour when heated, and of less specific gravity than the quartz. These red particles are not attracted by the magnet, but are slowly acted upon by muriatic acid, aided by heat. The substance, therefore, consists chiefly of a quartz sand, mixed with grains of one or more compound minerals; and if it has proceeded from a volcano, has probably been the dust of the various volcanic products, collected first on the sides and in the hollows of the crater, and afterwards dislodged and committed to the winds by some eruption more violent than usual.”

ART. II. *Remarks on Mr. George Don's opinion on the varieties of the Scotch Fir, (Pinus Sylvestris.)* By the REV. J. FARQUHARSON, F.R.S. (*Extracted from a Letter to the Editors.*)

I EMBRACE this opportunity of making known the results of very numerous observations which I have recently made on the extensive fir plantations in this neighbourhood, in reference to Mr. Geo. Don's opinions, first made known to me by your note to my paper “On the Native Forests of Aberdeenshire,” Vol. II. p. 6. Every opinion on botanical questions bearing the sanction of that distinguished name, must be treated with high respect; and it is with great deference that I suggest conclusions at variance with his. I find that the horizontal branches, and relatively broad and glaucous leaves, and smooth bark, are very extensively characteristics of such trees, in our fir plantations, as have accidentally abundant room for a free growth. Ought they not, therefore, to be accounted rather symptoms of healthy vegetation, than marks of different species, or even varieties? I can discover no leaves without minute serratures; and although in the broader leaves the serratures are frequently a little turned in from the margin towards the flat side of the leaf, yet the rule is not uniform. In regard to the cones, I find several instances where they vary as much in form on the same tree as they do through the whole plantations; and on the same tree also I find them often varying very considerably in smoothness.

The paucity of the cones, on healthy and vigorous trees, is in accordance with one part of the economy of other species, which seldom produce much fruit while they are going strongly to wood.

But even granting that there are permanent varieties, or distinct species of the Scotch fir, and the full validity of those distinctions which Mr. Don has indicated, I am yet enabled to state one circumstance, which leaves the argument against thick planting in its