adjacent to, the place. Climates are, therefore, frequently of a local nature, by which I mean of small superficial extent. Thus many varieties of climate may coexist about the same parallel of latitude, and even over a very limited portion of that zone. Instead of saying, then, that a whole country such as Britain has a certain mean temperature, as ascertained by lumping together observations made at places of widely different character, level, and exposure, we should rather say that there are in that island mountainous districts with a certain mean temperature, districts of open plain, having another, and sheltered districts and valleys having another; while parts near the sea-shore, have their own peculiar characteristics. To take a familiar case, we may refer to the Isle of Wight, all parts of which, small though the island be, can hardly have the same climate as Bonchurch and Ventnor, which are the favourite retreats of invalids in pursuit of health. That such local atmospheric distinctions do really exist may at once be shown by a reference to the varied distribution of plant life which, though no doubt largely affected by the nature of the soil, is nevertheless to a considerable extent dependent on the existence of certain atmospheric conditions.

If meteorological stations were to be established in some place situate in a low latitude—such, for example, as the Island of Java, we should be told, as I have more than once been in similar cases, that though 4 feet above the ground may be suitable for thermometers in Britain, it would be quite preposterous for so hot a climate as Java. Now if what were wanted was to ascertain the amount of heat emitted directly by the sun, such a statement might be correct; for then the instruments should be kept as clear of terrestrial influence as possible, and by taking proper precautions we might perhaps make our observations indifferently at sea or on land. But these would not be observations of climate. Now, as in the case we have supposed, it is the *climates* of Java and Britain that are to be compared by ascertaining the amount of heat communicated to thermometers by conduction and convection of the air which has been heated by solar, and cooled by terrestrial radiation, the observations must be made on the islands themselves and not on the sea which surrounds them, and by instruments placed at the same level above the surface of the ground. It has been farther objected that in very hot countries there are large districts where canes or other kinds of jungle vegetation rise much *above* the level of the thermometers, while in Britain there is generally a grassy sward nearly 4 feet *below* them. These differing kinds of vegetation nevertheless largely influence the character of climates, and their effects ought not to be eliminated even although it could be done. The results which have been obtained in a jungle should not, however, as I have already said, be mixed up with those of other places which have a free exposure. The truth is that by adopting different kinds of protecting boxes, and by varying sufficiently their levels above the ground, we may so far depress the temperature of a hot country and exalt that of a colder, as *instrumentally* to equalise them.

There is but one mode of getting results which shall be comparable, and that is by adopting the same standard height and the same standard form of protecting box. The results may, however, be vitiated in another way by placing the instruments near or under shelter of buildings, or still more, by the monstrous system of fixing them to the walls of houses; for masses of masonry or other building materials prevent either extreme from being recorded by the instruments. It must also be kept in view that however valuable continuous registrations may be, in showing intermediate variations of temperature, no photographic self-registering thermometer hitherto constructed gives any result which can be regarded as correct because it does not record the temperature of the air of the locality and is not comparable with those of common thermometers, nor even, perhaps, is ever comparable with those of other similar self-recording instruments. The house or framework with which the instruments are necessarily connected cannot fail variously to affect the mercury in the bulb and thus to veil the results. The only mode of counteracting this influence is to have common thermometers in the neighbourhood placed and protected in the usual way and to record their indications eight or twelve times in the course of the twenty-four hours.

It must be kept in view that I have been speaking only of local climates, or those which are subordinate to the *normal climate* due to geographical position. That such great climatic zones due to latitude exist and vary as we recede from the equator towards the poles is abundantly evident, both from the animal and the vegetable world. The best mode of investigating these climatic zones would be to select stations as little affected as possible by surrounding vegetation, the instruments being exposed as freely as possible all round and placed at the same level above the ground, and as nearly as possible at the same level above the sea, so as to avoid confusion with what have been termed the climatic zones of altitude. For this purpose I venture to suggest the use of an instrument which I proposed in 1870,[1] the indications of which depend on the heating up of a *large quantity of water* or other fluid contained in a thin glass globe which is freely exposed to the sun's rays. When the water expands under the influence of heat, the surplus fluid escapes into an adjoining vessel in which it can be afterwards weighed. On the other hand when the fluid is contracted by cold, the deficiency is continuously supplied from a connecting cistern kept always at the same, or sensibly the same, level. By this automatic arrangement the whole of the heat given out, however irregularly, by the sun, is constantly treasured up. The readings of maximum and minimum thermometers would also serve to correct errors due to the proximity of the tubes and cisterns of the instrument to which I have referred. The difference between the results of this and the common thermometer is the continuous registration of the alterations in bulk produced by the variations of temperature; whereas the common thermometer fails to record the many changes that take place between the maximum and minimum readings, and which are due to sudden obscurations and revelations of the sun caused by passing clouds during the day, while the terrestrial radiation at night is similarly affected. Even where this instrument is not used it would I think be an improvement on the present system were maximum and minimum thermometers kept constantly immersed in a large globe of thin glass filled with water.

THOMAS STEVENSON

VOLCANIC PHENOMENA DURING 1875

DR. GUSTAV TSCHERMAK'S *Mineralogische Mittheilungen* (1876, 2) contain a most interesting account of the volcanic occurrences during the year 1875, computed by Prof. C. W. C. Fuchs. In the short introduction Dr. Fuchs expresses his regret that the scientific academies and societies do not give more general attention to this most important branch of geological research, and points out that through the numerous and universal relations of the institutions in question the statistics of volcanic eruptions and earthquakes would become far more correct in details and numbers, than it is in his own power to make them. The publication of the valuable information now given by Prof. Fuchs therefore all the more deserves the highest praise and attention. Dr. Fuchs divides the events into two classes, viz., eruptions and earthquakes. The first volcano treated of is—

Etna.—After the short eruption of August 29, 1874, which lasted until the beginning of September, the mountain was perfectly at rest. Early in January, 1875, there were signs of new activity in the shape of repeated shocks, which, on the 8th, caused considerable damage near Acireale. But the shocks decreased again both in frequency and intensity, and a new period of rest ensued until the beginning of October. At that time a small crater on the south-side of the mountain became slightly active. From December 19, smoke mixed with reddish vapours

[1] *Journ. Scott. Met. Soc.*, vol. iii. p. 114.

was seen to rise, and the reflection of subterraneous fire could be seen from Acireale.

Vesuvius.—With the exception of a small eruption on July 18, 1874, this mountain had only given off clouds of smoke, and had come to complete inactivity by the end of that year. From January 3 to 6, 1875, slight earthquakes and subterraneous noises were remarked, but they remained without further consequences. Only in December the inclination to activity seemed to return. In the interior of the large crater of the last eruption considerable changes took place, a great portion, towards the south-east, fell in, and thick clouds of black smoke rose at this spot. On the 20th the glow of fire was seen in the crater, and all other phenomena increased in intensity, however, without it coming to an eruption by the close of the year.

Iceland.—The eruptions which occurred in this country during 1875 are the most important ones of all. They were numerous and followed each other in quick succession, some of them with extreme intensity. The first one was a side-eruption of the Vatna, which began with vehement earthquakes on January 2. A broad stream of red-hot lava broke forth on the following day and continued to flow until the third week of February. About this time a second eruption began in another locality. This was preceded by a copious fall of ashes spreading over Kelduverfet. The crater of this second eruption lies within one of the largest prehistoric lava-fields, called Odarhaun. A third eruption took place on March 10 to the north of the latter; no less than sixteen small craters ejected masses of red-hot slakes, and more to the west a broad stream of incandescent lava flowed for several days to a distance of 600 yards. The fourth eruption was perceived on the whole of the island. It occurred on March 29 on the Vatna, and was accompanied by loud reports and subterraneous noise. The most remarkable phenomenon in this eruption was an enormous fall of ashes, which was so dense in Oesterland that the sun was darkened and lights had to be lit. The ferry on the Yökul river could not penetrate for several days the enormous masses of floating pumice-stone. The fall lasted five hours in the Yökul Valley, three in the Fljotr Valley, and two at Seydisfjörd. A strong west wind carried particles of these ashes to enormous distances, *i.e.*, to Norway and Sweden. (We have repeatedly reported on the ashes found in those countries at that time, and upon their origin.) Another prolonged eruption took place on April 4. The active crater this time lay to the south of Burfell, and the phenomenon was accompanied by violent explosions and the ejection of high garbs of incandescent slakes. It lasted about twelve days. The next eruption happened between April 20 and 24 in the so-called Oster Mountains. Matter was ejected to an enormous height and streams of lava overflowed the environs to a distance of fifteen miles at a breadth of from 800 to 2,000 metres. Towards the end of June another new crater formed and several lava streams broke forth near Thingö, between Vivatn and the Yökulsan. The last eruption, another very violent one, occurred on August 15 at the same place as the last. Twenty different columns of smoke were ejected, and on the next day slakes and red-hot lava followed.

Kloët.—This volcano, one of the less-known mountains of Java, had a great eruption early in 1875, according to news dated February 3. An enormous stream of lava completely destroyed the settlement of Blikar, besides causing great damage in other localities.

Ceboruco.—This Mexican mountain (situated at lat. 21° 25′ N.), which rises to a height of 480 metres (1,525 metres above sea-level) was believed extinct since the discovery of America, its first historical eruption taking place in 1870. Another great eruption followed on February 11, 1875, together with violent earthquakes, which particularly damaged St. Cristobal and Guadalaxara. On the evening of February 10 a fall of ashes occurred, and a high garb of fire rose in the night.

Mauna Loa.—A crater on the summit of the Mauna Loa, called Mukunweoweo, had an eruption of lava on August 11, 1875, but more detailed accounts have not reached Dr. Fuchs. This is the same crater which sometimes causes the whole island of Hawaii to be covered with the so-called "hair of the Goddess Pele," a fine thread-like obsidian, resembling fine threads of cotton.

Tongariro.—This volcano, situated in New Zealand, was active in the second half of 1875, and from time to time ejected lava and slakes. At intervals great geyser eruptions occurred, and at one time more than fifty jets of hot water, surrounded by vast columns of steam, were counted.

Santorin.—Since the last eruption the fumaroles on the island of Santorin were extremely active. On October 10, 1875, M. Fouqué observed numerous openings ejecting gases, not differing much from air in a chemical sense. During the night they showed the reflection of fire, and the stones surrounding the openings were red-hot. A second group of fumaroles yielded sulphurous, carbonic, and hydrochloric acids, their temperature varying from 110° to 310° C. Yet another group ejected sulphuretted hydrogen, carbonic acid, and water-vapour, at a temperature of 90°-99° C.

Speaking of earthquakes, Dr. Fuchs gives a complete list of all the earthquakes and terrestrial shocks which were felt in different parts of the globe during 1875, and they amounted to no less than ninety-seven in number, occurring on 100 different days. We regret that our space does not permit us to enumerate them, but compels us to confine ourselves to an account of the distribution of their number over the different months. Thus we have in January, 15; February, 7; March, 12; April, 7; May, 9; June, 10; July, 6; August, 5; September, 3; October, 2; November, 9; December, 12. Of fifty-two of which exact details could be obtained, thirty-six occurred in the night. On ten days earthquakes occurred simultaneously in different localities, and fourteen distinct places were repeatedly visited by them during the year. The most lamentable of all—real catastrophes—were those of Cucuta, on May 16–18, destroying several towns and numerous villages, and of St. Cristobal and Guadalaxara (February 11), which reached from the Pacific Ocean to Leon. Very severe were the earthquakes of the Lifu Island (March 28), of Uschak (May 3–5 and 12), of Lahore (December 12), and of Porto Rico (December 21). Altogether Dr. Fuchs estimates the number of lives lost in these earthquakes at 20,000, not to speak of the great damage to property. In conclusion the author gives an account of those earthquakes which were in evident connection with the eruptions of neighbouring volcanoes; and also mentions a few whose causes were undoubtedly not volcanic but mechanical phenomena. In a short appendix Dr. Fuchs gives some details of an eruption which occurred between September 7, 1873, and January 22, 1874, on the Island of Vulcano (one of the Lipari Isles), in continuation of his Report for 1874.

BIOLOGICAL NOTES

Broca's Stereograph.—A very ingenious instrument for taking mathematically accurate drawings of human crania and other objects of natural history, known as Broca's stereograph, has been lately presented to the College of Surgeons by the President, Mr. Prescott Hewett, which will prove a useful adjunct to the systematic study of the important anthropological collection now contained in the museum. It was exhibited and its use demonstrated by Prof. Flower at his concluding lecture on the Comparative Anatomy of Man. Among recent additions to this department of the collection are the valuable series of skulls of natives of New Guinea, collected by Dr. Comrie, Staff-Surgeon R.N. of H.M.S. *Basilisk*, described in the last number of the *Journal* of the Anthropological Institute; also four of natives of the Navigation or Samoan Islands, presented by Dr. Pye Smith. On several occasions during the course, Prof. Flower pointed out the necessity of far larger series of human skeletons and skulls than are at present contained in our museums, before our knowledge of physical anthropology can be placed on a satisfactory basis, as the individual variations are so great that it is only when a considerable series of any race are brought together that their true characteristics can be determined.

Tendrils of Climbing Plants.—M. Casimir de Candolle publishes some interesting observations on the tendrils of climbing plants in the *Archives des Sciences Physiques et Naturelles* (January). The experiments the author made were suggested to him by reading Mr. Darwin's work on the movements and habits of these plants. With regard to the manner in which the curves of the tendrils which are fixed at both ends are formed, M. de Candolle arrives at the following conclusions:—When a tendril of *Bryonia*, isolated or not, is fixed at both its ends, its upper part soon assumes the shape of a sinuous curve with double curvature, just like that of free tendrils. But this curve