

Proceedings of the London Electrical Society. Part 8.—*By the Society.*

Annual Report of the Council of the Yorkshire Philosophical Society, for 1842.—*By the Society.*

Elements of Agricultural Chemistry. By Sir Humphrey Davy, Bart. (Sixth Edition.)—*By Dr John Davy.*

Proceedings of the Royal Astronomical Society. Vol. V. No. 29.—*By the Society.*

Proceedings of the Royal Society. Nos. 55 & 56.

Revised Instructions for the use of the Magnetic and Meteorological Observatories, and for the Magnetic Surveys. Prepared by the Committee of Physics and Meteorology of the Royal Society.—*By the Royal Society.*

Monday, 1st May 1843.

Sir T. M. BRISBANE, Bart., President, in the Chair.

The following Communications were read :—

1. An attempt to explain the Phenomena of the Freezing Cavern at Orenburg. By Dr Hope.

Dr Hope in the first place read, from the Proceedings of the Geological Society in London, the account of the freezing cavern furnished by the President of the Geological Society of London. This is one of several caves which exist in the southern face of a lengthened low hillock of gypsum. It is entered from the south by a passage rather narrow, and is about fifteen feet high, ten paces long, and seven wide, which seemed to send off irregular fissures into the body of the rock.

The extraordinary feature of this cavern is, that during summer it is so cold that ice is generated in it, and dry icicles hang from its roof; and that, in winter, all appearance of congelation ceases, and the temperature becomes such that the Russians say they could sleep in it without their sheep-skins.

Mr Murchison applied to Sir John Herschel for an explanation, and the theory which he proposed is, that the heat and cold of the surface gradually move, though very slowly, backward into the rock;

that it requires six months for the wave of cold, as he terms it, to reach the cavern, and consequently, that that frigid wave begins to arrive at the commencement of summer, and continues during that season, occasioning such a degree of cold in the cavern as to produce the congelations described by Mr Murchison.

At the commencement of winter, the first effect of the summer's heat arrives, and continues without interruption, and occasions warmth enough to prevent congelation.

Dr Hope entirely concurred with Sir John Herschel in thinking that alternate waves of heat and cold must exist and have a share in producing the phenomena, and in corroboration quoted the observations of Saussure, that at Geneva the winter's cold requires six months to descend $29\frac{1}{2}$ feet, and that the summer's heat penetrates to the same depth in a similar period of time; the maximum of cold taking place at mid-summer, and of heat at mid-winter.

But he also expressed his conviction that these alternate waves were not sufficient to account for the phenomena, further remarking, that were they the only powers employed, the paradoxical phenomena should occur equally in some of the other caverns of the Orenburg hillock, or in other caverns in different quarters of the globe. He observed, that there must be something peculiar to the Illetykaya Zatchita cavern which renders it the only cave in the world which possesses the singular property, so far as he knew. He then alluded to the caverns in different parts of the globe in which accumulations of snow are found in summer, and concurred with Mr Murchison in thinking that they have no analogy with that of Orenburg. They are merely receptacles of the winter snow and ice, and preserve it during summer, after the manner of an ice-house.

The circumstance peculiar to the Orenburg cave is the occurrence of the rents and fissures which rise from the back part of the cavern.

The author stated, that if it were granted that these fissures reach the surface, even by the smallest ramifications, and that they ascend within the reach of the alternate waves of heat and cold, the whole phenomena may be easily and satisfactorily explained. He ascribed the summer's coldness and congelation to a constant current of cold air through the fissures of the rock into the cavern; and he supposed that the current is occasioned in the following manner: When

at the close of spring the temperature of the external air and of that in the rents is the same, no particular occurrence takes place; but as soon as the wave of cold begins to make impression on the rocky parietes of the fissures, then the air in them will be somewhat cooled, contracted, and rendered specifically heavier. This being so, the weight of the column of air in these rents will be greater than that of a column of equal altitude of the external atmospheric air, and the consequence will necessarily be, that the colder air will descend, the warmer atmospheric air from above will supply its place, which, in its turn, will be cooled and descend, and thus a current of cold air through the crevices into and through the cavern will be established. As the temperature of the rocky parietes gradually falls with each successive wave of cold, the air in the fissures will become colder and colder, and in the same proportion will descend more rapidly.

But the rapidity of descent does not only depend upon the increasing coldness of the air in the fissures, but is further augmented by the warmth of the summer expanding the external air, so that the difference of weight between the external and internal columns becomes greater. In the manner now explained, a current of cold air is constantly descending and flowing through the cavern, producing all the surprising frigorific effects displayed within it.

That such a current does exist, Mr Murchison gives a satisfactory proof; he says, “ That upon unlocking the frail door of the cavern, a volume of air, so surpassingly keen, struck the legs and the feet, that he was glad to rush into a cold bath in front of him to equalize the effect.” This downward current will continue the same till the close of autumn, when its course comes to be changed; by that time the first approaches of May’s surface warmth will begin to be experienced, the cold of the sides of the rents begins to diminish, and the temperature of the external air must have fallen to nearly that of the internal current. As soon as an equality between the temperatures and densities of the external and internal columns shall have been established, all current must cease. At this period, namely, the commencement of winter, the wave of the summer’s heat begins to reach both the walls of the air-channels and of the cavern, and gradually communicates a warmth which progressively elevates the temperature, and dissipates every mark of the preceding summer’s congelation. It might at first be reasonably expected, that at this time the preceding order of things would be reversed, and that a current in the opposite direction would

commence, such as, it is known, happens in many mines; for, undoubtedly, the temperature of the atmosphere descending rapidly, the gravity of the external air would soon exceed that of the internal column. A current would immediately commence from below, and, entering from the cavern door and ascending through the rents, escape at the surface. The consequence of such a current would be, that the cold would soon reappear in the cave, and gradually increase during the severity of the winter, and completely overpower the heating influence of the thermal wave, now beginning to operate on the walls of the cavern, and so prevent the warmth of the cave during winter.

An occurrence, however, now takes place which puts a stop to the upward draught, and permits the thermal wave to have its full influence on the temperature of the cavern. The winter commences with repeated falls of snow, which form a thick covering on the surface of the earth, and closes up all the communications between the extremities of the crevices and the external air, and no current can take place. In this manner the influx of the intensely cold air into the cavern, and its ascent through the fissures, is prevented, and then full play is given to the calorific power of the wave of heat which continues to arrive in the cavern through its rocky sides during the whole continuance of winter, and communicates the warmth recorded by Mr Murchison. In the beginning of summer the snows melt, and the terminations and ramifications of the fissures have their communication with the atmosphere restored. The currents, as already described, are re-established, and all the paradoxical phenomena to which they give birth present themselves in due succession.

2. Observations on the Temperature of the Earth in India.

By John Caldecott, Esq. Communicated in a Letter to Professor Forbes.

These thermometers, made by Mr Adie of Edinburgh, were sunk in the ground at Trevandrum, in lat. $8^{\circ} 30' 35''$, to depths of 3, 6, and 12 *French* feet. Mr Caldecott says,—“ I send you herewith the readings of my long thermometers, which, from various causes, I was not able to put into the ground until the 1st of last May (1842). These two months' readings, therefore, will not, of course, have the proper temperature at the respective depths, especially as it has been raining more or less nearly ever since. Still, I think