

March 24, 1836.

FRANCIS BAILY, Esq., Vice-President and Treasurer, in the Chair.

Richard Beamish, Esq., was elected a Fellow of the Society.

A paper was in part read, entitled "On the Temperatures and Geological Relations of certain Hot Springs; particularly those of the Pyrenees; and on the Verification of Thermometers." By James David Forbes, Esq., F.R.S., Professor of Natural Philosophy in the University of Edinburgh.

The Society then adjourned over the Easter vacation, to meet again on the 14th of April next.

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April 14, 1836.

FRANCIS BAILY, Esq., Vice-President and Treasurer, in the Chair.

The reading of Professor Forbes's paper, "On the Temperatures and Geological Relations of certain Hot Springs; particularly those of the Pyrenees; and on the Verification of Thermometers," was resumed and concluded.

The author expresses his regret that notwithstanding the great interest, more especially in a geological point of view, which attaches to every topic connected with the origin, the nature, and the permanence in temperature of the many thermal springs met with in different parts of the world, our information on these subjects is exceedingly deficient. On many points which might easily be verified, and which are of essential consequence towards obtaining a satisfactory theory of the phenomena, we as yet possess but vague and uncertain knowledge. It is evident that the first step towards the establishment of such a theory must consist in the precise determination of the actual temperature of each spring; from which we may derive the means of estimating by comparative observations, at different periods, the progressive variations, whether secular, monthly, or even diurnal, to which that temperature is subject. We have at present, indeed, not only to lament the total absence of exact data on which to found such an inquiry; but we are obliged to confess that, owing to the difficulties which meet us even in the threshold, we have not, even at the present day, made any preparation for establishing the basis of future investigation, by applying such methods of experiment as are really in our power, and are commensurate with the superior accuracy of modern science. The researches of Fourier would lead us to the conclusion that, if the high temperature of these springs be derived solely from that of the interior portions of the earth, the changes which can have occurred in that temperature, during any period to which history extends, must be so minute as to be inappreciable. On the other hand, the theory of internal chemical changes, which have been assigned as the origin of volcanos, would suggest it as improbable that this temperature has remained constantly the

same ; and as a more likely occurrence, even were we to suppose that no uniform secular diminution took place, that it would be liable to occasional irregular fluctuations. The influence of earthquakes on the temperature of hot springs is also admitted ; and it would be very desirable to learn, from a series of consecutive observations, whether abrupt changes, similar to those which have occasionally been noticed, are not of frequent occurrence.

The author has diligently laboured to collect, by observations made on the spot, materials for supplying this great chasm in the natural history of our globe. As an essential preliminary means of obtaining accurate results, he applied himself to the verification of the scales of the thermometers he employed in these researches : and he describes, in a separate section of this paper, the methods which he adopted for the attainment of this object. He first fixed with great precision the standard points of each thermometer, namely the freezing and boiling temperatures of water, by a mode which he specifies : and afterwards determined the intermediate points of the scale by a method, similar to that of Bessel ; namely, that of causing a detached column of mercury to traverse the tube ; but simpler in practice. Instead of employing for that purpose columns of mercury of arbitrary length, and deducing by a complex and tentative process the portions of the tube having equal capacities, the author detaches a column of mercury from the rest, of such a length as may be nearly an aliquot part of the length of the scale for  $180^{\circ}$  ; and causes this column to step along the tube ; the lower part of the column being brought successively to the exact points which the upper extremity had previously occupied : so that, at last, if its length has been properly chosen, the upper end of the column is found to coincide with the end of the scale : and this being accomplished, it is easy to apply to every part of the actual scale of the instrument the proper corrections, which may, for greater practical convenience, be drawn up in the form of a table.

In the next section, the author gives a detailed account of his observations of the mineral springs of the Pyrenees, made during the months of July and August, 1835, following them in their natural order from west to east, and describing their geological positions, the special circumstances of interest relating to them, and their actual temperatures.

In the third and last section he extends his inquiries to the hot springs met with in some other parts of Europe ; and in particular, those of the baths of Mont d'Or and of Bourboule, in France ; of Baden-Baden, in Germany ; of Loèche, or Leuk, in the Vallais ; of Pfeffers, in the canton of St. Gall, in Switzerland ; and the baths of Nero, near Naples. The final results of all the observations contained in this paper are presented in the form of a table, with comparative columns of those derived from some unpublished observations of M. Arago, and of those of M. Anglada.