

Survey of India, made some valuable observations on certain points connected with soil-formation, &c., in Central Asia.

UNDER the title of "Die geographische Erforschung des afrikanischen Continents von den ältesten Zeiten bis auf unsere Tage," by Dr. Philipp Paulktschke, Messrs. Brockhausen and Bräuer of Vienna have published a volume of 320 pages, containing a brief but full sketch of the progress of African exploration from the earliest times down to the present day. Its special value consists in the detailed bibliography of the subject contained in the footnotes on every page, which must be of the greatest service to the student of African exploration and geography. There are occasional slips, as when Mr. Monteiro's book on "Angola and the River Congo" is entered under "Monteiro," as published in New York in 1875, and again under "J. John," as published in London in 1876. But such blunders are wonderfully few. About 1500 names are referred to altogether.

DR. LENZ, on November 22, was at St. Louis, whence he was going to Tangier.

As a memorial of the work performed in the *Vega*, a "*Vega* Fund" has been raised by subscription in Sweden to encourage further geographical research. The sum raised is 35,000 crowns, which will be intrusted to the Swedish Academy of Sciences, and the interest either employed at once or be allowed to accumulate for a term of years. Only natives of Sweden, Norway, Denmark, and Finland will be entitled to receive the benefit of the fund.

Two important expeditions are soon to be sent into Central Africa, under the auspices of the Algerian Missionary Society, which already has stations at the northern ends of Lake Tanganyika and the Victoria Nyanza. One will go from Zanzibar, and the other will ascend the Congo.

THE INFLUENCE OF PRESSURE AND TEMPERATURE ON THE SPECTRA OF VAPOURS AND GASES¹

IN the course of my inquiry last year into the homology of the spectral lines of chemically-related elements I occasionally made the observation that the two strongly-marked red lines which bromine in the fluid state gives when the spark is taken from it in De la Chanal's fulgurator grow very feeble or entirely disappear in the spectrum of the rarefied vapour in the Geissler-tubes, while other lines not previously seen become visible. It appeared to me of interest to inquire more particularly into the changes of the spectrum of one and the same element, as these changes are naturally of the greatest importance in the comparison of chemically-related elements; and with this view I addressed myself to the problem of the changes of spectra at higher pressures.

According to Wullner's well-known experiments, which only deal with the three permanent gases, hydrogen, oxygen, and nitrogen, the spectral lines of the second order grow broader with higher pressure, and at the same time a continuously illuminated background is to be observed. This phenomenon, however, presents even in the three permanent elements the greatest difference. Thus, while the lines in the hydrogen spectrum become easily broader even under moderate pressure, those in the spectrum of nitrogen do not expand. Therefore it occurred to me that a comparative investigation, which would extend to as many elements as possible, would be desirable, inasmuch as it encouraged the hope that by this means one could arrive at a law, perhaps even at an explanation, of these phenomena.

I now venture to present to the Academy a report of my experiments as far as they have gone, reserving a full account till their completion.

In my experiments I have treated the most volatile of the metalloids, and among the metals have included quicksilver and sodium. I will in due time give a full account of the apparatus and methods which I employed in my experiments, but at present I must confine myself to a statement of the results already ascertained.

The spectrum of the three halogens, at higher pressures, exhibits in each case the same peculiarities. The lines have the appearance of merging into each other, and without showing

¹ By G. Ciamician, in *Sitz. Ber. der k. Akad. der Wiss.*, Vienna, lxxvii. Band, v. Heft.

an expansion into bands, they become occasionally somewhat broader. There is a steadily luminous background which becomes brighter when the pressure is increased, and which is often more intense than the lines themselves. This latter circumstance is frequently seen in the case of iodine, where the continuous spectrum finally covers all the rest. In the case of chlorine and bromine single lines are always distinguishable from the continuous surrounding light. The appearance of certain lines in the red field in chlorine and bromine which always preserve their precision and delicacy is worth mentioning.

The changes in the intensity of the spectral lines as exhibited under different pressures are very interesting. If you compare the spectral lines of the halogens with each other, in order to ascertain their homology, and in doing so only employ the spectra of rarefied vapours in Geissler tubes, you meet considerable difficulties, for you can only compare the lines in groups, and these lines present frequently in each of the three elements such differences of intensity that you may be left in doubt as to the existence of a homology of their lines. But the apparent differences arise in reality out of the variation of intensity and the number of the lines with the pressure. By appropriate change in the density of the gas or vapour you can always produce spectra which exhibit the perfect homology of the lines. Thus, in the case of iodine you must employ that tension which iodine-vapour has at 50° or 80° C., while in the case of chlorine and bromine atmospheric pressure is required.

The spectrum of sulphur does not change at all at higher pressure, the lines maintaining their perfect sharpness, while in the red field a continuously illuminated background appears.

Phosphor and arsenic do not give any reaction, and even the continuous spectrum does not appear. With arsenic I observed what I think has hitherto been overlooked, namely, that it gives at a moderate pressure, and without the interposition of a Leyden jar, a spectrum of the first order. It is almost continuous, and with increase of pressure of interposition of the jar it gives to the spectrum of lines the spectrum of the second order.

Great is the difference between the metalloids of which we have hitherto been speaking and the metals; they show an expansion of their lines into bands, while the continuous light takes a less prominent place. In quicksilver the breadth especially of the green and violet lines is conspicuous.

With sodium I have only noticed the great width of the D-lines when they appeared reversed, for I could only examine the light after its passage through a layer of cooler vapour. Sodium gives at high pressures a continuously illuminated spectrum near the D-lines, which then appear reversed; at first one or two lines, but soon they widen and merge into each other, and the dark band of absorption gradually covers the whole illuminated part of the field.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—Prof. Stuart finds the progress of his School of Mechanism and Engineering again compels enlargement. Some pupils are now making small engines, and require more space for erecting them. A room for mechanical drawing is needed, and also an enlarged stove. The Museums and Lecture-rooms Syndicate think it best in the present condition of University funds to erect a new temporary building 46 feet long by 21 feet wide, adjacent to the present workshop, and this, with other rooms which can be added, will supply present necessities for about 360l.

The balance of 821l., being the debt on the last two years of the Museums Maintenance Fund, has been granted as an extra payment from the University Chest, and in future years 3000l. will be granted annually for the Museums and Lecture-rooms Maintenance Fund.

Prof. Stuart is to have the services of a Demonstrator of Mechanism and Applied Mechanics.

Clare College announces a scholarship of 60l. a year in chemistry and chemical physics, botany and geology, to be competed for on March 29 next, without limit of age. Jesus and Magdalene Colleges continue to offer no inducements to natural science.

By a Royal decree, published last month, a museum will shortly be opened at Palermo on the plan of the one founded in Rome in 1874, with the object of making known the best scho-